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CONTENTS

The Importance of Being Selective: Weighing the Role of Attribute Importance in Attitudinal Judgment

Joop van der Pligt, Nanne K. de Vries, Antony S. R. Manstead, and Frenk van Harreveld

Toward a Histology of Social Behavior: Judgmental Accuracy from Thin Slices of the Behavioral Stream

Nalini Ambady, Frank J. Bernieri, and Jennifer A. Richeson

Attractiveness, Attraction, and Sexual Selection: Evolutionary Perspectives on the Form and Function of Physical Attractiveness

Diane S. Berry

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Numbers in parentheses indicate the pages on which the authors' contributions begin.

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THE NATURE AND FUNCTION OF SELF-ESTEEM: SOCIOMETER THEORY

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Human beings appear to be strongly and pervasively concerned with self-esteem. Whether one thinks of a 17th-century French aristocrat (or a member of a modern street gang) resorting to lethal violence in response to a vaguely insulting hint of disrespect, or a woman reappraising her desirability after being rejected by her lover, or a child winning a contest, or a middle-aged businessperson who has been passed over for a promotion, or a sports fan whose favorite team has just reached the championship, or a student debating whether to try again after a disappointing exam performance, the impact of self-esteem on emotion and behavior is palpable and familiar. Indeed, it is nearly impossible to imagine an otherwise healthy and well-adjusted person who is truly indifferent to self-esteem.

Most contemporary psychologists would likely agree with Markus' (1980) suggestion that the ''notion that we will go to great lengths to protect our ego or preserve our self-esteem is an old, respected, and when all is said and done, probably one of the great psychological truths'' (p. 127). Theorists of many persuasions have discussed the importance of the self-esteem motive to human behavior; self-esteem has been implicated in a variety of behavioral, cognitive, and affective reactions; and many psychological problems have been attributed to an unfulfilled need for self-esteem. Indeed, self-esteem ranks among the most extensively studied constructs in behavioral science.

The purpose of this chapter is to develop and evaluate an explanation for why people are so concerned about their self-esteem. Specifically, we propose that, rather than playing a direct causal role in thought, emotion, or behavior (as has often been supposed), self-esteem is an internal, psychological monitor of something that is very important to people—namely

social belongingness. Health, happiness, success, and survival depend heavily on maintaining social ties to other people, and so it is vitally important to be the sort of person who will be a desirable relationship partner or group member. At its core, self-esteem is one's subjective appraisal of how one is faring with regard to being a valuable, viable, and sought-after member of the groups and relationships to which one belongs and aspires to belong.

We proceed in the following way. After defining self-esteem, we provide a brief overview of existing perspectives on self-esteem. Then we explicate our own understanding of the basis for the self-esteem motive. We argue that self-esteem is a sociometer—an internal monitor of the degree to which one is valued (and devalued) as a relational partner. The central propositions of the theory furnish a series of specific, testable hypotheses about self-esteem, which we evaluate in light of the empirical literature. Laboratory and other findings are examined for relevance to the sociometer theory and its specific hypotheses. We then use sociometer theory to reinterpret several interpersonal phenomena that have been explained previously in terms of the self-esteem motive.

I. Concept of Self-Esteem

As we use the term, *self-esteem* refers to a person's appraisal of his or her value. Global self-esteem denotes a global value judgment about the self, whereas domain-specific self-esteem involves appraisals of one's value in a particular area (such as on social, intellectual, or athletic dimensions). Self-esteem is, by definition, a subjective judgment and, thus, may or may not directly reflect one's objective talents or accomplishments. Indeed, self-esteem is related more strongly to perceptions of others' evaluations of oneself than to seemingly objective indicators of one's ability or goodness, for reasons we explain later.

Importantly, self-esteem is an affectively laden self-evaluation. Self-evaluations are assessments of one's behavior or attributes along evaluative dimensions (e.g., good–bad, positive–negative, valuable–worthless). Some self-evaluations are dispassionate (i.e., they have no emotional concomitants), whereas others are affectively laden. For example, people not only evaluate themselves as having behaved well or poorly, but they often feel good or bad about how they have acted. They not only know that they possess certain desirable or undesirable characteristics, but they also experience accompanying positive or negative emotions when they think about them. When people succeed, they not only know they performed well and

evaluate themselves positively, but they feel good about themselves. In contrast, when they fail, people not only comprehend their deficiencies at a cognitive and coldly evaluative level, but experience an affectively based decrease in self-esteem. Many previous writers have equated self-evaluation with self-esteem, which ignores the essential difference between merely evaluating oneself positively or negatively and evaluating oneself in a way that has potent affective concomitants. At its core, self-esteem refers to how we *feel* about ourselves (Scheff, Retzinger, & Ryan, 1989), and Brown (1993) persuasively argued that self-esteem is inherently rooted in affective processes. Rather than being based solely on cognitive self-evaluations, self-esteem involves affective processes that may or may not be related to specific, conscious self-evaluations.

Researchers interested in self-esteem have focused primarily on individual differences in dispositional or trait self-esteem. *Trait self-esteem* is a person's long-term, typical, affectively laden self-evaluation, or what James (1890) aptly described as the "average tone of self-feeling" that each person carries around. As a person's typical or summary self-evaluation, trait self-esteem may or may not reflect a person's self-esteem in a particular situation. *State self-esteem,* also called *self-esteem feelings,* refers to a person's affectively laden self-evaluation in a particular situation. If we ask, "How does Person X feel about him- or herself right now?" we get an index of X's state self-esteem (Heatherton & Polivy, 1991). Throughout this chapter, we distinguish between trait and state self-esteem as necessary.

II. Self-Esteem Motive

People appear to be pervasively concerned with protecting and enhancing their self-esteem. Writers of many theoretical orientations have suggested that people possess a strong and pervasive motive to maintain a certain level of positive feelings about themselves—to "increase, maintain, or confirm . . . feelings of personal satisfaction, worth, and effectiveness" (Jones, 1973, p. 186), and a broad range of research in personality and social psychology is based on the assumption that people want to avoid losses of self-esteem.

The assumption that people possess a self-esteem motive has provided the foundation for a great deal of work in behavioral science. Most theories of personality have discussed the importance of self-esteem to personality functioning (e.g., Adler, 1930; Allport, 1937; Horney, 1937; Maslow, 1970; Rogers, 1959). Within social psychology, the self-esteem motive has been invoked as an explanation for a wide variety of cognitive and behavioral

effects, including social comparison (Wills, 1981), attitude change following counterattitudinal behavior (Aronson, 1968; Steele, 1988), self-serving attributions (Blaine & Crocker, 1993; Snyder, Stephan, & Rosenfeld, 1978; Zuckerman, 1979), self-handicapping (Jones & Berglas, 1978), prejudice (Katz, 1960), and self-presentation (Baumeister, 1982; Leary & Kowalski, 1990).

Cognitive patterns of interpreting information about the self are also consistent with the notion that people are motivated to uphold self-esteem. Greenwald (1980) asserted that one of the broadest patterns of distortion by the ''totalitarian ego'' was toward what he called ''beneffectance''— showing the self to be benevolent and effective across many spheres. Likewise, an influential review by Taylor and Brown (1988) suggested that people systematically distort information about themselves in three primary ways, one of which involves exaggerating their good, desirable, positive qualities.

Emotional patterns also suggest that self-esteem is a pervasive human concern. As we discuss in detail later, losses of self-esteem are invariably associated with dysphoric reactions such as depression, anxiety, jealousy, and hurt feelings. Emotions that involve global condemnation of the self are highly aversive and often produce violent outbursts that seem designed to thwart any downward revision of the self-concept (Baumeister, Smart, & Boden, 1996; Tangney, Wagner, Fletcher, & Gramzow, 1992).

The research literature on people's search for feedback about themselves has been dominated by two main views, both of which have supportive evidence (see Sedikides & Strube, 1997). One is that people seek positive, self-enhancing feedback that will boost their self-esteem. The other is that people seek consistent feedback that will confirm their existing views of themselves. Although these two perspectives make conflicting predictions about some circumstances, they agree emphatically that people want to avoid *losses* of self-esteem and so are loath to receive feedback that is more negative than their current self-appraisal. Even the most ardent advocates of the view that people seek consistent feedback about themselves agree that people have an affective preference for favorable feedback (Swann, Griffin, Predmore, & Gaines, 1987; see also Shrauger, 1975). Furthermore, Sedikides (1993) has demonstrated that this motive toward self-enhancement is more powerful than the competing motives for accurate self-assessment and for self-consistency (see also Grzegolowska-Klarkowsa & Zolnierczyk, 1988).

Developmental psychologists have also emphasized the importance of self-esteem in adaptive development (Harter, 1993a), and the self-esteem motive has been implicated in many forms of emotional and behavioral problems (Leary, Schreindorfer, & Haupt, 1995). Not surprisingly, then,

clinical and counseling psychologists have focused on the therapeutic implications of self-esteem (Bednar, Wells, & Peterson, 1989).

To be sure, some of the evidence for the existence of a self-esteem motive pertains to the public self and some pertains to the private self. That is, people seem concerned both with maintaining a favorable, positive view of themselves and with having other people regard them favorably. Still, public self and private self are highly intertwined, and the fact that people often try to make other people admire them does not contradict the assertion that they are pervasively concerned with maintaining their private self-esteem as well. Indeed, several authors have pointed out that validation by others is a necessary prerequisite to many self-perceptions, and so people may try to impress others as a means of maintaining favorable self-views (e.g., Baumeister, 1982; Haight, 1980; Leary, in press; Schlenker, 1980, 1985; Wicklund & Gollwitzer, 1982). The theory we describe below makes this link between the private and public aspects of self explicit.

III. Function of Self-Esteem

If the research literatures summarized above are to be believed, self-esteem is an exceptionally pervasive and potent psychological motive. Given people's widespread concern with self-esteem, one might suspect that it is a powerful aid to adaptation and success or provides other noteworthy benefits. However, it is not at all clear what self-esteem actually *does* or why people should be so concerned with maintaining it.

One goal of this chapter is to explain why people are so concerned with self-esteem. Some readers may think that this goal is unnecessary because over the past couple of decades American society has widely embraced the idea that low self-esteem causes many problems in life, such as drug addiction, teen pregnancy, school failure, juvenile delinquency, unsafe sex, crime, and violence (see Mecca et al., 1989). In our view, there are a few liabilities associated with having low self-esteem (Baumeister, 1993), but these are too weak and scattered to offer a satisfactory explanation of why people are so concerned with maintaining their self-esteem (Adelson, 1996; Baumeister, Heatherton, & Tice, 1993; Colvin & Block, 1994; Colvin, Block, & Funder, 1995; Dawes, 1994). As Mecca et al. (1989) concluded in their edited compilation of research findings on the links between self-esteem and various personal and social difficulties: ''The news most consistently reported, however, is that the associations between self-esteem and its expected consequences are mixed, insignificant, or absent'' (Mecca et al., 1989, p. 15). Most writers have not addressed the question of why people

try to maintain self-esteem, appearing to assume that they seek self-esteem for its own sake. Pepitone (1968), for example, asserted that "the striving toward higher self-esteem and status (or avoidance of loss of esteem and status) must surely be counted as the most powerful and pervasive psychological motivation . . ." (pp. 349–350; see also Rosenberg, 1965). Nonetheless, at least five previous perspectives on the function of self-esteem can be identified.

A. WELL-BEING AND POSITIVE AFFECT

First, some writers have assumed that people seek self-esteem because high self-esteem is linked to subjective well-being and positive affect. When self-esteem rises, people experience pleasant, positive emotions, and when it falls or is threatened they experience unpleasant, negative emotions. Even if self-esteem had no other effects than to influence emotion, people might be chronically concerned about maintaining self-esteem simply because of their inclination to avoid unpleasant emotional states and to seek positive emotional states. Yet this answer is inadequate and unsatisfying. Surely it cannot be an accident of nature that self-esteem is strongly associated with human emotion if self-esteem otherwise has no pragmatic value. To invoke the emotional effects as a full explanation begs the functional question and implies that the concern with self-esteem is fundamentally misguided.

B. SUCCESSFUL COPING

Bednar et al. (1989) suggested that self-esteem serves to provide people with "continuous affective feedback from the self about the adequacy of the self" (p. 112). This affective feedback—self-esteem—is positive when the individual is coping with a psychological threat but negative when he or she is avoiding a threat. In turn, the level of self-esteem affects the probability of subsequent coping; high self-esteem increases coping, whereas low self-esteem increases avoidance. In our view, the difficulty with this perspective is twofold: It does not easily account for many known causes and effects of self-esteem, and the feedback loop it proposes is dysfunctional when people are coping poorly. Decreasing self-esteem would signal inadequacy, thereby leading to further avoidance, followed by even lower self-esteem and greater avoidance. As Bednar et al. themselves noted, "the psychologically weak will become weaker with the passage of time, whereas the strong will become stronger" (p. 133). Such a feedback system

might be functional if changes in self-esteem reflected a person's true resources for effective coping because a poorly coping individual might be better off avoiding than engaging the threat. But given that self-esteem is only weakly tied to one's "true" ability to cope with challenges, the system would be of questionable benefit.

C. SELF-DETERMINATION

Early humanistic psychologists traced self-esteem to a condition in which a person's real and ideal selves were congruent (e.g., Rogers, 1959). In a more recent exposition of this theme, Deci and Ryan (1995) proposed that "true self-esteem" emerges when people behave in self-determined, autonomous ways that reflect their "innate potentials and phenomenal core" (p. 46). When people are true to themselves, they have a healthy, integrated sense of self as well as high self-esteem. In contrast, they suggested that a second kind of self-esteem—"contingent self-esteem"—depends on the person matching standards that are imposed by oneself or others. In their view, true self-esteem is healthy and adaptive, whereas contingent self-esteem leads people to forsake their personal autonomy and true selves in order to please others or to achieve standards that are incongruent with who they really are. As will become clear, our view of self-esteem differs sharply from that of self-determination theory and similar humanistic perspectives.

D. DOMINANCE MAINTENANCE

Operating within an ethological perspective, Barkow (1980) proposed that self-esteem is an adaptation that evolved in the service of maintaining relative dominance in social relationships (see Tedeschi & Norman, 1985, for a similar argument). Starting with the assumption that early human beings lived in groups that were characterized by dominance hierarchies (such as modern nonhuman primates), Barkow reasoned that mechanisms for monitoring and enhancing dominance may have developed alongside the ability for self-relevant thought. To the extent that enhancing one's relative dominance would facilitate the acquisition of mates and other reproduction-enhancing resources, the tendency to monitor and increase one's social standing would have been adaptive. Because dominance was associated with attention and deference from other members of the group, self-esteem became associated with attention and deference. Thus, according to Barkow, the motive to evaluate oneself positively reduces, in evolu-

tionary terms, to the motive to enhance one's relative dominance (and thus reproductive fitness). We find ourselves sympathetic to this evolutionary argument because the universality and potency of self-esteem suggests that it is an inherent, adaptive part of human nature. Yet, for reasons that we will explain later, we do not think that all of self-esteem reduces to issues of social dominance.

E. TERROR MANAGEMENT

One of the more controversial explanations of self-esteem is provided by terror management theory. According to terror management theory, self-esteem buffers people against the existential terror they experience at the prospect of their own death and annihilation (Greenberg, Solomon, & Pyszczynski, 1997; Solomon, Greenberg, & Pyszczynski, 1991). People are motivated to maintain self-esteem because it helps them to avoid the paralyzing terror they would otherwise experience. Consistent with terror management theory, experimental manipulations that make mortality salient do heighten people's concerns with self-esteem. Furthermore, high self-esteem lowers people's anxiety about death (Greenberg et al., 1992). Despite strong support for aspects of the theory, data do not yet support the strong argument that the function of the self-esteem system is to buffer existential anxiety, and a few studies have failed to support aspects of the theory (Sowards, Moniz, & Harris, 1991). Furthermore, contrary to what terror management theory would suggest, people often engage in unhealthy, dangerous, and even life-threatening actions in order to make desired impressions on other people (Leary, Tchividjian, & Kraxberger, 1994), suggesting that concerns with social approval sometimes override fear of death.

F. SUMMARY

Space does not permit a full critique of these existing approaches to self-esteem. Each has notable strengths as well as logical and empirical weaknesses. We do not think that the data are sufficient to dismiss any of these perspectives outright, but we believe that sociometer theory provides a broader, more parsimonious explanation of what is currently known about self-esteem.

IV. Sociometer Theory

The fact that people are highly and pervasively motivated to protect and enhance their self-esteem suggests that self-esteem must somehow be linked

to some important and highly desirable outcome. In this section we identify that outcome and provide an answer to the question of the function of self-esteem.

A. METERS AND MOTIVES

We begin by noting that people are sometimes very concerned about things that, of themselves, provide minimal pragmatic or material consequences. One relevant type of concern involves the importance people attach to measures or gauges. People may react to certain stimuli not because the stimulus itself has any direct value or consequences, but because the stimulus reflects the quantity or quality of something that is important. For example, many people become distressed when the indicator on the bathroom scales points to a particular number not because the number itself has any consequences, but because it reflects an undesired state of affairs. By analogy, we suggest that people devote so much attention to their self-esteem not because self-esteem per se has particular consequences, but because self-esteem is a gauge or monitor of something that is important. Psychological theorists may have erroneously concluded that maintaining self-esteem is important for its own sake because they did not recognize that self-esteem resembles a gauge. People may be invested in self-esteem not because self-esteem itself has any inherent value, but because self-esteem reflects something that is of paramount importance. Self-esteem may then be sufficiently salient and potent that people could occasionally lose sight of what it is supposed to measure and act as if they cared about self-esteem for its own sake, but their concerns with self-esteem reflect a more genuine, valuable, and adaptive commodity than simply feeling good about themselves.

According to sociometer theory, self-esteem serves as a subjective monitor of one's relational evaluation—the degree to which other people regard their relationships with the individual to be valuable, important, or close. Put somewhat differently, the self-esteem system monitors one's eligibility for lasting, desirable relationships, including membership in important small groups. The self-esteem system is essentially a *sociometer* that monitors the quality of an individual's interpersonal relationships and motivates behaviors that help the person to maintain a minimum level of acceptance by other people (Leary & Downs, 1995). Subjectively, high self-esteem reflects the perception that one is a valued desirable person for groups and close relationships, whereas low self-esteem reflects the perception that one's eligibility for social inclusion is low.

Of course, the idea that self-esteem reflects people's beliefs regarding how they are perceived and evaluated by others (what are often called

"reflected appraisals") is not new. This notion appears in the writings of James (1890); the symbolic interactionists (Cooley, 1902; Mead, 1932); various neo-Freudians (Horney, 1937); humanistic and phenomenological psychologists (Maslow, 1970; Rogers, 1959); sociologists (Felson, 1993); and many contemporary social, developmental, and personality psychologists (e.g., Harter, 1993b; Rosenberg, 1979, 1981; Shrauger & Schoeneman, 1979). Sociometer theory goes beyond previous observations that self-esteem is simply influenced by other people's appraisals to propose that the self-esteem system is designed to *monitor and respond* to others' responses, specifically in regard to social inclusion and exclusion. Whereas previous approaches have viewed self-esteem as a simple reflection of other people's evaluations [i.e., Cooley's (1902) "looking glass self"], sociometer theory views self-esteem as a gauge that, much like fuel gauges and thermostats, has a function in terms of monitoring and maintaining the quality of people's interpersonal relationships. Before describing the operation of the sociometer in detail, we must examine a fundamental assumption underlying the sociometer theory of self-esteem.

B. NEED TO BELONG

Thus far, we have suggested that self-esteem is a prevailing concern because it reflects one's eligibility for social inclusion. Obviously this proposition is valid only to the extent that eligibility for inclusion in social groups and relationships is nontrivial and of high pragmatic value. We have reviewed elsewhere considerable evidence regarding the pervasive importance and value of social attachments (Baumeister & Leary, 1995). Therefore, we present just a brief overview of that material.

The value of belonging to groups and having close relationships is hard to dispute. From an evolutionary standpoint, the essence of adaptiveness is to produce offspring who will in turn reproduce. This requires survival up to reproductive adulthood, successful mating and gestation, and nurturance of offspring until they are able to care for themselves sufficiently to survive and mate. On all these counts, the lone human being is at a serious disadvantage in comparison to those who live with others. Mere survival is difficult alone, especially if one has to a compete against groups for scarce resources. Members of groups can share knowledge and divide labor to promote greater success and efficiency. And, at least some temporary affiliation is obviously necessary for mating itself. Furthermore, social ties to others may increase a woman's successful gestation, particularly with regard to providing food and protection during the last months of pregnancy. In addition, once they are born, offspring are more likely to receive care,

protection, and other resources if they belong to a group than if left alone or even if they live only with one or both parents (Barash, 1977; Bowlby, 1969; D. Buss, 1991).

It is therefore quite plausible that evolutionary selection has instilled in human nature a fundamental motivation to form and maintain at least a small number of social bonds. Elsewhere, we reviewed a broad assortment of empirical evidence consistent with this notion (Baumeister & Leary, 1995; see also Barash, 1977). People form social bonds quite easily and readily and with minimal impetus. They are reluctant to break social bonds, even ones that have ceased to be necessary or useful or even in some cases that generate pain and other problems. Cognitive and emotional patterns also suggest a motivated preoccupation with being accepted, and people who are deprived of social attachments suffer a broad assortment of negative consequences, including higher rates of mental and physical illness, stress, misfortune, and general unhappiness.

People appear to be particularly predisposed to seek and maintain interpersonal relationships that are characterized by stability, affective concern, frequent contact, and continuation into the foreseeable future (Baumeister & Leary, 1995). From an evolutionary perspective, relationships that possessed these characteristics would have promoted survival and reproduction to a greater extent than relationships that did not. In addition, stable, caring, long-term relationships that involve regular interactions are more beneficial to people's everyday happiness and well-being. Thus, although people avoid being shunned or rejected by most other people, they are particularly concerned with maintaining certain kinds of close interpersonal relationships.

C. THE SOCIOMETER

Thus, it seems fairly safe to conclude that the human organism is characterized by a basic need to belong—a fundamental motivation to form and maintain at least a handful of meaningful social attachments. The power and importance of this motivation are sufficient to think that people might well possess an internal meter to monitor such relationships. Indeed, when something is extremely important to an organism's well-being, internal mechanisms tend to develop for monitoring it. For example, pain serves to signal the possibility of damage to the body, and hunger and satiety monitor how well the person is obtaining nutrition and sustenance.

The central tenet of sociometer theory is that the self-esteem system monitors the quality of an individual's actual and potential relationships— specifically the degree to which other people value their relationships with

the individual. People do not always seek to be explicitly accepted but rather *relational appreciation*—the sense that other people regard their relationships with the individual as valuable, important, and close. When low relational evaluation, and particularly relational *devaluation* is experienced (and belongingness implicitly or explicitly threatened), the sociometer evokes emotional distress as an alarm signal and motivates behaviors to gain, maintain, and restore relational appreciation. In an evolutionary analysis of friendship, Tooby and Cosmides (1996) made a similar point, suggesting that ''adaptations should be designed to respond to signs of waning affection by increasing the desire to be liked, and mobilizing changes that will bring it about'' (p. 139). In our view, self-esteem is a familiar, affectively potent response because it is the adaptation that performs the essential job of monitoring and reacting to social acceptance and rejection.

1. State and Trait Self-Esteem

Some might raise the theoretical objection that the sociometer perspective renders self-esteem superfluous: Why not simply acknowledge that people experience emotional distress when they are rejected and elation when they are accepted, without bringing self-esteem into the picture? Ample evidence shows that emotion responds powerfully to changes in belongingness (see Baumeister & Leary, 1995, for a review), which raises questions about the theoretical or systemic benefits of self-esteem per se.

To overcome this objection, it is necessary to demonstrate that the benefits of self-esteem go beyond simple detection of acceptance and rejection. In our view, this crucial benefit involves the anticipation of interpersonal outcomes. That is, self-esteem not only signals one's relational value in the immediate situation but reflects the general outlook for relational appreciation and social belongingness in future encounters and relationships. Given the importance of social acceptance to human well-being and survival, a viable monitoring system must do more than simply set off alarms of emotional distress when one has already been rejected (at which point it may be too late to do anything to prevent exclusion). The system must also monitor the person's suitability for membership in desired groups and relationships generally and motivate behaviors that promote acceptance even when relational devaluation is not an immediate problem.

These two monitoring systems—one immediate and one long term—correspond to the common distinction between state and trait self-esteem. *State self-esteem* monitors the person's current relational value and, thus, the degree to which he or she is or is likely to be accepted and included versus rejected and excluded by other people in the immediate situation (Leary & Downs, 1995). The state self-esteem system monitors the person's

behavior and social environment for cues relevant to relational evaluation and responds with affective and motivational consequences when cues relevant to exclusion are detected. *Trait self-esteem,* in contrast, involves the assessment of the degree to which one is the sort of person who generally will be valued by desirable groups and relationship partners. It is a subjective sense of one's potential for social inclusion versus exclusion over the long run.

An analogy to a stock market analyst may clarify the interplay between state and trait self-esteem in monitoring belongingness. Successful investors monitor changes in the stock market at two levels. They are, of course, interested in daily, if not hourly changes in stock value and are prepared to make fast investment decisions when market conditions change at any time. Their ongoing responsivity to changes in the market is analogous to the state self-esteem system. At the same time, however, investors take a long-range perspective to anticipate the state of the market in the future, and their reactions to hourly and daily events depend on their assessment of a stock's long-term potential. Depending on their projections regarding future losses and gains, investors may or may not act on the basis of the state-like fluctuations they observe. In the same way, trait self-esteem provides a subjective projection on long-term relational appreciation. People can weather dips in acceptance (and, thus, state self-esteem) when they believe that the long-term projections for belongingness are positive (and trait self-esteem is high).

In this conceptualization, the link between actual social inclusion and trait self-esteem level is significant but slightly distant because trait self-esteem does not reflect whether one is actually accepted at the moment but whether one is acceptable in general. Thus, trait self-esteem does not change every time a social bond is made or broken (or offered or threatened). Rather, it changes only to the extent that changes in one's social world revises one's appraisal of how eligible and desirable one is for having good social bonds in general. Thus, a gap sometimes exists between one's current perceived relational value (state self-esteem) and trait self-esteem. This discrepancy may account for several circumstances that might otherwise seem to contradict the notion that self-esteem is tied to relational appreciation and devaluation.

For one, a person can be high in trait self-esteem despite not having a large number of close ties or important memberships at present. If trait self-esteem were a direct and explicit index of actual belongingness, then a lack of social ties would lead inevitably to low trait self-esteem. But the discrepancy between state and trait self-esteem could allow the person to regard the lack of current social bonds as a temporary aberration or a reflection of external circumstances rather than an indication of his or her

essential low relational evaluation by other people. An individual might still regard himself or herself as a highly desirable partner who will eventually have excellent social relationships and, thus, have high self-esteem.

In a similar fashion, the discrepancy between relational evaluation and trait self-esteem allows the possibility that someone might have low trait self-esteem despite having many strong social ties. A person might regard himself or herself as an undesirable partner who has somehow managed to be valued by other people but who may in the long run end up alone. One example of such a discrepancy involves the impostor phenomenon, in which the person believes that he or she has managed to gain acceptance by concealing the true self and that eventually others are likely to discover his or her true nature and then reject him or her (Clance & Imes, 1978). Appraising oneself as an undesirable partner might also lead one to regard one's social ties as precarious and unstable. In any case, such a person would have low trait self-esteem despite being amply valued as a relational partner by other people.

2. Automaticity

Several properties of the self-esteem system can be proposed on the basis of the sociometer function. First, the system should be highly sensitive to indications that one's social inclusion or acceptance is in danger. Second, it should operate continuously (or almost continuously) at an unconscious or preattentive level so that relational devaluation would be detected no matter what else the person is doing. Third, assuming that most people have at least the minimum amount of social acceptance they need most of the time, the system should be more sensitive to relational devaluation (i.e., potential rejection) than to relational appreciation (i.e., further acceptance).

Even though social inclusion is of paramount importance to their physical and psychological well-being, people do not possess the cognitive capacity to constantly monitor other's reactions to them at a conscious level. Thus, a system for monitoring relational appreciation and devaluation would have to function automatically, probably at a preconscious level (Cherry, 1953; Schneider & Shiffrin, 1977). As McNally (1987) noted, people are "prepared" to detect and process threats of evolutionary significance nonconsciously.

The primary advantage of automatic systems is their efficiency. Assessing real and potential belongingness is important to human well-being, but to consciously think through the implications of all interpersonal transactions and social experiences to assess their implications for belongingness would interfere with the person's ability to process other information (not to mention being terribly draining). Therefore, a mechanism

for monitoring one's global desirability for groups and relationships would need to be automatic. For maximal efficiency, the sociometer system should alert people to every possible instance of relational devaluation and, thus, it would be quite efficient at keeping constant watch for any relevant developments.

By all accounts, the self-esteem system possesses all of the characteristics of an automatic cognitive mechanism (Bargh, 1984, 1990). The processing of information vis-à-vis relational appreciation–devaluation is autonomous (occurring independent of other cognitive processes), effortless (requiring few cognitive resources), and largely involuntary and unintentional (beginning spontaneously). This automaticity permits people to monitor others' reactions for cues relevant to inclusion and exclusion while devoting conscious attention to other things. Thus, people may be interacting quite mindlessly when the nonconscious detection of such a cue prompts a conscious assessment of the situation. The automaticity of the self-esteem system explains how the concern with self-esteem can be as pervasive as researchers have assumed, yet people are only occasionally aware of monitoring others' reactions to them. In order to detect and respond to cues relevant to one's eligibility for social inclusion, the system must operate automatically and nonconsciously.

We are not the first to suggest that people monitor social cues, including those relevant to inclusion and exclusion, rapidly, automatically, and without conscious awareness. Along these lines, Rosenberg (1986) suggested that, ''at a given instant, a person's self-respect may be high, but in the following moment an unkind word, a gentle frown, or a slight setback may cause it to plunge sharply'' (p. 126). Similarly, Cooley (1902, p. 208) observed that people live ''in the minds of others without knowing it''—an apt description of an automatic process that monitors others' reactions to the individual.

3. Affective Aspects of Self-Esteem

Evidence suggests that self-esteem is, at its base, a motivational-affective process rather than a cognitive one (see Brown, 1993). James (1890) observed, for example, that the self is not ''cognized only in an intellectual way . . . When it is found, it is felt'' (p. 299). Similarly, Cooley (1902) indicated that there ''can be no final test of the self except the way we feel'' (p. 40).

Most motivational and drive systems produce aversive feelings when deficiencies are detected and pleasant affect when drives are satisfied. People experience negative affect when they are hungry, tired, or afraid, but positive or neutral affect when they are well-fed, rested, or safe, for example.

The negative feelings that accompany deficiencies in goal states may serve three functions: they alert the individual to internal or external conditions that pose a threat to the individual's well-being, they interrupt ongoing behavior to allow an assessment of the situation and its possible threat, and they motivate behaviors that remove the undesired state (and its removal serves as negative reinforcement for goal attainment) (e.g., Averill, 1968; Frijda, 1986; Izard, 1977). Thus, we assume that a system for monitoring one's relationships would produce negative affect when relational deficiencies are detected.

Changes in state self-esteem may be especially likely to set off emotional responses. Several recent treatments have emphasized that emotions respond more to change than to stable circumstances. Thus, anxiety occurs when threats become closer (Riskind & Maddux, 1993, 1994; Riskind, Moore, & Bowley, 1995; Riskind & Wahl, 1992), satisfaction comes with improvement in conditions or other changes in outcomes (Hsee & Abelson, 1991; Hsee, Abelson, & Salovey, 1991), romantic passion results from increases in intimacy (Baumeister & Bratslavsky, 1999), and a multitude of positive and negative emotions ensue when the self is perceived as getting closer to or farther away from its ideals or other standards (Carver & Scheier, 1990). By the same token, a drop in relational evaluation is likely to be accompanied by aversive emotions, whereas increased relational appreciation may bring positive, pleasant feelings.

The integral role that affect plays in self-esteem may be tied to the self-esteem system's evolutionary significance. Affective systems preceded cognitive ones phylogenetically (Izard, 1984). Furthermore, although conscious cognitions can cause affective responses, emotion may also occur as a result of preconscious processing (Zajonc, 1980). In light of this, we speculate that the affective-motivational aspects of the self preceded the emergence of the cognitive aspects. ''In both evolutionary and ontological terms, affective experiences precede the development of evaluative thought as regulatory processes'' (Ford, 1987, p. 638).

D. DETERMINANTS OF SELF-ESTEEM

Although considerable research has identified types of events that raise and lower self-esteem, sociometer theory offers a novel perspective on why these particular factors have their effects. According to the theory, things that affect self-esteem do so via their perceived association with social inclusion and exclusion.

1. Valued Social Attributes

If self-esteem is a subjective monitor of one's eligibility for inclusion, changes in self-esteem should be most responsive to events that have implications for how highly people are valued as relational partners by other people. Thus, we may learn about the determinants of self-esteem by examining the criteria that lead others to include vs exclude people from groups and relationships (see Baumeister & Leary, 1995).

First, people tend to exclude individuals who are not likable or are otherwise socially undesirable interactants. Unfriendly, argumentative, uncongenial people make undesirable partners and group members. People prefer to spend time with others who are friendly, pleasant, and nice. Second, groups exclude incompetent individuals. This can be seen formally in employment contexts, in which competence is a clear and explicit criterion for being hired and promoted. Even in informal groups, however, the person who cannot make any contribution to the group is unquestionably a less desirable member than someone who can help the group accomplish its tasks and achieve its goals (even if those goals are social ones). Third, unattractive people are regarded as less desirable group members and relational partners than more attractive ones. Physically appealing people are sought out more and receive more offers of inclusion than unattractive people. This ranges from romantic dates that might initiate relationships to employment and other contexts. Fourth, groups exclude people who break their rules and violate their norms. Untrustworthy, dishonest, unreliable people impair the group's functioning and impose costs and difficulties on others. The exclusion of violators can be seen formally in the practices of imprisoning or exiling people who break the rules. Likewise, deviants are often ignored or ostracized, and relationships often break up when one person regards the other's actions as sufficiently immoral. As is shown below, virtually all events that threaten self-esteem involve incidents that portray the individual as socially undesirable, incompetent, physically unattractive, or irresponsible or immoral. Furthermore, the primary dimensions of self-esteem reflect these same basic evaluative dimensions (Fleming & Courtney, 1984; Harter, 1993b; Heatherton & Polivy, 1991).

One implication of the argument that self-esteem is an internal measure of the properties that enhance the likelihood of belonging is that having high self-esteem should entail perceiving oneself as being likable, competent, attractive, and moral. Together these traits signify that the person would be a highly valued relational partner, if not sought after for membership in desired groups and relationships. Conversely, to have low self-esteem signifies a deficiency in one or more of those areas, and such deficiencies

render one vulnerable to being ignored, avoided, or excluded. In other words, low self-esteem signifies a judgment that one may not be the sort of person with whom other people will want to form lasting relationships.

2. Dominance and Self-Esteem

Barkow's (1980) explanation of self-esteem, described earlier, resembles sociometer theory in its use of an evolutionary argument. However, rather than linking self-esteem to social inclusion, Barkow tied it to dominance in a social hierarchy. Because dominance is associated with attention and deference from other group members, self-esteem became associated with attention and deference. Human beings seek self-esteem, according to Barkow, because the motive to evaluate oneself positively reduces to the motive to enhance one's relative dominance.

We are sympathetic to Barkow's analysis in many respects. As noted earlier, a motive as strong and pervasive as self-esteem likely conferred some degree of reproductive success among prehuman hominids to have become such a central part of human nature. Yet we differ with Barkow in suggesting that the system serves to maintain interpersonal relationships rather than enhance dominance per se. First, self-esteem seems to be more closely tied to acceptance and approval than to dominance. Self-esteem is often involved in situations in which dominance appears to be irrelevant, whereas the events that raise and lower self-esteem virtually always have a potential for influencing other's reactions vis-à-vis social inclusion and exclusion. Put differently, people's self-esteem is more likely to be hurt by expressions of disinterest, dislike, or rejection than by indications of insubordination. Second, interactions with more dominant people do not seem to threaten our self-esteem, which would seem to be implied by Barkow's approach. Third, Barkow's analysis would seem to predict that self-esteem would be more salient to male than female members of the species, given that dominance hierarchies more strongly control the resources and outcomes of men than women. Yet, women appear as likely as men to suffer losses in self-esteem.

In our view, dominance is related to self-esteem because status is sometimes a criterion for inclusion. The self-esteem system may become activated in situations involving dominance and submission when one's relative status has implications for the person's relational value. When relative status has implications for inclusion, self-esteem will be related to dominance because high status often increases both the benefits and the security of belongingness. To use a simple analogy, the higher one's rank in a corporation, the fewer people there are who can fire you, and the more who will seek you out as ally, mentor, and advisor. Similarly, higher status members of social

groups tend to feel more secure in their membership than lower ranking members. Also, higher rank gives one proportionally larger shares of the group's resources as well as more influence to make sure that the group pursues policies and projects that will serve and not thwart one's interests. Viewed in this way, Barkow's perspective is consistent with sociometer theory.

3. Audience Effects on Self-Esteem

Obviously, not all instances in which people experience relational devaluation deflate self-esteem. People are not motivated to be valued and accepted by everyone they meet, and rejection by peripheral persons may have little or no effect on self-esteem; a person needs only a certain amount of belongingess (Baumeister & Leary, 1995; Tooby & Cosmides, 1996). After being included in a certain number of primary groups and relationships, the motive to belong should decrease. Not only can a person's psychological, social, and physical needs be satisfied by a relatively small number of other people, but an increasingly number of relationships may actually interfere with existing social relationships, thereby lowering overall social inclusion. As with many motivational systems, satisficing, rather than maximizing, appears to be the rule (Simon, 1990). Tesser and Cornell (1991) presented evidence consistent with this point. Their data suggested that, although people are motivated to maintain their self-esteem at some minimum level, they are not motivated to maximize it.

When assessing their own behavior as it relates to relational evaluation, people presumably rely primarily on the standards of the people whose acceptance they desire. (People may use other standards for other purposes, but these would have little relevance to self-esteem) Thus, sociometer theory provides a new perspective on the concept of *reference group*. Merton and Kitt (1950) offered reference group theory to explain the processes by which people take the values and standards of other individuals and groups as their own frame of reference. In our view, a person's reference group consists of those persons whose acceptance the person desires. This perspective explains why people adopt the standards of their reference groups as well as why reference groups have such a potent impact on the development and maintenance of the selves of individual group members (Kuhn, 1964). Another way to say this is that a reference group consists of persons whose real or imagined reactions to the individual most dramatically affect his or her self-esteem.

There may be important cross-cultural differences in the sociometer. We have characterized trait self-esteem as an internal measure of one's perceived eligibility and desirability for memberships in desired relation-

ships and groups. In some cultures, people may be inextricably embedded in social groups on the basis of unchangeable, ascribed characteristics such as gender, caste, and family. The more fixed and stable social relations are, the less likely people are to be concerned about individual self-esteem. Conversely, the great preoccupation with self-esteem in contemporary Western cultures may reflect the pervasive instability of social relations in these societies. When people are constantly subject to changing jobs, spouses, neighbors, friends, and lovers, the danger of ending up alone is always present, and people are likely to be constantly and deeply concerned with maintaining their social connections and, thus, self-esteem. Relational uncertainties such as these should make people more attuned to the sociometer.

4. Events with No Immediate Implications for Belonging

People sometimes experience changes in self-esteem even when events appear to have no important, long-term consequences for acceptance. On the surface, this fact would seem to contradict the claim that the self-esteem/sociometer system serves to maintain a sufficient level of belongingness. On closer inspection, however, such events are consistent with the theory.

First, although state self-esteem responds to cues in the immediate social setting, it seems to involve more than a simple reaction to the implications of inclusion or exclusion in the current situation. People sometimes experience dramatic shifts in state self-esteem even when their inclusion is of no importance in the current situation. For example, a person may suffer a drop in state self-esteem in response to the rejecting reaction of a never-to-be-seen-again stranger even though their brief interaction has absolutely no consequences vis-à-vis inclusion. Similarly, participants in a psychology experiment may experience an increase in self-esteem after receiving feedback that they were particularly competent at solving anagrams even though anagram solving had no obvious interpersonal benefits in this instance.

Such examples suggest that state self-esteem responds not only to the immediate consequences of relational evaluation, but to its implications for potential appreciation and devaluation. Events often carry symbolic messages about one's broad eligibility for inclusion beyond the immediate situation. Thus, being accepted as a member of an organization affects state self-esteem not only because it involves current acceptance, but also because it implies that one is regarded as a prized group member with high relational value who will have opportunities for inclusion in other groups in the future. Being rebuffed by a stranger may affect self-esteem not because the stranger's response is of any consequence, but because it raises the possibility that one may be devalued by others whose reactions *do* matter.

Viewed in this way, state self-esteem can be regarded as an early warning system for events that, if experienced repeatedly, might eventually require a revision of trait self-esteem.

Second, social exclusion is not always either immediate or explicit. People suffer losses in self-esteem when they behave in ways that *might* lead to rejection even if no one else is currently privy to their behavior, and sometimes if they even *think* of doing something that, if discovered by others, might lead to rejection. Such an anticipatory feature of the sociometer is essential in order for the system to prevent people from privately engaging in behaviors that others may later learn about and to deter people from privately planning to perform behaviors that might jeopardize their connections with those individuals. Thus, one's private self-views are relevant to self-esteem because what one privately knows to be true about the self may eventually be discovered by others and, thus, have implications for social acceptance. In fact, it is highly beneficial that the sociometer alerts people to certain things about themselves privately in advance of public recognition so that they have the opportunity to fix them before they damage interpersonal relations.

Third, the fact that self-esteem functions to maintain belongingness does not preclude the possibility that the sociometer will sometimes respond in the absence of a true relational threat. Because occasional ''false-positives'' (registering unthreatening events as dangers) are less detrimental to well-being than a single ''false-negative'' (interpreting a dangerous event as benign), many regulatory mechanisms are biased in the direction of false-positives, occasionally responding even when no objective threat is present. When certain critical cues are detected, warning and defensive responses may occur even though they are not, when viewed objectively or in retrospect, necessary for the organism's well-being. Thus, certain interpersonal cues may cause changes in self-esteem and self-esteem motivation even when no actual threat to belongingness has arisen.

Finally, self-esteem may become functionally autonomous and thereby a preoccupation in its own right. Allport (1937) suggested that psychological processes that originally served a particular function sometimes begin to operate independently, losing contact to some degree with the function they originally served. In our view, the self-esteem system can become functionally autonomous so that people occasionally pursue self-esteem in situations in which belongingness is irrelevant or even in ways that are counterproductive. For example, a person who learns that failing to be conscientious in arenas that are important to other people results in negative, rejecting reactions may also behave conscientiously on much less important (if not downright trivial) tasks as well and may even ''feel bad'' (i.e., suffer a loss of self-esteem) for not completing such trivial tasks

conscientiously—even though doing so has no implications for belonging-ness. In fact, in some cases people do things that serve self-esteem while bringing some short-term cost to belongingness. For example, a person who refuses to apologize out of pride may be motivated by a functionally autonomous need to maintain self-esteem even though he or she is jeopardizing a relationship. Functional autonomy helps to explain such patterns.

E. SELF-DECEPTION: FOOLING THE METER

One argument against the sociometer perspective involves people's propensity for distorting information about themselves in a favorable direction. A great deal of research documents people's tendency to interpret information about themselves in a more positive light than seems warranted by objective facts (for reviews, see Blaine & Crocker, 1994; Greenwald, 1980; Leary & Forsyth, 1987; Taylor & Brown, 1988). If the self-esteem system is a gauge that monitors relational devaluation, why do people sometimes distort their interpretations of self-relevant information? Such a bias would undermine the sociometer's effectiveness in detecting and responding to real and potential exclusion.

From the standpoint of the sociometer perspective, self-deception is a matter of having higher self-esteem than objective appraisals of one's relational evaluation would warrant (see Colvin et al., 1995). If self-esteem were only a direct and immediate measure of social inclusion, then self-deception would be a matter of people persuading themselves that they are more valued by other people than they are or by exaggerating the desirability, closeness, or importance of the attachments they have. However, because close relationships generally require frequent positive interactions, people presumably find it difficult to fool themselves into believing in nonexistent relationships or into mistaking a distant, causal relationship for a close one.

In contrast, if, as we suggest, self-esteem is also an appraisal of one's *eligibility* for attachments, there is much greater room for distortion. We suggested earlier that people sometimes have high trait self-esteem despite a lack of current attachments if currently available attachments are undesirable or limited. Although that might be objectively true, it also might be a fertile room for subjective misperception. For example, in our experience, many college students hold stereotypes indicating that students of the other sex on their campus are generally undesirable. On the face of it, such beliefs would seem maladaptive because, presumably, people would be better off exaggerating the positive attributes of their potential romantic partners. But the appeal of such beliefs can be understood if one assumes that they

serve to support the self-esteem of unattached members of such groups. Such individuals can tell themselves that their unattached status does not reflect on their general eligibility for desirable relationships. Instead, they can think they are unattached simply because the available partners are a sorry lot who don't deserve them anyway.

This kind of self-deception essentially fools the sociometer, thereby cognitively bypassing what the meter actually measures. The consequences of self-deception may thus be maladaptive. To the extent that people downplay or ignore real threats to belongingness in order to foster a sense of social acceptability or felt security, they may fail to take appropriate steps to maintain and, when necessary, repair important relationships. In addition, self-deception may undermine people's motivation to change in ways that enhance their relational value. Rather than making substantive changes that increase their desirability to others, people can simply find ways to convince themselves that they are desirable, thereby maintaining self-esteem without a correspondent improvement in relational appreciation.[1]

The practice of cultivating self-esteem for its own sake can be compared to drug abuse. Drugs take advantage of natural pleasure mechanisms in the human body that exist to register the accomplishment of desirable goals. A drug such as cocaine may create a euphoric feeling without one's having to actually experience events that normally bring pleasure, fooling the nervous system into responding as if circumstances were good. In the same way, cognitively inflating one's self-image is a way of fooling the natural sociometer mechanism into thinking that one is a valued relational partner. Similar self-deceptive processes have been identified in other domains. For example, people are highly motivated to have control over their environments but, when control is not possible, they often foster illusions of having control. These illusions make one feel good and may be adaptive in other ways, but they are obviously not as beneficial as truly having control. Thus, in the case of self-esteem, one wants first to be accepted, but if one's relationships are actually limited or tenuous, the individual may obtain some of the same affective benefits and maintain felt security by means of self-deception.

People who feel better about themselves than they seemingly should—those we call egotistical, conceited, or narcissistic—are viewed unfavorably by professionals and laypeople alike. The disparagement of people with

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[1] We speculate that self-deception is, evolutionarily speaking, a relatively recent psychological development. Self-deception requires the capacity for sophisticated self-relevant thought, as well as other high-level cognitive abilities. As we conceive it, the sociometer likely emerged as a regulatory mechanism even before the dawn of self-consciousness and may have functioned more effectively before people developed the cognitive capacity that allowed them to override it.

excessively high self-esteem is an intriguing phenomenon: Why do we feel so strongly about such individuals? The answer may be that self-deception imposes costs on everyone who must deal with such persons. Others are forced to interact with an individual who falls short on certain inclusionary criteria—for example, they must contend with social unpleasantness or take up the slack for an incompetent or irresponsible member—all while the self-deceptive individual reaps the psychological benefits of being a good partner or group member (in the sense of feeling valued, having high self-esteem, and experiencing positive emotions). Because people want others to actually be desired partners and group members—not just for others to think that they are—there should be a strong tendency to resent, dislike, and censure people who engage in self-deceptive egotism (Leary, Bednarski, Hammon, & Duncan, 1997).

Although researchers have focused primarily on self-enhancing interpretations, we should point out that people often distort information in a negative, self-deprecating direction as well. People often assume the worst about their performances (on tests, for example), judging themselves less able than the evidence eventually proves them to be. Similarly, they often react strongly with hurt feelings and lowered self-esteem to seemingly minor interpersonal slights and sometimes detect rejection when none exists. As Goffman (1955) noted, people tend to give a ''worst case reading'' to difficult encounters, assuming that their social images are more tainted by events than they are. Such considerations suggest that people are not perpetual egotists and that self-serving biases and egotism are countered by occasional self-deprecation.

F. SUMMARY OF THE THEORY

We have proposed that self-esteem operates as an internal measure of one's potential for inclusion in desirable groups and relationships. It is thus essentially a meter that serves to monitor, regulate, and maintain interpersonal attachments, and it is designed to motivate behaviors to increase inclusion and forestall rejection. Self-esteem will be based on whatever criteria those important groups use to include or exclude individuals. These criteria will primarily involve some combination of competence, likability, attractiveness, and trustworthiness (or moral character in general). State self-esteem will respond to immediate cues relevant to relational evaluation, including particular episodes of acceptance and rejection, whereas trait self-esteem will be a relatively stable appraisal of one's relational value in general.

As a sociometer, the self-esteem system is likely to monitor the environment constantly for cues or signals that pertain to one's inclusionary status, and so automatic, preattentive processing is likely involved. Assuming that most people have some social ties most of the time, the danger of losing attachments is more urgent than the appeal of forming new ones, and so the sociometer should be especially attuned to cues that connote devaluation, rejection, exclusion, or any broadly undesirable aspect of the self. When the monitoring system detects cues suggesting that one may be rejected now or in the future, the sociometer triggers negative affect as a warning to take preventive or remedial action.

The sociometer is tied both to specific changes in actual interpersonal relationships and to the possibility of future changes. Thus, for example, a bad test score could trigger a loss of self-esteem and resultant anxiety because it suggests a lack of competence that could make one less appealing to others (for instance, as an employee or as a provider in a close relationship). The salience, pervasiveness, and emotional power of the sociometer most likely entail it acquiring a degree of functional autonomy in the sense that people may become concerned about self-esteem without always noting the link to belongingness.

V. Relevant Evidence

Having described the sociometer theory of self-esteem, we turn our attention to research evidence relevant to the theory. We examine empirical evidence relevant to seven predictions of sociometer theory: (1) self-esteem responds strongly to inclusion and exclusion outcomes, (2) public events affect self-esteem more strongly than private events, (3) the primary dimensions of self-esteem reflect attributes that are relevant to being valued as a relational partner, (4) the importance people place on dimensions of self-esteem is interpersonally determined, (5) trait self-esteem is related to perceived relational appreciation and devaluation, (6) changes in self-esteem are accompanied by changes in affect, and (7) the sociometer is calibrated to efficiently detect relational devaluation. We discuss each of these bodies of evidence in turn.

A. SELF-ESTEEM RESPONDS TO INCLUSION/EXCLUSION OUTCOMES

The fundamental prediction of sociometer theory is that people's feelings of self-esteem are highly sensitive to cues that connote the possibility of

social exclusion or rejection. Consistent with the theory, explicit indications that other people devalue, dislike, or reject the individual appear to be among the most potent causes of lowered self-esteem. Events such as romantic rejection, expulsion from family or social groups, unemployment, abandonment, and exile are typically devastating experiences that are accompanied by losses in self-esteem. On the other hand, indications that others value and embrace the individual—praise, love, bonding, admission to desired groups, and the like—are associated with increased self-esteem. As Jones (1973) observed, gaining information from others that one is liked and respected produces ''satisfactions in [the] self-esteem need'' (p. 187).

Thus, fluctuations in self-esteem are largely due to how people think they are regarded by others (Shrauger & Schoeneman, 1979). The more support and approval people believe they are receiving, the higher their self-esteem tends to be (Coopersmith, 1967; Haas & Maehr, 1965; Harter, 1993a; Videbeck, 1960). Laboratory studies that have experimentally manipulated participants' perceptions of rejection show that subjects who are led to believe that others reject them feel less positively about themselves (Leary, Tambor, et al., 1995; Nezlek, Kowalski, Leary, Blevins, & Holgate, 1997). Furthermore, simply imagining scenes involving rejection leads to negative affect and physiological arousal (Craighead, Kimbell, & Rehak, 1979) and lowered self-esteem (Leary, Haupt, Stausser, & Chokel, 1998). Self-esteem is also enhanced by cooperative relationships relative to competitive ones (Deutsch, 1985), possibly because competitive relationships connote less acceptance than cooperative relationships. Importantly, research suggests that, among adolescents and adults, being valued by one's peers—acquaintances, classmates, co-workers, and so on—may be more critical to self-esteem than the acceptance of close friends and family members (Harter, 1990). This may be because most people perceive that they are at least minimally valued by close friends and family members, whereas the degree to which people are valued and accepted by other individuals in their lives is less certain.

Furthermore, self-esteem appears to be more responsive to decrements than to increments in belongingness. Psychologists studying many different phenomena have noted the asymmetry of negative and positive events; in general, negative events evoke stronger negative feelings than equally positive events evoke positive feelings. (For example, failure is generally a more negative experience than success is a positive one.) Various explanations of this effect have been offered. For example, because most experiences in life range from neutral to positive, positive reactions from others lack the saliency and diagnosticity of negative ones (Kanouse & Hanson, 1972). In a similar vein, rejection results in more potent aversive reactions than acceptance does in pleasant emotions, suggesting that the sociometer

displays this same asymmetry (Leary, Tambor, et al., 1995). As Fenigstein (1979) observed, ''rejection and acceptance are not comparably balanced instances of positive and negative social interactions'' (p. 81).

From an evolutionary perspective, an asymmetry in reactions to inclusion and exclusion is understandable. Most motivation and drive systems respond more strongly to deprivation states than to less-than-total satiation. The system that controls thirst and drinking, for example, triggers subjective feelings of thirst and drive-related behavior when an organism becomes dehydrated, but does not push the individual to remain maximally hydrated at all times. Similarly, from the standpoint of survival in a natural state, it would be more important for a person to detect and respond to relational devaluation than to seek to be maximally, unconditionally valued and accepted by an increasing number of people. As a result, the sociometer should be more likely to detect and respond to stimuli that connote relational devaluation rather than to those than connote relational appreciation.

Romantic outcomes undoubtedly provide some of the most impactful experiences of acceptance and rejection, and sociometer theory would predict that self-esteem would be strongly involved in intimate relationships. Sure enough, Baumeister, Wotman, and Stillwell (1993) found that accounts of unrequited love contained frequent indications that romantic rejections led to drops in self-esteem. Rejected lovers spoke of wondering what was wrong with them and of losing confidence to approach other potential partners. Their accounts also contained a high frequency of self-enhancing statements, often peripheral to the narrative, which suggests that their personal interpretations of being rejected revolved around ways of restoring their self-esteem. Meanwhile, accounts by rejectors occasionally referred to getting a boost in self-esteem from being the target of someone's affections, although this seemed to evaporate once they determined that the suitor was not a desirable partner. Thus, self-esteem drops when a desired relationship is thwarted, and the offer of a relationship may boost self-esteem, but primarily if the potential relationship is appealing (see also Baumeister & Wotman, 1992).

The sociometer theory also predicts that how people feel about themselves when they perform certain behaviors should parallel their expectations about how others would react to their behavior vis-à-vis relational evaluation. Leary, Tambor, et al. (1995, Study 1) showed this to be the case. In this study, participants rated behaviors according to how they thought other people would react if they themselves performed each behavior. They also indicated how they would feel about themselves after performing each action. The rank order of the behaviors was virtually identical for expectations of others' reactions and one's own self-feelings. On an

event-by-event basis, events that make the possibility of rejection salient lower state self-esteem.

Baldwin's work on relational schemas shows that priming people (via a subliminal cue) with the picture or name of another person leads them to evaluate themselves according to the primed individual's standards (Baldwin, 1992, 1994; Baldwin, Carrell, & Lopez, 1990; Baldwin & Holmes, 1987). For example, Baldwin et al. (1990) found that graduate students evaluated their own research performance more critically after subliminal exposure to a picture of the scowling face of their department chair. Similarly, Baldwin, Sinclair, and Brugger (1995) showed that participants who received a subliminal prime of a critical person's name subsequently had lower state self-esteem than participants who were exposed to an accepting person's name. The fact that subliminal primes affect people's momentary self-evaluations supports the idea that people's private self-evaluations are tied to the real or imagined evaluations of other people and that these evaluations can occur automatically and nonconsciously (see also Baldwin, 1994).

Apparently, many people suffer a drop in self-esteem following the death of a loved one, and this decrease is sharper in cultures characterized by greater interdependence (Catlin, 1992). Such a finding is easily explained if we assume that people feel less valued as a relational partner when those who previously accepted them have passed away and that the strength of the effect is a function of the importance placed on one's interdependent relationships. The connection between relational devaluation and self-esteem also helps explain why people who are physically abused or assaulted often show decrements in their self-esteem (Bhatti, Derezotes, Kim, & Specht, 1989; Goodman, Koss, & Russo, 1993). Not only does physical violence connote that the perpetrator does not value his or her relationship with the victim, but in many cases, victims of assault (rape victims, for example) worry that their victimization will lead other people to reject them.

Self-esteem tends to decline when people move from one social milieu to another. For example, children often show a decrease in self-esteem when they move from one school to another (Rosenberg, 1986). Presumably, these effects occur because when people move into new or less familiar situations and social groups, they usually are less assured of acceptance than they had been in more familiar groups in the past. In addition to simply lacking the support they have in more familiar situations, people in novel situations are more likely to worry about behaving in ways that lead to rejection simply because of uncertainty about how best to act (Leary & Kowalski, 1995).

Sociometer theory makes the counterintuitive prediction that people's successes may lead to decreased self-esteem if they lead other significant people to devalue or reject them. For example, Jones, Brenner, and Knight

(1990) instructed participants to role-play a self-serving, reprehensible person in a structured interview, then gave them feedback indicating that they had either succeeded or failed at playing the role convincingly. Participants who scored low in self-monitoring subsequently reported higher state self-esteem when they failed at the role-play task than when they succeeded. Apparently, the possibility of being evaluated unfavorably (if not relationally devalued) for appearing to be a reprehensible person lowered their self-esteem in spite of their successful performance. Participants who scored high in self-monitoring showed the opposite pattern, displaying higher self-esteem after success than failure. Given that high self-monitors desire to behave consistently with situational demands (Snyder, 1974), they may have focused on being accepted for playing the assigned role successfully rather than on being rejected for appearing to be a bad person. Along the same lines, people whose primary groups reward failure with acceptance and approval not only avoid success but will show increased self-esteem when they fail (Kaplan, 1980), and people who desire the acceptance of deviant groups (such as gangs) show an increase in self-esteem when they behave in a delinquent manner (Bynner, O'Malley, & Bachman, 1981; McCarthy & Hoge, 1984). Overall, the data suggest that behaviors that might lead to rejection, not failure per se, lowers self-esteem.

B. PUBLIC EVENTS AFFECT SELF-ESTEEM MORE THAN PRIVATE EVENTS

If self-esteem were primarily a mechanism for personal, *self*-evaluation, as most theorists have assumed, there would be no particular reason that public events (i.e., those known to others) would affect self-esteem differently than private ones (i.e., those known only to oneself). In contrast, if the sociometer theory is correct in conceptualizing self-esteem as an index of one's interpersonal desirability for social inclusion, the events known to others should have a stronger impact on self-esteem than confidential, private events because what other people know has much greater implications for social acceptance and rejection.

The empirical data strongly support the prediction that public events exert a stronger effect on self-esteem than private events. For example, failures that are known by other people are more likely to result in changes in self-esteem than are private failures (Stotland & Zander, 1958). Similarly, people's emotional reactions to ego threats are stronger when those threats are known by others (Leary, Barnes, & Griebel, 1986).

People are also more likely to engage in behaviors that appear designed to protect or enhance self-esteem when the esteem threat is public rather

than private (Baumeister & Jones, 1978; Frey, 1978; Greenberg & Pyszczynski, 1985; Schneider, 1969). Leary et al. (1986) had participants take a potentially ego-threatening test under one of four conditions that differed according to whether they personally would learn their score and whether they thought the researcher would learn their score. Before taking the test, they made attributions for their performance, believing in all conditions that the researcher would see their answers. Results showed that self-serving attributions were stronger for participants who were high in fear of negative evaluation who thought their scores would be public than for any other condition. Such a pattern documents that such attributions are often made for interpersonal reasons rather than to protect private self-esteem (Weary & Arkin, 1981). A similar finding appears in the literature on self-handicapping. Although Berglas and Jones (1978; Jones & Berglas, 1978) originally described self-handicapping as a means of protecting self-esteem, Kolditz and Arkin (1982) and Tice and Baumeister (1990) showed that self-handicapping occurred primarily when participants' behavior was public.

These findings are difficult to explain if we assume that self-esteem is affected only when people violate their own privately held standards. If the self-esteem system motivates people to maintain positive views of themselves, violations of personal standards should affect self-esteem and produce ego-defensive reactions whether or not others are aware of the behavior. Yet, behaviors that are known by others exert a far stronger impact on self-esteem than those that are private.

Several researchers have suggested reasons that threats to inner self-esteem are more pronounced in public (e.g., Aronson, 1968; Tetlock & Manstead, 1985), but such explanations are unneeded if we assume that self-esteem is involved in monitoring others' reactions to the individual. As a mechanism for monitoring and responding to other people's responses to the self, the sociometer *naturally* responds to changes in others' perceived reactions to the individual.

C. DIMENSIONS OF SELF-ESTEEM INVOLVE ATTRIBUTES RELEVANT TO RELATIONAL EVALUATION

Although it is often treated as a monolithic entity, self-esteem differs across various areas of people's lives. For example, the person with low academic self-esteem may possess high self-esteem regarding social attributes and moderate self-esteem regarding his or her athletic ability (Fleming & Courtney, 1984; Harter, 1993b; Hoyle, 1987).

Sociometer theory predicts that the primary domains of self-esteem should reflect factors that determine the degree to which people are valued by others. In support of this notion, the content of commonly used measures of self-esteem and self-concept reflect valued social attributes (see, for example, Fleming & Courtney, 1984; Harter, 1985, 1993b). First, most self-esteem inventories measure how well one gets along with others, as in being likable and friendly. Second, they measure self-perceptions of competence, such as being able to perform well in school or in a career and, in some cases, physical and atheletic skills as well. Third, they measure self-perceptions of physical attractiveness, and, fourth, they often assess perceptions of one's personal goodness, worth, or value. These dimensions are identical to the primary criteria for inclusion and exclusion discussed previously. Factor analyses of self-esteem inventories also reveal similar dimensions. In addition to a dimension of global self-worth, people appear to differ in self-esteem on dimensions related to interpersonal attributes, intellectual ability, physical appearance, and physical ability (Heatherton & Polivy, 1991; Hoyle, 1987; Wylie, 1974). Because people are commonly valued and devalued on the basis of their social characteristics, their competence (including intellectual and physical ability), their appearance, and their possession of morally relevant attributes, self-feelings on these particular dimensions are particularly salient. In short, the basic dimensions of self-esteem appear to reflect the primary criteria on which people are valued as relational partners (and thus included vs excluded) by others.

Furthermore, research has shown that people's self-perceptions of their likeability, competence, and physical appearance strongly predict their overall self-esteem (Harter, 1993b; Pelham & Swann, 1989), and sociometer theory explains why this is the case. Believing that one possesses attributes that are likely to lead one to be valued by others will result in higher global self-esteem than believing that one does not possess such attributes (or, worse, believing that one's characteristics are likely to lead to relational devaluation). Consistent with James' (1890) notion that self-esteem depends on people's successes and failures in domains that people regard as important, self-perceptions in a particular domain (likeability, competence, appearance, or whatever) predict self-esteem only to the extent that people regard the domain as important (Harter, 1993b). Sociometer theory regards these ''important'' domains as those on which an individual has staked his or her social acceptance. An individual who believes her social acceptance is predicated on her athletic ability but not on her intelligence will suffer a greater loss of self-esteem following an athletic failure than an academic one.

As noted, people differ in their self-esteem in various domains, although the correlations among self-esteem in various domains tend to be high.

This pattern of differences in domain-specific self-esteem against the background of a general level of self-esteem is consistent with sociometer perspective. In addition to holding some general, omnibus sense of their relational worth (as reflected in overall self-esteem), people's self-esteem may be differentially affected when certain bases of relational evaluation become salient in particular contexts.[2]

[2] As we've thought about the measurement of self-esteem from the standpoint of sociometer theory, it has become clear that few, if any, of the existing self-report measures of self-esteem cleanly assess self-esteem separate from other related constructs. As we defined it earlier in this chapter, self-esteem is an "affectively-laden self-evaluation" or "a person's appraisal of his or her value." Yet, measures of self-esteem typically include items that assess not only subjective self-esteem but also self-perceived competencies or self-efficacy, and sometimes perceptions of how one is regarded by other people as well. For example, some of the items on the Rosenberg (1965) Self-Esteem Scale, undoubtedly the most frequently used measure of trait self-esteem, involve self-perceived competency rather than self-esteem per se (e.g., "I am able to do things as well as most other people." "All in all, I am inclined to feel that I am a failure"). Recently, Fleming and Courtney's (1984) scale has received considerable use (including by us), but it too assesses more than how the respondent evaluates or feels about him- or herself. For example, in addition to assessing self-evaluations, their Self-Regard Subscale—which is used as a measure of global self-esteem—includes items about social respect, confidence in one's abilities, and being inferior to other people. Fleming and Courtney's other subscales—for social confidence, school abilities, physical appearance, and physical abilities—are even more problematic in terms of assessing far more than self-esteem per se. The Coopersmith (1967) Self-Esteem Inventory, which has been used widely with children, casts an even wider net, asking respondents whether they worry, daydream, wish they were younger, get scolded, and are picked on by other children. Many researchers have also used Pelham and Swann's (1989) Self-Attributes Questionnaire (SAQ), which asks respondents to rate themselves on 10 attributes—such as intellectual capability, physical attractiveness, emotional stability, and leadership ability—relative to a comparison group of other people of their age. Although Pelham and Swann correctly refer to the SAQ as a measure of "self-conceptions" or "self-views," some researchers have used it as a measure of self-esteem, which it is not.

Each of these scales, as well as dozens of others that have been designed to assess self-esteem (see Blascovich & Tomaka, 1991, for a review) undoubtedly tap into the positivity of people's beliefs and feelings about themselves. However, given the broad content of their constituent items, most of these scales appear to assess more than self-esteem per se. By including items that assess conceptually different entities (e.g., self-esteem, ability, self-efficacy, self-confidence, reflected appraisals), the interpretation of the scale score is clouded.

Just as important, however, is the fact that simply knowing that one is good (or that other people think one is good) on one or more specific dimensions does not necessarily imply that the person *feels* good about him- or herself (that is, has high self-esteem). Undoubtedly, believing that one is efficacious and successful is often associated with higher self-esteem but this is an empirical relationship rather than a conceptual one. According to sociometer theory, believing that one is competent in a particular domain will lead to self-esteem only to the degree that the person believes that the attributes in question will lead other people to value having relationships with him or her. Put differently, beliefs about one's attributes should trigger changes in the sociometer only if those attributes are relevant to relational evaluation.

D. IMPORTANCE PEOPLE PLACE ON SELF-ESTEEM DOMAINS IS SOCIALLY DETERMINED

Sociometer theory predicts that the dimensions of self that are most important to people's self-esteem should be those that they believe *others* regard as important. Consistent with this, the importance people place on various domains of their lives (intellectual, social, athletic, etc.) correlates very highly with the importance they think other people place on these areas. Furthermore, self-esteem correlates highly with the individual's performance in domains he or she believes are important to others (Harter & Marold, 1991). Such effects are consistent with a model that links self-esteem to the monitoring of others' reactions to the individual. Furthermore, people tend to internalize feedback from these significant others more easily than feedback from other people, and respond to self-relevant stimuli consistent with the standards of whatever private audience is most salient. As Baldwin and Holmes (1987) observed, "individuals process self-relevant information according to patterns established in the context of significant relationships" (p. 1096).

According to sociometer theory, events that affect self-esteem do so because they imply changes in relational evaluation. For example, failure generally lowers self-esteem because it lowers one's relational value (and, thus, raises the possibility of rejection), whereas success increases self-esteem because it connotes greater relational value (and acceptance). As sociometer theory predicts, not only do people implicitly associate failure with rejection, but people with low trait self-esteem demonstrate a stronger nonconscious association between success–failure and acceptance–rejection than people with high self-esteem and are more inclined to see their social acceptance as precarious and conditional on their performance (Baldwin & Sinclair, 1996).

Presumably, people develop different levels of self-esteem in different areas of their lives when others respond differently, vis-à-vis inclusion and exclusion, to their behavior in various domains. Thus, the academically proficient, but athletically inexperienced student may be acclaimed and accepted for his or her intellectual ability, but ignored (or even ostracized) when it comes to sports. Among adolescents, feelings of self-esteem are highest when among friends and lowest when in the classroom (Gecas, 1972). Presumably this is because most adolescents feel more accepted by their friends than by their teachers.

People differ in the number of self-defining dimensions they regard as personally important. Studies show that people who possess complex self-concepts more easily cope with the failures, stresses, and tragedies of every-

day life than people whose self-concepts are less complex (Linville, 1985, 1987). In our view, part of this self-complexity effects stems from the nature of the self-esteem system. In essence, a person with a simple self-concept stakes his or her social inclusion on only one or two dimensions of self. If a failure occurs in this domain, the person's sense of social inclusion will be threatened, resulting in a precipitous drop in self-esteem and in negative affect. In contrast, people who are high in self-complexity are somewhat buffered against failures in one domain by the other domains. Because their sense of inclusion is not based on a single attribute or relationship, they are less affected by failures in any particular domain.

E. TRAIT SELF-ESTEEM IS RELATED TO PERCEIVED RELATIONAL APPRECIATION AND DEVALUATION

If, as we have proposed, trait self-esteem involves the assessment of one's relational value over the long run, we should find strong links between trait self-esteem and events that connote relational appreciation and devaluation. The literature is rife with such connections.

1. Development of Trait Self-Esteem

When viewed from the standpoint of previous theories of self-esteem, low self-esteem is somewhat of a paradox (Baumeister, 1993); if people have a strong motive to maintain high self-esteem, why do certain people have low self-esteem? Has the self-esteem system of low-self-esteem people malfunctioned? Our answer is ''no,'' and, in fact, it may be functioning quite well.

As we have suggested, people *do not* have a motive to maintain high self-esteem per se, but rather a system for monitoring and responding to threats to relational evaluation. For such a system to function properly, it must alert the individual to possible relational devaluation. Presumably, then, people with relatively low self-esteem are those who have had more than their share of cues indicating disinterest, rejection, or ostracism—from parents, teachers, peers, coaches, or whomever. When people experience relational devaluation, including explicit rejection, repeatedly over time, they are likely to develop relatively low trait self-esteem.

For example, one of the best predictors of trait self-esteem in children is the child's sociometric status. Children who are widely rejected or avoided by their peers have lower self-esteem than those who are accepted (Harter, 1993a, 1993b). Along these lines, Harter, Whitesell, and Junkin (1998) concluded from their study of the self-evaluations of disabled and normally

achieving adolescents, that "indices of peer social appeal . . . were [the most] highly correlated with global self-worth" (p. 670). In addition, relationships with parents are potent predictors of self-esteem. Studies have shown that positive and accepting relationships with parents are associated with higher self-esteem than negative, rejecting relationships (e.g., Garber, Robinson, & Valentiner, 1997; Litovsky & Dusek, 1985; McCranie & Bass, 1984). Overall, the relationship between perceived social approval and support and trait self-esteem is quite strong (Harter, 1987). As Shaver and Hazan (1987) noted "low self-esteem is a natural component of a negative model of self based on actual attachment-related experiences" (p. 116).

Possibly, childhood is so critical in the formation of trait self-esteem because children do not possess the adult's ability to modify offending behavior to enhance inclusion, seek alternate accepting relationships in lieu of the rejecting ones, or cognitively minimize the meaning of certain rejecting behaviors (e.g., Mom's had a bad day; my friend is putting me down because he's envious). Thus, unlike that of the adult, the self-esteem system of the child is undefended against rejecting onslaughts.

Several writers have observed that few people have truly low self-esteem. By and large, those who score at the lower end of the distribution of commonly used measures of trait self-esteem are, in an absolute sense, *moderate* in self-esteem (Baumeister, Tice, & Hutton, 1989; Brown, 1993; Tice, 1993). This state of affairs is consistent with our analysis. People are much more likely to communicate their positive than negative reactions to others (Blumberg, 1972; Kanouse & Hanson, 1972), and relatively few people receive wholesale rejection. For example, when a woman rejects a man's request for a date, she tends to offer an excuse that seems explicitly designed to minimize the damage to his self-esteem (Folkes, 1982). Thus, at worst, most people receive some mixture of accepting and rejecting feedback throughout life; even hardcore reprobates typically receive some positive feedback and feel valued by a confidante or two. As a result, few individuals feel absolutely uncludable.

2. Reactions to Interpersonal Evaluation

Several studies have documented an inverse relationship between trait self-esteem and negative reactions to failure and unfavorable evaluations (Jones, 1973; Rosenberg, 1965). People with higher trait self-esteem appear less bothered by negative evaluation than people with low trait self-esteem. Furthermore, people who have recently suffered a loss in self-esteem appear particularly motivated to attain others' approval and to avoid disapproval, and people who are low in trait self-esteem score higher in need for approval and fear of negative evaluation than those who are high in self-esteem

(Crowne & Marlowe, 1960; Hewitt & Goldman, 1974; Leary & Kowalski, 1993; Schneider, 1969). (Some studies have found a positive relationship between self-esteem and scores on the Crowne–Marlowe Social Desirability Scale, but this effect appears to be due to the fact that some people who score high on measures of self-esteem—those characterized as having ''defensive'' or ''questionable'' self-esteem—actually have low self-esteem but obtain high scores because of their tendency to rate themselves in an excessively favorable manner, Hewitt & Goldman, 1974). In the same vein, people with low self-esteem—whether dispositionally low or experimentally induced—are more attracted to those who approve of them and dislike those who evaluate them negatively than people whose self-esteem is high (Dittes, 1959; Hewitt & Goldman, 1974; Jacobs, Berscheid, & Walster, 1971; Walster, 1965). Low self-esteem is also associated with rejection sensitivity—the disposition to expect, perceive, and overreact to social rejection (Downey & Feldman, 1996; Levy, Ayduk, & Downey, in press).

Trait self-esteem is among the best predictors of social anxiety and shyness (Leary & Kowalski, 1993; Zimbardo, 1977). Social anxiety arises when people are motivated to make particular impressions on others but doubt they will do so (Schlenker & Leary, 1982; Leary & Kowalski, 1995). Although people desire to make particular impressions on others for many reasons (Baumeister, 1982), a primary reason is to increase their social acceptance and inclusion (Leary, 1995; in press).

These assorted findings are consistent with sociometer theory. People who have low trait self-esteem are less likely to perceive that their needs for social inclusion are being met—that is, the sociometer is more likely to register low relational evaluation. As a result, people with lower self-esteem should be more sensitive to events that cause a downward drop in the sociometer than those with higher self-esteem. High-self-esteem people do not show these effects, presumably because they already feel adequately valued and included. People with high trait or state self-esteem, while not wishing to jeopardize their standing in others' eyes, need not chase after additional approval.

3. Stigmatization and Self-Esteem

Our claim that trait self-esteem is a function of relational appreciation and devaluation may be questioned on the basis of research on the trait self-esteem of members of stigmatized groups. Although some research has shown that some stigmatized groups have lower than average self-esteem (obese children, for example, have lower self-esteem than children of normal weight; Sallade, 1973; Wadden, Foster, Brownell, & Finley, 1984), members of many stigmatized groups—for example, women, blacks, men-

tally retarded persons, and physically unattractive people—do not consistently have lower self-esteem than other people. Crocker and Major (1989) explained this paradox by suggesting that possession of a stigmatizing condition can actually protect people's self-esteem from damage caused by discriminatory behavior. Instead of attributing others' negative reactions to their personal characteristics, people can attribute rejection to prejudice against their stigma, thereby protecting their self-esteem.

Although such an attributional process may be at work, we also suggest that prejudical treatment should not be expected to automatically lower trait self-esteem as some theorists have supposed. As we have seen, people need only a certain level of belongingness and are not motivated to be valued and included by everyone (Baumeister & Leary, 1995). Once the person's need to belong has been fulfilled by relationships with some relatively circumscribed group of people, relational devaluation—even outright rejection—by others may have little effect on self-esteem. Such rejection may be upsetting, angering, or frustrating (because it interferes with the attainment of desired goals or connotes unjustified discrimination), but it need not affect self-esteem.

Thus, members of stigmatized groups may not suffer a loss of self-esteem as a result of the prejudices of out-group members because their needs for social inclusion are being satisfied by members of their in-group, such as parents, friends, and teachers (Hughes & Demo, 1989; Rosenberg & Simmons, 1972). The people with whom we form our most important and stable relationships are likely to be those who value their relationships with us in spite of our shortcomings and stigma. This analysis suggests that members of discriminated-against groups should suffer a decrement in self-esteem only to the extent that they either do not otherwise have an adequate social network or desire to be accepted by the out-group members who reject them (cf. Rosenberg, 1979, 1981).

4. Moderating Effects of Trait Self-Esteem on Perceived Acceptance

Although sociometer theory focuses on the effects of perceived acceptance and rejection on self-esteem, it acknowledges that a person's current level of self-esteem (either state or trait) can also moderate his or her perceptions of interpersonal feedback. The fact that people with high trait self-esteem tend to believe that others are more accepting of them than people with low self-esteem (Leary, Tambor, et al., 1995; Leary et al., 1998) is due partly to the effects of acceptance–rejection on self-esteem and partly to the reciprocal influence of self-esteem on perceptions of others' reactions. Felson's (1989, 1993) longitudinal studies of reflected appraisals show that not only do people's perceptions of others' appraisals (i.e., reflected apprais-

als) affect their personal self-appraisals, but self-appraisals influence peo-
ple's perceptions of how they are perceived by others. Although Felson's
research dealt with cognitive self-appraisals rather than self-esteem per se,
we assume that the same process operates in both cases.

In our view, a history of rejection (or even minor instances of relational
devaluation) not only results in lower trait self-esteem, but it calibrates the
sociometer to be particularly sensitive to potential threats to inclusion. A
person with a history of unequivocal rejection may be well-served by a
heightened awareness of rejection cues that allow him or her to forestall
potential exclusion. In contrast, someone whose inclusion has rarely been
in question (and who apparently possesses attributes that will assure his
or her acceptance in the long run) need not be as attuned to occasional
indications that others do not fully value their relationships with him or her.

Recent research on adolescents' intuitive theories about self-esteem
makes this point in a somewhat different way. Harter, Stocker, and Robin-
son (1996) asked adolescents to choose between three statements regarding
the relationship between social approval and self-esteem, indicating
whether (a) the degree to which others like and approve of them affects
how they feel about themselves, (b) how they feel about themselves affects
whether others like and approve of them, or (c) others' approval has no
effect on their self-esteem. The results showed that participants who indi-
cated that social approval determines their self-esteem had significantly
lower self-esteem than participants who believed that self-esteem preceded
approval. In addition, participants who thought that social approval deter-
mined their self-esteem appeared more sensitive to rejection, reported
having lower peer support (which also appeared to fluctuate more over
time), focused more on their social lives (often to the detriment of their
schoolwork), and were more preoccupied by approval than the participants
who thought that self-esteem determined approval by others.

Sociometer theory provides a straightforward interpretation of these
patterns. People who do not feel adequately valued and accepted will
experience low self-esteem because of the action of the sociometer. At the
same time, they will become acutely attuned to the degree to which they
are being accepted or rejected and, thus, will be quite aware that events
in their social environment affect their self-esteem. The sociometer's detec-
tion of relational devaluation will motivate efforts to enhance their rela-
tional value, focusing them on their social networks and leading them to
try to enhance inclusion and forestall rejection. In contrast, people who
feel adequately valued and accepted will have high self-esteem, and, as long
as their sociometers detect no threats to their inclusion, such individuals will
be rather oblivious of the effect that social approval and disapproval is
having on their self-esteem. Bolstered by having a full interpersonal tank,

they can travel many miles without a moment's thought to how much gas they have or even a concious glance at the fuel gauge (even while the sociometer operates quietly in background mode.) As a result, they may not be aware of the effect that others' approval actually has on their self-esteem. Satisfied with the status quo, they feel no need to devote special attention to their interpersonal relationships nor to go out of their way to be accepted (Heatherton & Vohs, in press).

Of course, if Harter et al.'s (1996) participants are correct in their belief that their self-esteem is unaffected by social approval, sociometer theory would be in a great deal of difficulty. However, we have good reasons to doubt the validity of their claims. Leary, Hoagland, Kennedy, and Mills (1999) used Harter et al.'s measure to distinguish between participants who believed that their self-esteem was affected by social approval and disapproval and those who maintained that their self-esteem was not in the least bit affected by others' evaluations of them. Then, in a laboratory study, participants received bogus favorable or unfavorable feedback ostensibly from three other participants in the session. Although the favorability of the feedback affected participants' state self-esteem overall (as sociometer theory predicts), participants' responses to social approval and disapproval were unrelated to their beliefs regarding whether others' evaluations affect their self-esteem. Despite their claims to the contrary, the self-esteem of participants who denied that approval affects their self-esteem did in fact change as a function of other people's evaluations.

F. CHANGES IN SELF-ESTEEM ARE ACCOMPANIED BY AFFECTIVE CHANGES

We suggested that a mechanism that monitors stimuli of vital interest to the individual would be expected to evoke affective reactions when such stimuli were detected. If we compare how people generally feel when they believe they are valued, loved, accepted, respected, or included with how they feel when they think they are devalued, disliked, rejected, disparaged, or excluded, we easily see that events that lower self-esteem are aversive.

The feelings that accompany perceived social exclusion appear to be of two interrelated types. On one hand, when people experience a threat to self-esteem they feel badly *about themselves* (Brown, 1993). These feelings go beyond mere unfavorable self-evaluations (simply perceiving oneself as incompetent, evil, or weak, for example) to negative feelings about the self (e.g., feeling ashamed, self-conscious, desperate, devastated) (Semin & Manstead, 1981). Scheff et al. (1989) proposed that *shame* is the central emotion in low self-esteem (and that high self-esteem is characterized by

pride). To the extent that shame can be conceptualized as a vehicle for teaching and enforcing appropriate behavior (Buss, 1980; Scheff, 1990), failures to behave appropriately would raise the specter of rejection and, thus, elicit feelings of shame.

In addition, real or imagined relational devaluation produces diffuse negative affect that is not directly associated with self-evaluations. Rejection and its concomitant losses of self-esteem are associated with a variety of emotions, including anxiety, depression, hurt feelings, and loneliness (Burish & Houston, 1975; Leary, Barnes, & Griebel, 1986; Leary, Koch, & Hechenbleikner, in press). In one study, the state self-esteem of students who had just received midterm exams correlated in excess of .50 with their feelings of anxiety and depression (Heatherton & Polivy, 1991). In a related vein, Watson and Clark (1984) reviewed evidence that self-ratings correlate strongly with measures of negative affect and concluded that low self-esteem is an aspect of negative affectivity. Likewise, Pelham and Swann (1989) showed that self-esteem correlated negatively with negative affectivity and positively with positive affectivity. Conversely, when people are asked about sources of happiness, their top selections tend to involve the quality of their interpersonal relationships; a happy marriage, a good family life, and good friends are rated above occupational success, financial security, and possessions (Campbell, Converse, & Rodgers, 1976). Clearly, potent affective reactions are tied to the degree to which people are included in meaningful interpersonal relationships.

Furthermore, belongingness buffers people against the experience of negative emotions. For example, the presence of social support lowers stress and promotes psychological well-being (Cohen & Wills, 1985; Goodenow, Reisine, & Grady, 1990; Manne & Zautra, 1989). Importantly, this effect is due to the perception that others value and care for the individual rather than to the pragmatic benefits of the received support (Stroebe & Stroebe, 1997). Indeed, if the monitoring system is highly sensitive to belongingness-relevant feedback, then having others show support would be particularly salient and welcome during times of stress, setting off a strong positive reaction that might not be apparent at other times, and this would be particularly true when the stress itself resulted from events that threatened self-esteem (such as final exams, divorce, or tenure denial).

G. SOCIOMETER IS CALIBRATED TO DETECT RELATIONAL DEVALUATION

Although evidence is only suggestive, the sociometer system appears to respond more strongly to decrements than increments in real and potential

inclusion. Granted, we feel good when we think we are valued or loved, but most people seem to feel far worse after learning they are devalued or hated. In two relevant experiments, participants who believed they were excluded showed a decrease in self-esteem feelings relative to a control group, but participants who thought they were accepted showed no corresponding increase in self-esteem (Leary, Tambor, et al., 1995, Studies 3 & 4; see also Videbeck, 1960). Studies of unrequited love show that rejected lovers suffered serious blows to their self-esteem, whereas targets of unrequited love (who had received positive, accepting reactions) had at most a small, transitory boost (Baumeister & Wotman, 1992).

Ogilvie's (1987; Ogilvie & Clark, 1991) research on the undesired self demonstrates a similar asymmetry. Ogilvie has shown that self-esteem and life satisfaction are more closely related to how far people think they are from their undesired self than to how close they think they are to their ideal self. If the undesired self is conceptualized as the self most likely to result in relational devaluation and social exclusion, such a finding is consistent with the sociometer perspective.

In mapping the relationship between objective changes in rejection–acceptance and subjective feelings of self-esteem, Leary et al. (1998) found that self-esteem was at its lowest when interpersonal feedback was mildly negative, but did not peak until exceptionally positive, accepting feedback is received. This pattern may reflect the fact that, from a practical standpoint, there is little difference between ambivalence and rejection. In everyday life, we impart positive outcomes on those we like and accept, but simply ignore or avoid those whom we regard neutrally or negatively. Except in extreme cases (such as when we exile or retaliate against someone), rejection carries no greater interpersonal penalty than indifference. As a result, people tend to regard ambivalence or neutrality as rejection. For example, a lover is likely to react about as negatively to a partner's ambivalence (i.e., ''I really don't care whether we stay together or not'') as to outright rejection. The same reaction is reflected in the cliche, ''If you're not for me, you're against me.''

H. SUMMARY AND EVALUATION OF THE EVIDENCE

The research evidence strongly supports several hypotheses derived from sociometer theory. As the theory predicts, state self-esteem is highly responsive to events that connote inclusion and exclusion, particularly when those events are public rather than private. Furthermore, low trait self-esteem appears to emerge from a history of relational devaluation, and people with low self-esteem (either state or trait) act in ways that suggest that they

are deficient in belongingness. Thus, the results of numerous laboratory and field experiments, correlational studies, and longitudinal investigations support a link between perceived inclusion–exclusion on one hand and state and trait self-esteem on the other. As always, questions may be raised about the validity of any particular study, but taken as a whole, the data consistently show that self-esteem both responds to events that have implications for the individual's relational evaluation by others and moderates reactions to those events.

The importance people place on these events is closely related to how important they believe others regard them, and self-esteem correlates highly with the individual's performance in domains they believe are important to others. Clearly, self-esteem is tied closely to how people think others view them, and their self-evaluations change as a function of which other people are most salient to them at a particular moment. Such effects are consistent with a model that links self-esteem to the monitoring of others' reactions to the individual.

Furthermore, the data suggest that the basic dimensions of self-esteem—as revealed by analyses of common measures of state and trait self-esteem—involve attributes that are relevant to relational evaluation and, thus, inclusion and exclusion. The most important dimensions of self-esteem involve social qualities, competence and ability (both intellectual and physical), and physical appearance, which, as we saw, are also the primary factors that determine the degree to which people value others as friends, lovers, family members, and other relational partners. Although they support the sociometer perspective, these data must be regarded as only suggestive because of the possibility that the findings are empirically tautological. That is, investigators create measures of self-esteem based on a priori conceptions of what self-esteem entails. Content and factor analyses of these measures will only reveal dimensions that investigators built into them. However, the convergence of findings across diverse measures and studies suggests that the dimensions that have been uncovered reflect more than a particular researcher's idiosyncratic conceptualization of self-esteem.

Support also exists for the proposition that changes in self-esteem are closely tied to positive and negative affect. Changes in state self-esteem are associated with changes in mood, and trait self-esteem correlates highly with the predisposition to experience most varieties of negative emotion, including depression, anxiety, jealousy, embarrassment, and shame. To the extent that emotional systems are involved in helping the organism deal with life challenges, we can assume that the self-esteem system must serve some purpose other than its own self-maintenance.

More research is needed on the calibration of the sociometer. Research that examined the functional relationship between acceptance–rejection

and subjective self-esteem suggests that the sociometer is particularly sensitive to rejection, but many of the relevant studies involved participants imagining how they would feel if they received various patterns of feedback. Laboratory experiments in which participants received actual accepting or rejecting feedback are consistent with the role-playing studies as far as they go, but only one laboratory experiment has used more than two or three levels of feedback.

In brief, the available data strongly support the central propositions of sociometer theory. Furthermore, the theory provides a framework for parsimoniously integrating what is known about the features of the self-esteem system.

VI. Implications and Applications

Having examined evidence relevant to sociometer theory, we turn our attention to how the theory may help us to understand several features of human behavior in which self-esteem has been implicated. Sociometer theory offers to bring order to the far-ranging literatures on self-esteem, as well as to explain several seemingly paradoxical findings that are not easily encompassed by other approaches. A complete discussion of the implications of the theory for understanding all aspects of self-esteem would require far more space than we can devote here. Thus, we settle for a brief look at how the sociometer model accounts for several known facts about self-esteem.

A. REACTIONS TO SELF-ESTEEM THREATS

A great deal of research has examined people's reactions to events that threaten their self-esteem, such as failure, interpersonal rejection, and incompetence. According to sociometer theory, these events have their effects not because they threaten an inner sense of self-esteem but because they are associated with the possibility of relational devaluation.

People who confront events that may damage their self-esteem engage in a variety of behaviors that appear intended to ameliorate the threat (Blaine & Crocker, 1993). Such self-serving or ego-defensive behaviors can occur preemptively before the threat has actually occurred or reactively in response to actual threats to self-esteem. For example, people who face the prospect of failure (or are uncertain about their chances of success) may create impediments to performance to which subsequent failure, if it

occurs, may be attributed (Jones & Berglas, 1978; Leary & Shepperd, 1986). It appears that people with low self-esteem are particularly prone to self-handicap to protect themselves against the implications of possible failure (Tice, 1991). In contrast, people with high self-esteem self-handicap mainly to increase their potential credit for success. From the standpoint of sociometer theory, these results suggest that those who are insecure about their interpersonal appeal seek to avoid any possible failure because it might provide reason for rejection or exclusion, whereas those who believe their interpersonal appeal is strong (i.e., those with high self-esteem) see less reason to worry about the implications of possible failure.

In addition to self-handicapping, people who confront threats to their self-esteem offer preemptive self-serving attributions (or self-reported handicaps) to create plausible excuses for possible failure. After failure, people may make self-serving attributions (Bradley, 1978), derogate the diagnosticity or validity of the test (Frey, 1978), deny the relevance of the failure for their self-esteem (Tesser & Paulhus, 1983), falsely claim that their performance was impeded by factors beyond their control (Higgins & Snyder, 1991), or compensate by enhancing the positivity of their self-evaluations on dimensions unrelated to the failure (Baumeister & Jones, 1978).

After devoting years to trying to understand the source of these self-serving reactions, most researchers acknowledge that they occur for several distinct reasons involving coldly cognitive, intrapsychic, and interpersonal processes (Bradley, 1978; Miller & Ross, 1975; Tetlock & Manstead, 1985). Without discounting previous explanations, we suggest that many, if not most of the behaviors that have been attributed to self-esteem motives arise not from concerns with one's private self-evaluation per se but from concerns with other people's reactions to the individual vis à vis inclusion–exclusion. From the sociometer perspective, ego-defensive behaviors do not reflect attempts to raise self-esteem per se (as has been widely supposed), but rather efforts to reduce the likelihood that failure or other undesirable behaviors will result in a disintegration of one's connections with other people.[3]

Even socially unacceptable behavior can enhance self-esteem if it increases the possibility of social inclusion. Research shows, for example, that people are more likely to cheat after their self-esteem has been lowered

[3] The sociometer analysis of self-serving responses is closely related to previous explanations proposing that people use public attributions as self-presentational tactics to convey particular impressions of themselves to others (Forsyth & Schlenker, 1977; Schlenker, 1980; Weary & Arkin, 1981). However, our analysis extends previous conceptualizations by linking these self-presentations to the need for social inclusion and by showing precisely how self-esteem is involved.

than when it has been raised. Aronson and Mettee (1968) attributed this effect to the fact that high self-esteem deters dishonest behavior, but it is also possible that cheating after a loss of self-esteem may be a means of restoring one's social image and relational appreciation by appearing to be a ''winner.'' Similarly, people sometimes make ''counter-defensive'' attributions in which they accept responsibility for failure (Bradley, 1978; Miller & Ross, 1975; Weary, 1979). Such attributions are far more readily explained by sociometer theory than by explanations that posit inherent needs for self-esteem. Specifically, because people who make self-serving attributions are sometimes disliked and rejected (Forsyth, Berger, & Mitchell, 1981; Forsyth & Mitchell, 1979), they sometimes find it in their best interests to either refrain from making such attributions or to make explicitly counter-defensive ones (Bradley, 1978).

This is not to suggest that ego-defensive behaviors never occur in private; they do. However, we attribute instances of private self-serving reactions to (a) people's concerns that their private behaviors may, at a later time, be known to others; (b) an automatic, overlearned tendency to engage in esteem-protecting actions even when they have no effect on others' reactions; or (c) an effort to lower one's own anxiety about one's private behaviors. For example, even a private failure may lead a person to question whether he or she can successfully perform the next time a similar evaluation occurs in public. In an effort to reduce the anxiety associated with such a possibility, self-serving responses may occur. We argue, however, that these responses are due to concerns with potential interpersonal outcomes rather than to violations of one's personal standards.

B. SOCIAL COMPARISON

Self-esteem is affected not only by people's judgments of their objective characteristics but by how they compare themselves to others. Self-esteem improves if we compare ourselves to those with less desirable characteristics than ourselves (Affleck, Tennen, Pfeiffer, & Fifield, 1988; Schultz & Decker, 1985). In an early demonstration of this effect (Morse & Gergen, 1970), students completed an application for a research position alongside a confederate posing as another applicant. In one condition, the confederate was clean and well-dressed, whereas in another condition, the confederate was sloppy and unkempt. Participants who completed the application in the same room as ''Mr. Clean'' suffered a transient drop in self-esteem. Because of these effects of social comparison on self-esteem, people seek out others who are below them when their self-esteem is on the line (Wills, 1981; Wood & Taylor, 1991).

Tesser and Campbell (1983; Tesser, 1988) proposed a theory of self-evaluation maintenance (SEM) that deals with how people utilize social comparisons to maintain their self-esteem. Among other things, SEM theory predicts that people seek associations with those who are superior to them primarily if the others are superior on dimensions that are not relevant to the person's own self-concept (see Tesser, Campbell, & Smith, 1984). In contrast, people prefer to associate and compare themselves to people who have a lower standing on the dimensions they personally consider important. From the standpoint of sociometer theory, these effects occur because the presence of people who are superior to oneself constitutes a threat to social inclusion. When others are superior on dimensions that people view as important, they are more likely to view themselves as socially dispensable. In contrast, others' superiority on dimensions irrelevant to oneself poses no threat because the individual possesses desired characteristics that the comparison other does not. Because the other person's characteristics have no implications for one's relational value or social inclusion, self-esteem is not affected.

C. CONFORMITY AND PERSUASION

Although much research has concluded that people with lower self-esteem are more easily influenced than those with higher self-esteem (Brockner, 1983; Cohen, 1959; Janis, 1954; Janis & Field, 1959), a meta-analysis by Rhodes and Wood (1992) showed that self-esteem is curvilinearly related to social influence: people with moderate self-esteem are more easily influenced than people with either low or high self-esteem. In line with the Yale–McGuire model of persuasion, Rhodes and Wood suggested that this pattern occurs because, relative to people who have moderate self-esteem, people with high self-esteem are particularly confident of their own opinions (and, thus, less likely to change their minds) and those with low self-esteem are more distracted from attending to and processing the message. As a result, both lows and highs are less persuadable than moderates, but for different reasons.

Without discounting this explanation of the relationship between self-esteem and influence, sociometer theory puts a slightly different spin on the effect. Conformity, compliance, and other forms of social influence are often mediated by people's desire to behave appropriately and avoid disapproval (Shaw, 1981). To the extent that people with high self-esteem already feel valued, accepted, and socially integrated, they may not be as concerned with behaving appropriately and fitting in as people who feel less so (Moreland & Levine, 1989; Snodgrass, 1985). Thus, because high-

self-esteem people do not respond to implied social pressure to conform, they are not easily influenced by other people.

People with low self-esteem, on the other hand, are more concerned about behaving in ways that increase relational appreciation. As a result, they tend to conform readily to obvious social norms (Brockner, 1983). Research shows that conformity is associated with higher need for approval, fear of social rejection, and a stronger interpersonal orientation (Hare, 1976; Shaw, 1981). However, when confronted with a persuasive communication (particularly one that is complex), people with low self-esteem may be distracted from focusing fully on the message by their self-conscious concerns regarding other people's reactions to them. As a result, they may not process persuasive messages fully and, thus, are not as easily influenced by them.

D. SELF-ESTEEM AND CLOSE RELATIONSHIPS

Close relationships—such as those involving romantic partners, spouses, and close friends—are particularly potent influences on self-esteem. People tend to feel very good about themselves when they feel accepted and loved by close relational partners, but very bad about themselves when their partners and friends seem disinterested or rejecting. Romantic rejection in particular undermines self-esteem (Baumeister et al., 1993). Furthermore, people's trait self-esteem has implications for the quality and stability of their intimate relationships.

In general, people who have higher trait self-esteem have more satisfying and stable relationships than those with lower self-esteem (Hendrick, Hendrick, & Adler, 1988). Not only are they happier and more satisfied, but their partners also report greater satisfaction with their relationships than the partners of people with lower self-esteem (Fincham & Bradbury, 1993; Murray, Holmes, & Griffin, 1996a, 1996b). Many things may contribute to these differences, but one important factor involves how people with high vs low self-esteem perceive and react to their partners. People with high trait self-esteem tend to perceive their relational partners more favorably than people with low self-esteem, and their positive evaluations of their partners decline less over time (Murray et al., 1996a, 1996b). Furthermore, when their own self-esteem is threatened, they continue to believe that their partners regard them favorably, whereas people with low self-esteem react to self-doubt with heightened insecurity about their partner's love and tend to distance themselves from him or her (Murray, Holmes, MacDonald, & Ellsworth, 1998).

Our interpretation of these patterns relies again on the link between trait self-esteem and perceived relational evaluation. Relationships no doubt fare better when people feel that they are valued as relational partners. However, as we noted, the sociometer appears to be calibrated to be overly sensitive to relational threats (Leary et al., 1998). Thus, when people do not feel valued and accepted—either because of events that transpire in the relationship or their dispositional tendencies to feel less accepted—they tend to be particularly vigilant to cues that indicate threats to the relationship. As a result, they are sensitized to the relational implications of both their own and their partner's shortcomings, which leads them to detect and place greater weight on problems and transgressions than they would if they felt more relationally valued. Furthermore, people with low self-esteem are more likely than highs to believe that their personal failings and shortcomings will lead to rejection (Baldwin & Sinclair, 1996), which presumably leads them to infer that their personal failures will cause their partners to reject them (Murray et al., 1998, Experiment 4). Although people with lower self-esteem are often more concerned about their partner's regard than they objectively need to be (Murray et al., 1998), such reactions are predicted by the sociometer's negative bias and by differences in how low- and high-self-esteem people perceive relational threats.

In addition, as we described earlier, drops in the sociometer produce negative affect. People who do not feel adequately accepted in close relationships experience negative emotions that, if expressed, may then may create conflict and undermine the partner's satisfaction. Because people with lower trait self-esteem feel less valued and accepted overall (Leary et al., 1995), they respond more strongly to real and imagined relational difficulties, thereby fueling mutual dissatisfaction. People who have lower self-esteem tend to be more rejection sensitive, and rejection-sensitive people behave in ways that undermine their relationships when they do not feel valued and accepted (Downey & Feldman, 1996; Levy et al., in press).

This is not to say that high self-esteem is a reliable recipe for creating good relationships. In fact, some forms of favorable self-regard may weaken relationships. For example, narcissists, who have high self-esteem, tend to have relatively unstable relationships because they believe they can easily replace their current partner with an equal or better one (Campbell, in press). More generally, a recent review concluded that loving oneself is neither necessary nor sufficient for loving others and, in fact, can detract from it in multiple ways (Campbell & Baumeister, in press). None of these patterns is inconsistent with the general sociometer theory, however. Although narcissists do have unstable relationships and abandon them readily for new partners, they still maintain their favorable self-views by

believing that others accept and admire them. In fact, the very instability of their relationships is a result of their assumption that others desire them.

E. EMOTIONAL AND BEHAVIORAL PROBLEMS

Low self-esteem has been implicated in several emotional disorders and maladaptive behaviors, and psychotherapeutic interventions for emotional and behavioral problems often target the client's self-esteem. A great number of psychological difficulties correlate with trait self-esteem (such as depression, anxiety, eating disorders, and substance abuse), and others have been attributed to misguided efforts to bolster self-esteem (such as deviant and delinquent behavior; see Mecca et al., 1989). In our view, such problems do not arise from low self-esteem per se. Rather, they are the direct result of rejection or reflect maladaptive attempts to achieve a minimal level of social inclusion. By and large, these difficulties and low self-esteem are coeffects of unfulfilled needs for social inclusion rather than causally related. To the extent that the motivation to develop and sustain meaningful and supportive relationships is a fundamental interpersonal motive, difficulties in satisfying this need would be expected to lead to problems of various sorts. Although space does not permit a full discussion of the relationships among perceived exclusion, self-esteem, and psychological difficulties, we briefly discuss the implications of the theory for understanding and treating three categories of psychological disorders (see Leary, 1999; Leary, Schreindorfer, & Haupt, 1995).

First, self-esteem correlates negatively with nearly every variety of negative emotion, including depression, anxiety, irritability, jealousy, loneliness, and general negative affectivity (Block & Thomas, 1955; Burns, 1979; Jones, Freemon, & Goswick, 1981; Kanfer & Zeiss, 1983; Rosenberg, 1985; Watson & Clark, 1985; White, 1981). People with low trait self-esteem also tend to be less satisfied with their lives in general (Campbell, 1981). In our view, these are largely emotional reactions to perceived social exclusion or a low sense of includability. As we discussed earlier, perceived rejection appears to lead to negative affect; indeed, negative emotion may be an inherent reaction to unfulfilled belongingness needs, as it is for other states of deprivation (Baumeister & Tice, 1990; Leary, 1990; Spivey, 1989).

Second, given that high self-esteem is associated with positive feelings, it is not surprising that people with low self-esteem (trait or state) desire to reduce the negative affect associated with relational devaluation, sometimes resorting to behaviors that are maladaptive. Baumeister (1991) has documented the variety of ways in which people "escape the self" in order to avoid distressing self-examination through alcohol and drug abuse, eating

disorders, masochism, and other escapist behaviors. Through behaviors such as these, people intentionally disable their sociometers, rendering them temporarily incapable of registering real or imagined relational devaluation and inducing negative affect.

Third, many types of deviant, socially undesirable, and risky behaviors are more common among people with low than high self-esteem. Drug and alcohol abuse, unsafe driving, unwanted pregnancy, juvenile delinquency, and criminal behavior are more likely among people who score low in self-esteem (Scheff et al., 1989), although the correlations are usually weak and the low self-esteem may often be the result rather than the cause of such problems. Despite these ambiguities, the ballyhooed relationship between low self-esteem and maladaptive behavior has led some to suggest that community interventions to raise self-esteem would help to alleviate such problems (California Task Force, 1990; Mecca et al., 1989), although to our knowledge such efforts have not met with any notable success. Sociometer theory sheds a different light on the link between low self-esteem and deviancy. In our view, it is not self-esteem but rather concerns regarding one's relational value and inclusion that produces such effects. People with low self-esteem will resort to more desperate, dangerous, or extreme measures to be valued and accepted than people who already feel valued by their primary groups. If this is true, community interventions should focus on heightening a sense of belongingness and social inclusion rather than self-esteem.

VII. Final Remarks

Self-esteem has emerged as one of the cardinal constructs in behavioral science but, despite thousands of studies, no consensus has been reached on fundamental questions regarding the nature, function, and source of self-esteem. Although it undoubtedly does not address everything that is known about self-esteem, sociometer theory provides a plausible framework for explaining and integrating a great deal of the self-esteem literature. Notably, it provides a viable account for why human beings appear to have a pervasive need for self-esteem and explains why low self-esteem is associated with many problems in living.

If the sociometer theory of self-esteem is even partially accurate, researchers should augment their study of self-esteem with increased attention to the phychological systems by which people monitor and control the quality of their relationships with other people. Psychologists have long recognized that people appear to need self-esteem and possess a potent

desire to be accepted and included by others. Yet they may have underesti-
mated the powerful link between these two pervasive psychological facts.

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TEMPERATURE AND AGGRESSION

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> The day drags by like a wounded animal
> The approaching disease, 92°
> The blood in our veins and the brains in our head
> The approaching unease, 92°
> ("92°" by Siouxsie and the Banshees, *Tinderbox,*
> David Geffen Company, 1986)

I. Introduction

Hot weather and violence go hand in hand. This fact can be derived from a variety of sources, from a variety of centuries, and from a variety of continents. For instance, languages are replete with heat-related imagery. Consider the following American English phrases: "hot headed," "hot tempers," "tempers flaring," "hot under the collar," "doing a slow burn." Social commentators have noted weather effects on human behavior and have used heat-related imagery for thousands of years. Cicero (106–43 B.C.) noted that, "The minds of men do in the weather share, Dark or serene as the day's foul or fair." Shakespeare noted (in *The Merchant of Venice*) that "the brain may devise laws for the blood, but a hot temper leaps o'er a cold decree."

Social philosophers, social geographers, and other students of behavior began to apply empirical methods to this theory in the middle 1700s. For

63

instance, based on his observations during his many travels Montesquieu (1748/1989) stated that, ''You will find in the northern climates peoples who have few vices, enough virtues, and much sincerity and frankness. As you move toward the countries of the south, you will believe you have moved away from morality itself; the liveliest passions will increase crime . . .'' (p. 234.) It was another hundred years or so before more objective empirical methods were used to examine this heat hypothesis. Leffingwell (1892) examined quarter-of-the-year effects on two broad categories of violent crime in England and Wales in 1878–1887. Other early studies of heat effects include those by Lombroso in Italy (1899/1911), Guerry in France (cited in Brearley, 1932), Dexter (1899) in New York City, and Aschaffenburg (1903/1913) in Germany and France. Despite use of empirical methods that are somewhat crude by modern standards, these early studies supported the prevailing theory that hot temperatures increase violent behavior (Anderson, 1989).

A. EPISTEMOLOGY: HOW TO ORGANIZE TEMPERATURE–AGGRESSION FINDINGS

The first major review of the empirical literature on temperature effects on aggression (Anderson, 1989) relied on two epistemological strategies— triangulation and meta-analysis. Those two strategies still provide a good approach to understanding this diverse literature. Triangulation is the strategy of examining an idea from several different perspectives in order to arrive at the best overall view of that idea. As Richard Cardinal Cushing noted when he was asked about the propriety of calling Fidel Castro a communist, ''When I see a bird that walks like a duck and swims like a duck and quacks like a duck, I call that bird a duck'' (*New York Times,* 1964). Our target idea here is not whether Mr. Castro is a communist, but whether there is a true relation between temperature and aggressive behavior. By examining the heat hypothesis from the perspectives of several very different methodologies, each of which has its particular strengths and weaknesses, we get a better overall view than if we confine ourselves to one methodology.

The second strategy—meta-analysis—refers to combining results of studies with the same methodologies whenever possible in order to improve the reliability of the conclusions. For example, data from multiple studies that report violent crime rates as a function of month were pooled and reanalyzed as a larger data set. Note that ''meta-analysis'' in this chapter refers to this general data-pooling strategy, not just to the more specific statistical techniques that now go by the name of ''meta-analysis.''

In this chapter we also adopt a third strategy, one that implicitly underlies much modern science but that has occasionally been ignored in articles on the temperature–aggression hypothesis, namely, parsimony. Theoretical explanations that are simple and that account for many observed phenomena are preferred over complex ones that account for only a portion of extant findings.

There has been considerable confusion in the terminology used in the temperature–aggression literature. We recently proposed a few standard definitions to help reduce such confusion, in our own writings as well as in the writings of other scholars working in this area (Anderson & Anderson, 1998). The *temperature–aggression hypothesis* is the theoretical statement that uncomfortable temperatures cause increases in aggressive motivation and, under the right conditions, in aggressive behavior. The *heat hypothesis* refers more specifically to the hot side of this hypothesis and is the most widely studied version. Obviously, these is a corresponding *cold hypothesis,* which states that uncomfortably cold temperatures cause increases in aggression. The *heat effect* refers to the empirical observation of an increase in aggressive behavior in hot (as compared to comfortable) temperatures. Again, one could refer to a *cold effect* as well, but it is quite rare in this literature.

B. REVIEW OF PRIOR FINDINGS IN NATURALISTIC SETTINGS

Reviews of research on the heat hypothesis in naturalistic settings have confirmed the early views linking hot temperatures to high levels of aggression (Anderson, 1989; Anderson & Anderson, 1998; Anderson & DeNeve, 1992). The triangulation approach has identified three very different types of studies in this domain—geographic region studies, time period studies, and concomitant measurement studies. Data from all three types of studies support the heat hypothesis.

Geographic region studies examine aggression rates of geographic regions that are similar in some ways (e.g., part of the same country) but that differ in climate. For instance, recent archival studies have supported the heat hypothesis by showing that U.S. cities with hotter weather have higher violent crime rates than similar-sized cooler cities even when various social and cultural factors (e.g., poverty rate) are statistically controlled (Anderson & Anderson, 1996, 1998). Figure 1 displays a latent variable model of this effect. (See Anderson & Anderson, 1996, for a regression approach to analyzing these data and for more statistical control variables.)

In this model three latent factors—Temperature, Southernness, Low Socioeconomic Status (SES)—and one measured variable (Population size)
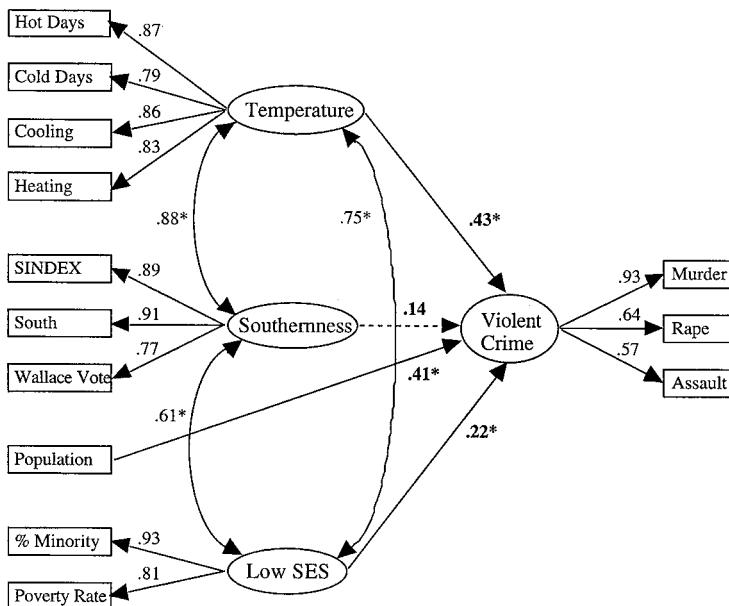
Fig. 1.   Latent variable model of temperature and southernness (culture of honor) effects on violent crime in the United States in 1980. An asterisk indicates that the directional path weight to Violent Crime latent factor was statistically significant. Error terms and correlations among error terms are not displayed to simplify the picture: $\chi^2 = 216$; $df = 54$; comparative fit index = .94; goodness of fit index = .89; Bentler and Bonett's (1980) Non-normed Index = .92; Bentler and Bonett's Normed Fit Index (1980) = .92; cold days and heating were reverse coded. SINDEX is the southernness index by Gastil (1971).

were used to predict the latent Violent Crime rate factor. The southernness factor was indexed by three measured variables: a southernness index (SINDEX) created by Gastil (1971), which was based on migration patterns from the Old South; a North/South dichotomy based on U.S. Census Bureau classifications; and the percentage of voters who voted for George Wallace in the 1968 presidential election (Scammon, 1970). The results were quite clear. Temperature, population, and low SES were positively related to violent crime in U.S. cities. Southernness was also positively related, but not significantly so.

Time–period studies examine aggressive behavior rates within the same region but across time periods that differ in temperature. For example, assault rates are consistently higher in summer months than during the rest of the year. This has been found across a wide range of countries (France, Germany, United States) and eras (e.g., 19th and 20th centuries). Figure 2
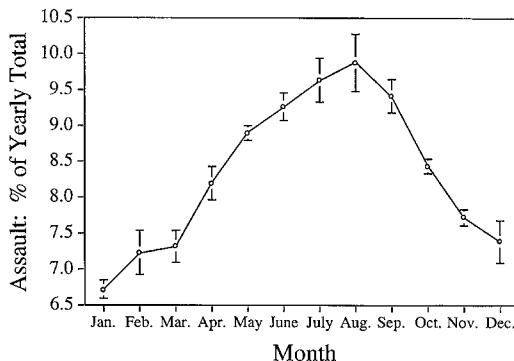
Fig. 2. Monthly distribution of assaults ±1 SE. Adapted from Anderson and Anderson (1998).

displays this pattern of assaults, averaged across seven different data sets (all from the Northern Hemisphere). Similar time–period effects have been reported in studies in which the time period was longer (e.g., quarter of year) and shorter (day). For example, in a pair of studies Reifman, Larrick, and Fein (1991) showed that major-league baseball batters are more likely to get hit by pitched balls during hot games than during cool games, even after controlling for a variety of other factors (such as number of walks).

Concomitant measurement studies are a special case of time-period study—the indicator of temperature and the measure of aggression are taken simultaneously (more or less). For instance, Kenrick and MacFarlane (1984) assessed the effects of temperature on aggressive horn honking in Phoenix with temperatures ranging from 84° to 108°F. As expected, there was a significant linear effect of temperature on horn honking, $p < .01$. (Note that the authors reported that similar effects occurred whether latency to honk or duration of honking or number of honks was used.) Furthermore, this effect was significantly stronger for subjects without air-conditioned cars ($r = .76$) than for subjects in cars with air conditioning ($r = .12$), $Z = 2.54$, $p < .02$. Similar effects of heat on aggression were reported by Vrij, van der Steen, and Koppelaar (1994) in their study of police officers' behavior in training exercises.

C. ALTERNATIVE EXPLANATIONS

In sum, there is little doubt or controversy about the existence of a heat–violence relation in real-world data. Whether temperature plays a

direct causal role has been the question stimulating most recent research in this area. Alternative explanations can sometimes account for the particular results of a particular type of study. We turn our attention to two particularly interesting ones.

1. Routine Activity Theory (RAT)

Cohen and Felson (1979) developed Routine Activity Theory (RAT) to explain the link between increases in crime and increases in temperature. This sociological view states that opportunities to commit crimes increase in the summer because social behavior patterns change. For instance, the increase in violent crime during the summer might be an artifact of students being out of school or the increase in family vacations. In the summer people (potential victims as well as perpetrators) are more likely to leave their homes and their families. Increases in alcohol consumption and a reduction in guardianship have also been posited as crime-related warm weather behaviors (Cohn, 1990; Landau & Fridman, 1993).

The RAT has been supported by some archival studies of the temperature–aggression relation (Cohen & Felson, 1979; Field, 1992) and not by others (e.g., Michael & Zumpe, 1986). For example, the fact that violent crime increases during hotter days within summer months (e.g., Anderson & Anderson, 1984), that the size of the summer increase in violence is greater in hotter years than in cooler years (Anderson, Bushman, & Groom, 1997), and that major-league batters are more likely to be hit by pitched baseballs on hotter days (Reifman et al., 1991) all cast considerable doubt on the claim that routine activities associated with temperature fully account for the heat effect. There is no doubt that routine activities have a substantial impact on a wide variety of human behaviors, including aggression. But, by considering the total array of studies of the heat hypothesis we can rule out RAT as a sufficient explanation and offer a more parsimonious explanation for all of the findings in field settings: heat increases aggressive motivation.

2. Southern Culture of Violence (SCV)

Social theorists have long noticed higher rates of violence in regions that are closer to the equator. Recent theories of a U.S. southern culture of violence range from the sociological to the evolutionary and economic (see Anderson & Anderson, 1998, for a review). Some focus on the relatively lengthy time period in which the U.S. South was an unsettled wilderness frontier, whereas others attribute the development of a southern culture of violence to swashbuckling Cavaliers who settled in the early South.

Of particular interest is Cohen and Nisbett's recent theory of a southern culture of honor (Cohen & Nisbett, 1994; Nisbett, 1990, 1993). They posit that the livelihood of people who settled in the South depended on a herding economy. In order to thrive in this economic system, male producers were required to be highly protective of their livestock from poachers. These frontier people (adaptively) socialized their offspring to hold these aggressive defensive attitudes toward potential intruders as well as taught them the behaviors necessary to fight effectively (e.g., how to operate a gun).

This approach has yielded a number of interesting results, some supportive of the SCV theories, some contradictory (see Anderson & Anderson, 1998, for a review). However, the claim that SCV explains away the heat effect on violent crime in U.S. cities is not well supported. For example, the city crime rate analyses of Anderson and Anderson (1996, 1998), as displayed earlier in Fig. 1, strongly contradict this claim; if it were true then the Southernness factor should have been strongly related to violent crime and the temperature link to violent crime should have been nonsignificant. Furthermore, although SCV theory (including the Nisbett and Cohen culture of honor version) and the temperature–aggression hypotheses both attempt to explain the high homicide rate often found in southern U.S. cities, these approaches need not be viewed as mutually exclusive. A southern culture of violence (or culture of honor) could have an effect on violence that is independent of temperature.

Alternatively, as posited by Anderson and Anderson (1996), SCV could have partially (or wholly) evolved because of the hot climate. Indeed, cross-cultural work by Pennebaker, Rimé, and Blankenship (1994) suggests that emotionality in general may be increased by hot climates. More recently, Van de Vliert, Schwartz, Huismans, Hofstede, and Daan (1999) showed that cultural masculinity was related to climate and to domestic political violence and posed an interesting explanation based on parental investment theory. Societies high in cultural masculinity are those ". . . in which men are expected to be dominant, assertive, tough, and focused on material success . . . ," whereas societies low in cultural masculinity are those in which men ". . . are expected to be subordinate, modest, tender, and concerned with the quality of life" (p. 300). According to Van de Vliert et al., level of cultural masculinity is positively associated with amount of domestic political violence and accounts for the empirical link between climate (specifically, how hot it is) and domestic political violence. The parental investment theory explanation of these linkages is based on three postulates. First, climate influences males' decisions regarding investing time and effort in providing for a single family versus investing in fertilizing multiple partners to increase offspring. Second, in cold climates and extremely hot climates (e.g., desert climates rather than the mild U.S. South

climate) meeting the basic needs for food, safety, and security requires considerable parental investment in offspring, thus encouraging development of a less ''masculine'' set of norms for male behavior. Third, cultural masculinity influences competitiveness not only in the mating domain, but also influences conflicts at a broader societal level, including frequency of domestic political violence. In essence, cultural masculinity and domestic political violence are both expected to peak in climates that demand the least parental investment by males, i.e., climates much like that in the U.S. South. To be sure, other plausible explanations of links between climate and aggression-related cultural norms can be generated. And, domestic political violence may well be different from the more affective-based violence most studied in the heat–aggression literature (Anderson, 1989). Nonetheless, the Pennebaker et al. (1994) and the Van de Vliert et al. (1999) works suggest that temperature may causally influence the development of cultural differences that are linked to some forms of aggression and provide interesting avenues for future work on temperature effects on culture.

From an even broader view of the heat hypothesis, the SCV approach cannot explain several well-established heat effects. It is irrelevant to all of the time-period studies and the concomitant measures studies. For instance, it cannot explain why violent crime rates are higher during hot years than during cool years (Anderson et al, 1997). The simple heat hypothesis, however, accounts for all of these effects.

II. Contemporary Controversy

Most naturalistic field studies of the heat hypothesis have found positive monotonic effects of temperature on aggression. However, some researchers claim that heat increases real-world violence only up to moderately hot temperatures (e.g., 80°F) and that further increases in temperature (e.g., 95°F) produce significant decreases in violence (e.g., Cohn & Rotton, 1997). This is an important issue for both theoretical and practical reasons. At a theoretical level, there are several reasons to expect hot temperatures (e.g., 90°F) to produce lower levels of aggression than moderately warm temperatures (e.g., 85°F). These theories are described in a later section. At a practical level, recommendations concerning issues such as police deployment and expected effects of global warming differ if, in fact, hot temperatures decrease aggression. In this section we show how nonstandard data analyses may have led to inappropriate conclusions in the one archival study that purportedly shows a downturn in aggression at high temperatures

(Cohn & Rotton, 1997) and how nonstandard data analyses may lead to misinterpretations of a related archival study (Cohn, 1993).

A. ASSAULT IN MINNEAPOLIS

Cohn and Rotton (1997) conducted an analysis of the reported assaults in Minneapolis in 1987 and 1988 as a function of time of day, day of week, month, and temperature. Each day was divided into eight 3-h periods. Temperature and number of assaults (and several other variables) were recorded for each time period. The use of 3-h time periods distinguishes this research from conceptually similar research on violent crime in Chicago and Houston (e.g., Anderson & Anderson, 1984). One advantage of the shorter time period is that the aggressive behavior and the corresponding temperature are measured in closer proximity. However, it is also important to remember that people have memories and that the instigation to aggress may take place some time (hours, days, or weeks) prior to aggressive retaliation.

Two important findings reported by Cohn and Rotton (1997) were huge effects of time of day and day of week. Consistent with RAT, assaults were most frequent at times of day and days of week when most people's behaviors are not severely restricted by their present situations, that is, during leisure time. This finding is not surprising, because in order for an assault to occur there has to be both an opportunity to get angry enough to aggress and an opportunity to aggress; such opportunities vary by day of week and time of day. It is relatively harder to assault others when on the job or in school or at church, for example. So, assaults were higher on weekends (replicating an effect reported by Anderson & Anderson, 1984) and evenings. The time-of-day effect on assault rate is, of course, confounded with temperature because time of day is highly correlated with temperature. This confounding is very important to keep in mind because it is related to problems with the data analysis to be discussed shortly.

One of the main conclusions of the article involving the heat effect is simply not borne out by the reported results. Specifically, the claim that there was a significant downturn in assault as temperatures became hot was based on a series of problematic data analysis choices. Two of these choices are particularly important and the consequences of these two can be illustrated using results found in the tables and footnotes of the Cohn and Rotton (1997) article.

1. Problem 1: Overaggregation (or Undercontrol)

Consider Fig. 3, which is adapted from Cohn and Rotton's Fig. 1. This figure appears to present overwhelming evidence of a significant downturn
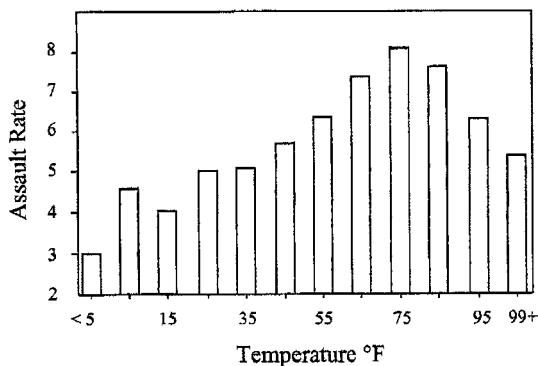
Fig. 3.   Assault rate as a function of temperature (adapted from Cohn & Rotton, 1997, Fig. 1).

in assault as temperatures increase from about 75° to 99°F. But think for a minute—of all the 3-h time periods that are at 85°F or hotter in Minneapolis, what proportion occur during the time of day when assaults are most possible, i.e., during the late evening and early morning hours? Obviously, only a small proportion of the uncomfortably hot time periods occurred after 9:00 P.M. In Minneapolis (and most other cities as well) the vast majority of hot time periods occur during periods of time when school and job activities drastically decrease the opportunities for assault. Think also about the time periods that fall in the 65°–75°F range. What proportion of them occur during the late evening and early morning hours? Obviously, a much greater proportion of them fall in the high assault hours than do hot time periods. Thus, this figure overaggregates the data by ignoring the RAT-expected time of day and day-of-week effects on assault rates. Aggregating over time of day is especially problematic because time-of-day is so strongly related to temperature. Aggregating over day of week is less problematic in testing the heat hypothesis because day of week is not related to temperature. However, because day of week also causally (theoretically) accounts for large assault rate differences (via opportunity), it too needs to be taken into account in the proper analysis of these data. In brief, this figure is misleading concerning the true effect of temperature on assault rate.

At a minimum, what is needed is an estimate of the effect of temperature on assault rate that partials out the effects of time of day and day of week. One way to do this is with a regression analysis estimating the linear and curvilinear effects of temperature on assault while including time-of-day and day-of-week terms in the statistical model. Then, one can plot the
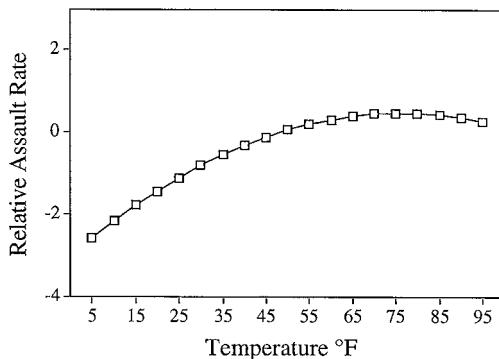
Fig. 4. Relative assault rate as a function of temperature, with time-of-day, day-of-week, and month controlled statistically. Based on slopes from Cohn and Rotton (1997).

resulting best fit regression line relating temperature to assault rate. Cohn and Rotton did such an analysis and included a number of other predictor variables as statistical controls. They reported the slope estimates in the text but did not graph the results. Figure 4 is based on their reported slopes.[1]

The shape of the temperature–assault function in Fig. 4 is different from the one presented by Cohn and Rotton's Fig. 1 (our Fig. 3). One can still see a bit of a downturn at the higher temperatures, but it is not nearly so pronounced as in our Fig. 3. Whether the downturn is significant was not reported; it seems unlikely given the relative scarcity of data points at 95°F or above in Minneapolis. But, we believe that even this figure does not give an accurate representation of the temperature effect on assault in Minneapolis. This is because one of the statistical controls used in this analysis was month of year. This is the second problem warranting attention.

2. Problem 2: Underaggregation (or Overcontrol)

By including month of year as a statistical control variable, Cohn and Rotton essentially discarded any true heat effect on monthly differences in assault rates. Thus, if temperature is truly causally related to assault in a linear (or a positive monotonic) way, controlling for month inappropriately partials out a major portion of the true linear heat effect. What happens if the same regression analysis is conducted but without month in the statistical model? Cohn and Rotton reported (in their footnote 2) that it

[1] In all figures in this chapter, centered and standardized temperature terms have been converted back to raw temperature for ease of exposition.

does not really change the results much. However, Fig. 5, which uses the reported slopes to graph the resulting function along with the same function obtained when month was partialed out, shows that partialing month does matter. The region where the two lines differ most—at the hot end—is exactly where it is most important theoretically. There is no hint of a downturn in aggression at the highest temperatures normally experienced in Minneapolis, *when month effects are not controlled.*

3. Overaggregation Revisited

Another way of avoiding the overaggregation problem caused by ignoring time-of-day and day-of-week effects is to do the regression analysis *separately* for each of the 56 day-of-week (7) × time-of-day (8 3-hour blocks) time periods. Cohn and Rotton provide this information in their Table 5. The linear temperature term was positively ($ps < .05$) related to assault 29 times and was never negatively related. The curvilinear temperature term (a quadratic term) yielded a statistically significant effect in only 10 cases, but in 7 of those the slope was positive, indicating that at hotter temperatures assault rates increased more rapidly with further temperature increases. These findings clearly contradict the hypothesis that the general shape of the temperature–assault relation is an inverted U. In only 3 of 56 time periods (7 days/week, 8 periods/day) did a significant negative quadratic term occur; this may well happen by chance.

Furthermore, the fact that a quadratic temperature term produces a negative slope that differs significantly from zero does not mean that a significant downturn in aggression occurred. It may merely indicate that
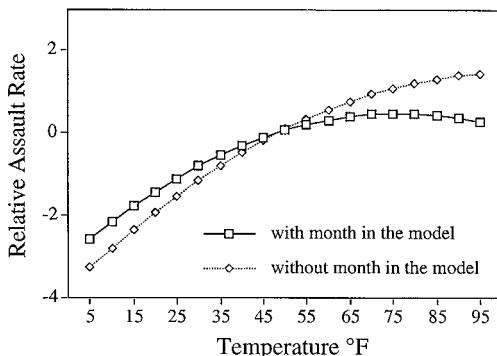
Fig. 5.   Relative assault rate as a function of temperature, with and without month controlled statistically. Based on slopes from Cohn and Rotton (1997).

the rate of increase in aggression is smaller at hot temperatures than at cool temperatures, as in the Fig. 5 line with the diamonds (without month in the model)—i.e., there is an asymptote.

However, one might ask why we believe that ignoring time of day and day of week is inappropriate overaggregation (undercontrol), whereas statistically controlling for month is inappropriate underaggregation (overcontrol). The answer involves the theoretical status of the variables. Cohn and Rotton (1997) report that time-of-day and day-of-week effects on aggressive behavior are caused largely by known factors that are causally unrelated to temperature. Thus, time-of-day is spuriously correlated with temperature. We view Cohn and Rotton's RAT analysis as the most important contribution in that article. Specifically, the routine activities that engage people at different times of the day are such that assault-producing events and opportunities are relatively rare during the hottest times of day. These include such events as spousal or other family arguments and drinking in bars and other entertainment venues. It is therefore crucial that time-of-day effects be taken into account before examining temperature effects. However, there is no good theoretical justification for expecting big month effects on assault due to spurious (nontemperature) factors, but month is highly correlated with temperature in a causal way, especially in cities like Minneapolis. Thus, controlling for month artificially decreases the estimated effect of temperature on assault. One might argue that summer vacations from school and work might increase aggression opportunities. However, studies that have restricted their sampled days to summer months have yielded the same positive relation between temperature and violent crime, thereby ruling out this alternative explanation (Anderson & Anderson, 1984; Cotton, 1986; Harries & Stadler, 1988).

In sum, the Minneapolis assault data provide evidence of a downturn in assault at high temperatures only if key data analysis decisions are made in a way that appears to us to be suspect on both theoretical and empirical grounds. More complete and appropriate analyses of this data set are underway. If a significant downturn can be demonstrated for some time periods when more appropriate statistical approaches are used, and if they can be replicated in cities with hotter weather patterns, then it would be interesting to see which of several curvilinear theories (discussed later) best account for the downturn. At the moment, we believe the evidence for a downturn at hot temperatures in field settings is much too weak.

B. RAPE AND DOMESTIC VIOLENCE IN MINNEAPOLIS

Cohn (1993) published another interesting article using the same basic sources of data as were later used in Cohn and Rotton (1997) but with

different statistical methods and focusing on rape and domestic violence instead of assault. There are many interesting results in this article, but the temperature results are difficult to interpret, in part because of the complexity of the analyses and in part because of some nonstandard methods.

Cohn reported that three temperature terms were used in the analyses, a linear term, a quadratic term, and a cubic term. She reported all results in terms of standardized beta weights, ". . . thus avoiding the issue of scaling and removing the need for centering the scale before prediction" (p. 76). Therefore, it appears that the quadratic and cubic temperature terms were created from the raw temperatures, rather than from centered temperatures. Methodologically, this is acceptable under some circumstances. However, it does create an artificially high correlation between the various temperature terms. This multicollinearity problem can be severe if the correlations are too high. Even if multicollinearity is not too big a problem, the standard procedure for testing such terms is to do so hierarchically. That is, the linear term cannot be estimated and tested with the quadratic or cubic terms in the model, the quadratic term must be estimated and tested with the linear but not the cubic term in the model, and the cubic term must be estimated and tested with both the linear and quadratic terms in the model. Otherwise, the interpretation of the slopes (in this case, betas) is problematic (e.g., Cohen & Cohen, 1983).[2]

Possible confusions arise from Cohn's (1993) results because in several models higher order temperature terms were tested and betas reported without lower order terms in the model. For instance, in her Table 7 Cohn reported a prediction model of domestic violence that included a significant quadratic temperature beta of .15, but the linear term was not in the model. Readers might be tempted to interpret this as meaning that the temperature effect on domestic violence is strictly a "U"-shaped function. That would be a misinterpretation. Similarly, Cohn's (1993) Table 8 reported a prediction model of rape that included significant linear ($\beta = .15$) and cubic ($\beta = .19$) temperature terms, but not the quadratic term. This can easily lead to the misinterpretation that the function linking temperature to rape is a generally upsweeping line with two inflection points. It is important to note that Cohn (1993) did not make these interpretations in that article and, in fact, said relatively little about the temperature functions. But how is one supposed to interpret these results?

[2] If the distribution of temperatures is symmetric, then centering prior to squaring will yield uncorrelated linear and quadratic terms. Under those circumstances, which typically occur only in laboratory studies where the temperature distribution is controlled, simultaneous testing of linear and quadratic terms would be acceptable. However, the linear and cubic terms are still highly correlated, and in the real world, the quadratic term is likely to be correlated with both the linear and cubic terms.

To get a clearer picture of the shape of the temperature–aggression function found in these data, we made a few simple computations displayed in Table I. We then applied the betas in the prediction models from Tables 7 and 8 from Cohn (1993) and plotted them in Fig. 6. Note that these models included time of day and a two-level weekend/weekday predictors, but did not include month. As can be seen, for both domestic violence and rape, the general shape of the temperature function is very similar to that found repeatedly in other studies, with hotter temperatures being associated with higher levels of aggression.

One might ask why we don't see a "U"-shaped function for domestic violence, which included only a quadratic temperature term. The answer is that given the distribution of temperatures found in almost all cities, when a quadratic term is created from raw temperatures, the quadratic term is artifactually highly correlated with the linear term, even when each is subsequently transformed into z scores. In our simplified example in

TABLE I

LINEAR, QUADRATIC, AND CUBIC TEMPERATURE TERMS BASED ON RAW TEMPERATURES (-5 TO
$95°F$), z SCORE TEMPERATURE TERMS, AND PREDICTED VALUES FOR DOMESTIC VIOLENCE AND
RAPE USED TO INTERPRET RESULTS FROM COHN (1993)

Raw T	$z - \text{raw } T$	T^2	$z - T^2$	T^3	$z - T^3$	Domestic violence	Rape
-5	-1.61	25	-1.00	-125	-0.8090	-0.15	-0.387
0	-1.45	0	-1.01	0	-0.8085	-0.15	-0.355
5	-1.29	25	-1.00	125	-0.8081	-0.15	-0.323
10	-1.13	100	-0.97	1000	-0.8048	-0.15	-0.290
15	-0.97	225	-0.93	3375	-0.7958	-0.14	-0.257
20	-0.81	400	-0.87	8000	-0.7784	-0.13	-0.223
25	-0.64	625	-0.79	15625	-0.7497	-0.12	-0.189
30	-0.48	900	-0.70	27000	-0.7069	-0.11	-0.153
35	-0.32	1225	-0.59	42875	-0.6472	-0.09	-0.116
40	-0.16	1600	-0.46	64000	-0.5677	-0.07	-0.078
45	0.00	2025	-0.31	91125	-0.4657	-0.05	-0.037
50	0.16	2500	-0.15	125000	-0.3382	-0.02	0.005
55	0.32	3025	0.03	166375	-0.1825	0.00	0.050
60	0.48	3600	0.23	216000	0.0042	0.03	0.097
65	0.64	4225	0.44	274625	0.2248	0.07	0.147
70	0.81	4900	0.67	343000	0.4821	0.10	0.200
75	0.97	5625	0.92	421875	0.7789	0.14	0.256
80	1.13	6400	1.19	512000	1.1180	0.18	0.315
85	1.29	7225	1.47	614125	1.5023	0.22	0.378
90	1.45	8100	1.77	729000	1.9346	0.27	0.445
95	1.61	9025	2.09	857375	2.4176	0.31	0.516
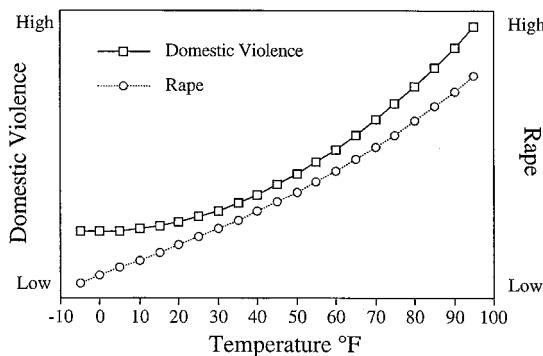
Fig. 6. Relative rape and domestic violence rates as a function of temperature. Based on slopes from Cohn (1993).

Table I for instance, the correlation between the linear and quadratic terms is .958. In other words, the two terms are highly confounded and artificially so. The quadratic term has both linear and quadratic components built into it, whereas the linear term has only a linear component. Thus, testing the linear term for significance when the quadratic term is in the model inappropriately partials out much (or most) of the true linear component. Estimating the magnitude of the quadratic component without the linear component in the model gives that quadratic estimate variance that properly belongs to the linear component. This latter problem, using only the quadratic component, is not terribly severe if one plots the resulting function as we have done in Fig. 6. Similar reasoning applies to the question of why the rape function in Fig. 6 doesn't show the two major bends one normally expects from a cubic term.

In sum, the Minneapolis studies do not contradict the pattern found in other studies of the shape of the temperature–aggression function. Indeed, they add support to prior research, in large part because they used the shorter time frame of 3-h time periods.

Finally, it is important to note that we believe that there may well be circumstances in which hot temperatures (within normal human tolerances) may produce a decline in aggression in naturalistic settings. However, to date there are no convincing data of such a relationship. (Obviously, finding a decrease in aggression at extremely high temperatures is uninformative. As pointed out by Anderson and Anderson (1984) aggression must decline at some high temperature point, "because at extremely high temperatures everyone gets sick and dies, precluding aggressive acts" (p. 96).

We next turn to a general theoretical model of human aggression, specific models of the relation between temperature and aggression, and laboratory

studies designed to shed some light on this ubiquitous phenomenon. Though there are still some unanswered puzzles, we will see that considerable progress has been made in recent years.

III. General Affective Aggression Model

Before outlining specific theories about temperature effects on aggression, we briefly outline a general framework for understanding human aggression. Figure 7 presents a recent version of the basic theoretical model that we have been using for several years (Anderson, Anderson, & Deuser, 1996; Anderson, Deuser, & DeNeve, 1995; Anderson & Dill, in press; Lindsay & Anderson, in press). We focus on the "person in the situation," called an *episode*. Because social interactions are continuous, any dynamic model of social behavior is necessarily circular. Thus, one can enter and exit the model at any point, though some points seem more natural than others. An episode is one cycle of the ongoing social interaction. Figure 7 presents a simplified version of the main foci of the model. The four main foci concern: (a) inputs of various person and situational variables, (b) routes though which these variables have their impact, (c) appraisal
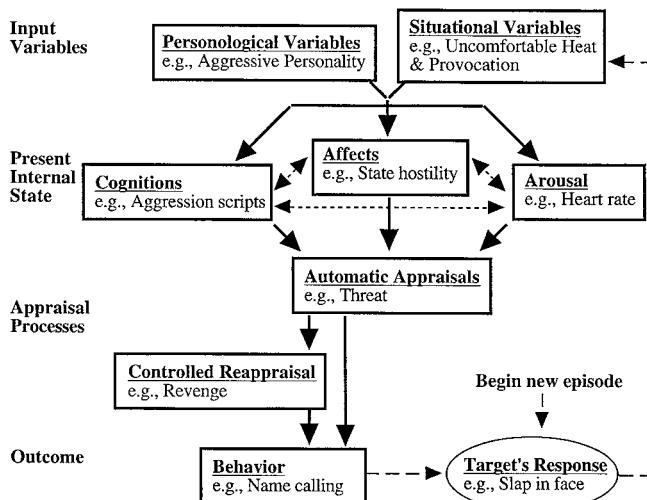
Fig. 7. A General Affective Aggression Model.

processes, and (d) behavioral outcomes of the underlying appraisal pro-
cesses.

A. INPUTS

Person factors include all the specific things that a person brings to
the situation, such as personality traits and attitudes. For example, trait
irritability is positively related to aggression (e.g., Caprara, Barbaranelli,
Pastorelli, & Perugini, 1994). Situational factors include any important
features of the situation, such as presence of a provocation, an aggressive
cue, or, most importantly in the present context, uncomfortably hot (or
cold) temperature. For example, the classic weapons effect (Berkowitz &
LePage, 1967) shows that the mere presence of aggression-related cues in
a situation can increase human aggression (see Carlson, Marcus-Newhall, &
Miller, 1990, for a meta-analytic review).

B. PRESENT INTERNAL STATE

Input variables combine, sometimes in interactive ways (e.g., Bushman &
Geen, 1990), to influence the final outcome, but do so through the present
internal state that they create. There are three ''routes'' that input variables
might traverse on their way to influencing the aggression process. They
may influence the cognitive state of the person, such as by increasing the
accessibility of aggressive thoughts, scripts, or related knowledge structures.
They might influence the affective state, such as by increasing feelings of
state hostility or anger. They might influence the state of arousal, such as
by increasing heart rate.

A given input variable may have most of its impact via any or all of the
three routes listed for present internal state. For example, some of our
research suggests that the weapons effect has its impact primarily through
the cognitive route (Anderson, Anderson, & Deuser, 1996; Anderson, Ben-
jamin, & Bartholow, 1998). Other input variables may influence more than
one route. A strong provocation may increase aggressive thoughts, anger,
and heart rate. It is also important to recognize that these three internal
states are themselves interlinked with each other, such that an input variable
may directly influence one state and indirectly influence the others. For
instance, being reminded of a past insult may directly increase aggressive
thoughts, which in turn increase the present state of anger.

The focus on the episode and the present internal state does not mean
that either the past or the future are irrelevant. To the contrary, develop-

mental issues are crucial to any general model, including this one. The past is represented by what people bring with them to the present episode, in terms of beliefs, expectations, general affective state, personality traits or styles, and so on. Similarly, future plans and expectations are brought to the present by people's construal of what is possible, likely, desirable, and so on.

C. APPRAISALS

The third focus, on appraisals, includes several complex information processes, ranging from the relatively automatic to the heavily controlled (Lindsay & Anderson, in press). Automatic appraisals (called ''immediate appraisal'' in earlier versions of our model) are evaluations of the present environment and internal state that are made on-line, very quickly, with little or no awareness. When slapped in the face people will automatically ''judge'' that the present environment is threatening and that they are angry and/or scared—what is commonly referred to as the emotional part of the ''fight or flight'' response (e.g., Berkowitz, 1984, 1993, in press). Berkowitz's Cognitive Neoassociationist (CNA) model also posits that such automatic appraisals include the behavioral aspects of fight or flight, a notion that is entirely consistent with our model.

Controlled reappraisals are somewhat slower and require more cognitive resources than the automatic appraisals. In some situations, where there is little time for reappraisal, for instance, a relevant behavior is chosen and performed before reappraisal can take place. However, reappraisal does often occur, as when one carefully considers why a provoking individual behaved in a particular way before deciding how to respond. Although we've presented appraisal and reappraisal as a dichotomy, in keeping with recent thinking in cognitive psychology it would be more accurate to view appraisal processes as existing along a continuum with completely automatic and completely controlled as the endpoints (e.g., Bargh, 1994).

D. OUTCOMES

Whether an aggressive behavior is emitted depends upon what behavioral scripts have been activated by the various input variables and the appraisal processes. Well-learned scripts come to mind relatively easily and quickly and can be emitted fairly automatically. Therefore, people who score high on aggressive personality have a relatively well developed and easily accessible array of aggression scripts which are easily activated by minimal provocation

(e.g., Anderson et al., 1998). Of more relevance to the present chapter are situational factors that can increase the accessibility of aggression-related thoughts, feelings, and behavior scripts or motor programs. Provocations of various kinds can do this (e.g., insults, physical attacks), as can various background factors that are aversive, such as temperature.

E. TEMPERATURE EFFECTS ON PRESENT INTERNAL STATE

Laboratory studies have shown that hot temperatures can influence all three categories of internal states (Anderson & Anderson, 1998). Several types of cognitive effects have been reported. Hot temperatures increase self-reported hostile attitudes (e.g., Anderson, Deuser, & DeNeve, 1995); hot people are more likely to agree with the following item: ''It is all right for a partner to slap the other's face if challenged.'' Hot temperatures also impair performance on a number of cognition-related tasks, including visual and auditory vigilance tasks, rifle marksmanship, arithmetic tasks, and short-term memory tasks (e.g., Johnson & Kobrick, 1988 as cited in Kobrick & Johnson, 1991; Kobrick & Fine, 1983; Mortagy & Ramsey, 1973; Pepler, 1958; Poulton, Edwards, & Colquhoun, 1974; Ramsey, Dayal, & Ghahramani, 1975; Wing & Touchstone, 1965, as cited in Kobrick & Johnson, 1991).

Hot temperatures also increase the specific affect of state hostility (anger) as well as more general affects such as feeling upset, uncomfortable, and distressed (e.g., Anderson, Deuser, & DeNeve, 1995; Anderson, Anderson, & Deuser, 1996). Finally, hot temperatures have two somewhat paradoxical effects on arousal (e.g., Anderson, Deuser, & DeNeve, 1995; Anderson, Anderson, & Deuser, 1996). Hot temperatures increase heart rate, but decrease perceptions of arousal. Physiological arousal (as measured by heart rate) is increased by excessive heat, whereas psychological arousal is decreased (e.g., feeling lethargic, not energized).

Whether these heat effects on cognition, affect, and arousal are direct or indirect is unclear. There is some reason to believe that being uncomfortably hot directly affects emotion and arousal and that the cognitive effects are indirect, most likely the result of affective priming (e.g., Anderson, Deuser, & DeNeve, 1995; Anderson, Anderson, & Deuser, 1996). Considerably more research is needed before firm conclusions can be drawn, however.

The effects of uncomfortably cold temperatures have received little empirical study (see Anderson & Anderson, 1998, for a review). However, what little evidence exists suggests that cold temperatures should increase aggressive affect and cognition in much the same way as does excessive heat. Behavioral increases in aggression due to cold are expected in lab settings, where the researcher can prevent people from compensating for

the cold. Cold effects are less likely to occur in the natural environment, because people can usually compensate fairly easily by adding clothing.

IV. Lab Inconsistencies and Curvilinear Models of Heat Effects

A major controversy surrounding laboratory research on the heat hypothesis concerns inconsistencies among laboratory studies themselves. The basic problem has been that hot temperatures sometimes increase and sometimes decrease aggressive behavior in laboratory settings. An interesting theoretical approach to dealing with these inconsistencies is the Negative Affect Escape Model (NAE), an early version of which was proposed by Baron and Bell (1975). Later writings on the NAE model (Anderson, 1989; Anderson & DeNeve, 1992; Baron, 1979) have clarified the basic assumptions and postulates. The main difference between NAE and a Simple Negative Affect model (SNA) is that in SNA, aggressive motivation and aggression are both assumed to be a direct function of negative affect, whereas NAE adds a number of assumptions about the competing role of escape motivation. It is important to note that the NAE position on the role of escape motives is wholly compatible with Berkowitz's CNA model and our own General Affective Aggression Model (GAAM). Though GAAM and NAE have occasionally been portrayed as in opposition, there is nothing in GAAM ruling out the possibility of multiple motives simultaneously existing and competing.

Figure 8 displays the main features of NAE. As can be seen in Fig. 8A, aggressive motives and escape motives are increased by increases in negative affect, but at different rates.

A variety of factors may influence the overall level of negative affect. For instance, uncomfortable temperatures, personal insults, pain, and other aversive stimuli can increase negative affect. At low overall levels of negative affect, aggressive motives are assumed to dominate escape motives, at least in some settings. However, the slope relating negative affect to escape motivation is assumed to be steeper than the corresponding slope relating negative affect to aggression motivation (Fig. 8A). Thus, when the overall level of negative affect is low, increases in temperature (from comfortable to uncomfortably warm) should increase aggressive behavior (Fig. 8B). But, when the overall level of negative affect is moderate, increasingly uncomfortable temperatures should make the escape motive dominant and should therefore decrease aggressive behavior. Note that this reverse heat effect on aggression should occur *only* when escape behavior is incompatible with aggressive behavior.

The NAE explanation of past laboratory inconsistencies relies on an assumption that the overall level of negative affect has varied systematically
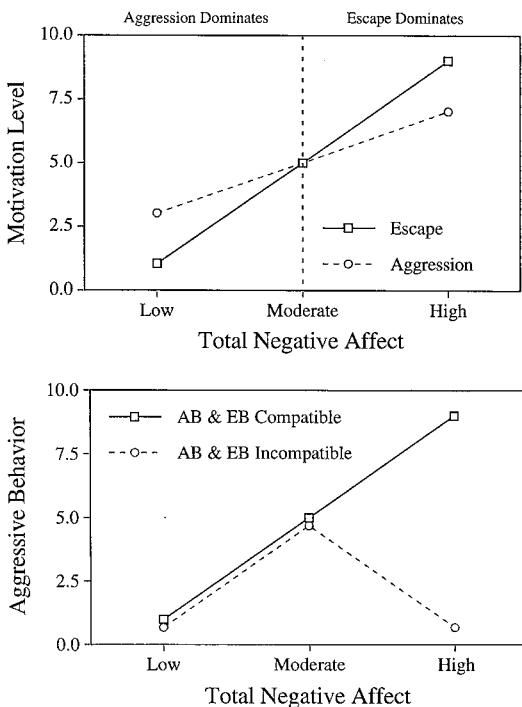
Fig. 8.   The Negative Affect Escape model. (A) Motivation levels as a function of total negative affect. (B) Aggressive behavior as a function of total negative affect and compatibility of aggression and escape behaviors.

with the obtained findings of either a standard heat effect or the reverse heat effect. Several contextual factors have been used in prior research to vary the overall negative affect, such as attitudinal similarity, a cooling drink, and anger manipulations. According to the NAE explanation, the standard heat effect should occur when the context is relatively neutral, whereas the reverse heat effect should occur when the context is negative.

There are two problems with the NAE explanation of laboratory inconsistencies. First, most laboratory studies of the heat effect do not include any real escape option for participants. Thus, escape behaviors cannot interfere with aggressive behaviors and therefore none of these conditions should produce a decrease in aggression at hotter temperatures. The second problem is that the studies still appear to show considerable inconsistency even when categorized in terms of overall (context) level of negative affect (Anderson, 1989). To more objectively test the heat hypothesis in lab

settings, we conducted a meta-analysis (reported briefly in Anderson & Anderson, 1998), which is reported next.

A. META-ANALYSIS OF LAB HEAT EFFECTS

All research reports which presented results of laboratory experiments that included both (a) a temperature manipulation and (b) a measure of aggressive behavior were included in the meta-analysis. First, all experiments referenced in the Anderson (1989) review were obtained. Second, the computer reference database *Psycinfo* was also searched from January, 1974 though December, 1995 crossing the words "temperature," "heat," and "climate" with all permutations of the words "aggress" and "violent." Third, the reference sections of the resulting articles were combed for additional relevant articles. A total of 10 articles were found; they reported a total of 11 experiments.

1. Effect Size Calculation and Categorization

In order to assess the interactive effects of temperature and various affect-inducing manipulations on aggressive behavior, d indexes representing the difference between hot (90.0°–99.1°F) and comfortable (68.0°–75.2°F) temperatures on aggressive behavior were calculated for each nontemperature manipulation condition. We had to estimate means from reported graphs of the means and the mean square error (MS_e) from the estimated means and reported Fs for five experiments. For five other experiments, the MS_e was estimated from reported Fs and the d indexes were derived from the estimated MS_e and the reported means. For the remaining experiment (Baron & Lawton, 1972), the reported Mann–Whitney U statistics were converted to z scores from which d indexes were calculated. One experiment (Baron, 1972) reported the results of two dependent variables, so the d indexes were averaged for this experiment. We calculated d indexes for one dependent variable in each of the remaining 10 experiments. A total of 28 effect sizes of the heat–aggression relation were derived. All d indexes were weighted by sample size (see Shadish & Haddock, 1994).

In order to test the effects of the nontemperature variables, we adopted a simple rule of assigning $+1$ to factors which may increase positive affect or reduce negative affect (e.g., a cooling drink) and -1 to those which may decrease positive affect or increase negative affect (e.g., an insult, or having dissimilar attitudes to a confederate). Conditions in which the net value of the nontemperature contextual factors were either positive or zero were assigned to a "neutral context" category. Those in which the net value was negative were placed in an "extranegative context" category. Table II lists

TABLE II
Temperature and Aggression Effect Sizes by Affect-Inducing Context Factors[a]

Report	Dependent variable	n	Context factors		Net valence of context factors	d
			1	2		
Baron (1972)	Shock intensity and duration[b]	20	Anger (−)		−1	−.58
		20			0	−.64
Baron and Bell (1975)	Shock intensity × duration	16	Anger(−)	Aggressive model (−)	−2	−.21
		16	Aggressive model (−)		−1	.52
		16	Anger (−)		−1	−1.35
		16			0	1.10
Baron and Bell (1976)						
Experiment 1	Shock intensity × duration	11.7	Anger (−)		−1	−.87
		11.7			0	.43
Experiment 2	Shock intensity × duration	16	Anger (−)	Cooling drink (+)	0	−.51
		16	Cooling drink (+)		+1	.19
		16	Anger (−)		−1	−.79
		16			0	.79
Baron and Lawton (1972)	Shock intensity	20	Anger (−)	Aggressive model (−)	−2	.14
		20	Anger (−)		−1	−.46

Study	Measure	n				
Bell (1980)	Rating of E's	18	Anger (−)		−1	1.19
	reappointment	18			0	−.36
Bell and Baron (1976)	Shock intensity × duration	16	Anger (−)	Dissimilar attitudes (−)	−2	−.83
		16	Dissimilar attitudes (−)		−1	.07
		16	Anger (−)	Similar attitudes (+)	0	.16
		16	Similar attitudes (+)		+1	1.43
Bell and Baron (1977)	Shock duration	18	Anger (−)		−1	−.84
		18			0	.75
Palamarek and Rule (1979)	Choice of aggressive task	24	Anger (−)		−1	−.23
		24			0	.38
van Goozen, Frijda, Kindt,	Withheld money from E.	30	Anger (−)	High anger disposition (−)	−2	0.0
and van de Poll (1994)		30	Anger(−)	Low anger disposition (0)	−1	.14
Boyanowski, Calvert-Boyanowski, Young, and Brideau (1975)	Shock intensity	10	Anger (−)		−1	1.28
		10			0	.23

[a] From Anderson and Anderson (1998).
[b] Shock intensity and duration effects were averaged for this experiment.

87

the types of affect manipulations and their presumed net effects on the participants' affective states as well as the *d* indexes of the effects of temperature on aggression.

2. Main Results

Across all 28 effects, there was no consistent effect of temperature on aggression. The average weighted *d* index was close to zero, $d_+ = .060$, and the 95% confidence interval included zero [$-.114$ and $.234$]. The 28 effect sizes were heterogeneous [$\chi^2 (27, N = 28) = 56.29, p < .001$]. Therefore, we tested the effect of the context factors (extranegative versus neutral) as a potential moderator of the temperature–aggression relation. The neutral contexts yielded significantly higher effect sizes of the temperature–aggression relation than the extranegative context conditions [$\chi^2(1, N = 28) = 4.19, p < .05$]. As expected by virtually all theoretical models, the mean weighted *d* index for the neutral conditions was positive, $d_+ = .264$, but it was barely significant, 95% confidence interval = [$.001, .526$]. The extranegative conditions revealed a nonsignificant negative relation between temperature and aggression, $d_+ = -.101$, 95% confidence interval = [$-.333, .132$].

3. Supplementary Results

One experiment which appears to support NAE at the behavioral level actually opposes it in other ways (Palamarek & Rule, 1979). Consistent with the NAE, aggressive behavior decreased more in the hot angry conditions than in the other conditions in this study. This experiment also included measures of escape motives and attributions about the causes of the participants' moods. Two interpretation problems arise from consideration of the results from these additional dependent variables. First, no temperature effects were found for desire to escape. Thus, this finding contradicts the NAE prediction that escape motives cause a decrease in aggression at uncomfortable temperatures. Second, more participants attributed their moods to the situation in the hot angry and cool nonangry conditions than in the other two conditions. These attributions match the decreases in aggression in these two conditions, suggesting that attributions rather than escape motives constituted the key mediational factor. Because of these concerns, we conducted a second meta-analysis with the two effect sizes from this experiment removed. The effect sizes remained heterogeneous [$\chi^2 (25, N = 26) = 55.18, p < .001$]. The difference between the neutral and extranegative context conditions became nonsignificant [$\chi^2 (1, N = 26) = 3.28, p > .05$], because the mean effect size for each context condition

became closer to zero. The neutral context condition effect of temperature became nonsignificant, $d_+ = .250$, 95% confidence interval $= [.-.028, .528]$ and the extranegative condition moved even closer to zero, $d_+ = -.089$, 95% confidence interval $= [.-.332, .154]$.

4. Summary

Overall these results confirm earlier claims that the laboratory results of temperature–aggression studies are inconsistent. There is some support for the NAE predicted pattern of behavior, but little support for NAE itself. The Palamarek and Rule (1979) findings are particularly inconsistent with the NAE model.

B. OTHER POSSIBLE CAUSES OF CURVILINEAR FUNCTIONS

Other factors may also create a curvilinear relation between level of negative affect and aggressive behavior. Four seem particularly relevant to the analyses of conflicting heat effects.

1. Attention Deficits

Attentional deficits may occur as temperatures become increasingly uncomfortable (e.g., Hancock, 1986; Razmjou & Kjellberg, 1992; Shanazarov, Makhnovskii & Kuzyuta, 1989). At high temperatures, for instance, attention may be sufficiently diverted so as to interfere with the person's ability to notice or to fully process other provocation cues in their environment, such as a personal insult. Similarly, such attentional deficits may interfere with attempts to carry out an intended aggressive act. In both cases, a curvilinear relation between negative affect and aggression could be obtained. A modified version of the NAE model would also fit within this attention approach. If escape motives are distracting they may decrease aggression even in situations where escape behavior plays no direct interfering role. Figure 9 displays the perception of insult version of the attentional effects.

2. Social Justice

Social justice concerns (e.g., Tedeschi & Felson, 1994) may prevent a linear negative-affect–aggression pattern in some paradigms. For instance, a hot temperature may prompt an initial aggressive outburst against a provocateur, followed by a lowering of aggression on later trials because
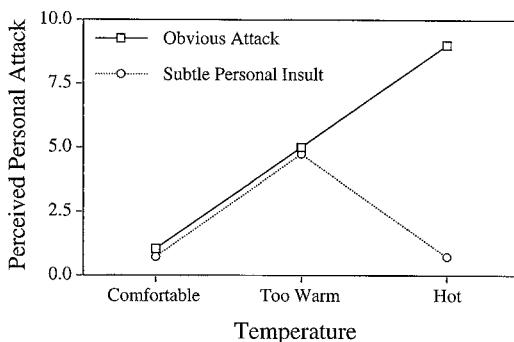
Fig. 9.   Attention-deficit model of linear and curvilinear temperature effects.

the provocateur has been "sufficiently" punished (see Fig. 10). Those in a moderate negative-affect condition (e.g., in moderately uncomfortable temperatures) may not be sufficiently upset by the initial provocation to succumb to the desire to deliver an initial aggressive outburst. Consequently, on later trials they may not feel that sufficient punishment has been delivered and therefore may not choose to decrease their aggression level. If the dependent measure of aggression fails to capture the initial outburst, or averages across multiple trials, then a curvilinear relation between negative affect and aggression may be observed. (Note that though this sequence may accurately capture the curvilinear aspect it may also miss or average out the initial outburst effect.)

In the standard Taylor Competitive Reaction Time (TCRT) paradigm, for instance, participants believe they are participating in a series of reaction
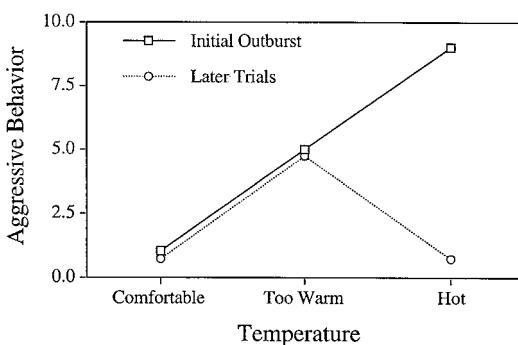
Fig. 10.   Social Justice model of linear and curvilinear temperature effects.

time contests against an opponent (Taylor, 1967). The participants believe that the loser of each trial receives a punishment (usually electric shock), the intensity of which has been set by their opponent. Before each trial, the participant ''sets'' the punishment level that their opponent will receive if the opponent loses that trial.

In the TCRT paradigm, the participants actually receive wins, losses, and punishments on a predetermined schedule. In many real-world settings, of course, an initial aggressive outburst (either behavioral or verbal) is likely to produce immediate retaliative consequences which may, in turn, provoke even more highly aggressive responses. Thus, even if this social justice process is real, the curvilinear ''he's suffered enough'' social justice effect may not come into play at all in many natural settings. Nonetheless, this model is particularly interesting because it is the only one that predicts both an initial outburst and a later diminution of aggression at high levels of negative affect.

3. Negative Affect Correction

When a person's self-perceived negative state of mind is obviously related to some stimulus other than a social provocation, there may be some attempt to ''correct'' one's perceptions or treatment of other people. In other words, in unbearably hot conditions the realization that the heat might affect their reactions to other people in a negative way may lead to an attempt to correct for this negative bias by being nicer than what the situation seems to call for. When combined with the Simple Negative Affect process, this correction process may also produce interesting curvilinear effects on aggressive behavior and rated perceptions of others. Specifically, this would produce the same inverted ''U'' function between negative affect and aggressive behavior as in the NAE model when aggressive and escape behaviors are incompatible (Fig. 8), the Attention Deficit model when the insult is subtle (Fig. 9), and the Social Justice model for later aggressive trials (Fig. 10). What distinguishes the Negative Affect Correction model from the others is that it is the only one that predicts an inverted ''U'' function for judgments about the hostility (or kindness) of other people's behaviors. This would most likely occur in situations in which the meaning of others' behaviors is at least somewhat ambiguous.

4. Lab Setting Artifacts

One frequent criticism of laboratory research on aggression in general is that aggression in the lab is fundamentally different than ''real'' aggression—that it lacks external validity. But a number of analyses have shown

that standard laboratory measures of aggression have considerable external validity (Anderson & Bushman, 1997; Anderson, Lindsay, & Bushman, 1999; Carlson, Marcus-Newhall, & Miller, 1989; Giancola, & Zeichner, 1995). For example, Anderson and Bushman (1997) found considerable correspondence between the effect sizes of key independent variables on aggression in lab and real-world settings.

The inconsistencies in laboratory research on temperature may be the result of laboratory artifacts. The possibility of participant suspicion is theoretically uninteresting, but could account for some inconsistent results in early studies in the temperature–aggression domain (Anderson, 1989; Rule & Nesdale, 1976). In many studies participants in the hotter conditions had a kerosene heater in the same room with them while performing the aggression task. If people in our society do have intuitive theories relating hot temperatures to aggressive behavior, then the obviousness of the temperature manipulation might well produce unusual behavior. To date, however, there has been no systematic assessment of people's beliefs about the likely effects of hot temperatures on aggressive behavior. Our Experiment 1 (to be described in a later section) provides such an assessment.

A more interesting lab-setting problem concerns paradigms that have used a series of trials, such as the TCRT procedure described earlier. This procedure can mask true linear or curvilinear relations between negative affect and aggression in two distinct ways. The apparent interactive nature of the serial contests may well make participants use their punishment settings to try to control what their opponent will set for them on future trials. In other words, the goal of controlling one's opponent may well override aggressive and/or social justice goals in ways that distort the aggressive behavior results (Baron, 1973; Gaebelein, 1978). Second, averaging early trial measures of aggression with later ones may hide true linear, curvilinear, or both types of relations between temperature and aggression. Our Experiment 5 (described in a later section) includes a modification to the TCRT procedure that eliminates the goal of controlling one's opponent and thus provides a better opportunity for the pattern displayed in Fig. 10 to occur. In both Experiments 4 and 5 we analyze the aggressive responses generated by participants on the first trial separately from their later aggression opportunities to allow for the detection of an outburst effect.

C. HOT AND COLD EFFECTS

All models that involve negative affect or discomfort must deal with yet another inconsistency. This concerns a lack of symmetry between heat and cold effects in the field data as well as in the laboratory tests. The major

models of temperature effects on aggression rely on negative affect in one way or another (Anderson, 1989; Anderson, Anderson, & Deuser, 1996; Baron, 1979; Berkowitz, 1993). But cold temperatures might increase negative affect in much the same way as hot temperatures do. Therefore, we might expect to see increased aggression as a function of cold discomfort paralleling the hot discomfort effects. However, there is little evidence of a cold effect in field settings and there are few tests of it in laboratory settings (Anderson & Anderson, 1998).

There is one simple explanation for the lack of parallel cold-induced aggression in naturalistic settings. People and societies are generally better at reducing cold discomfort (via clothing, heating) than they are at reducing heat discomfort. There may well be evolutionary reasons for this, but such speculation takes us well beyond the scope of this chapter. Given that the temperature discomfort effect itself is a relatively fragile one, it is not too surprising that cold-induced increases in violent crime rates (for instance) are not obvious. If one eliminates this real-world asymmetry in ability to compensate for excessive cold vs heat, as one can do in lab settings, then similar hot and cold effects on aggressive behavior may well occur. In all five experiments reported in this chapter, we assess the effects of both hot and cold temperatures on a variety of dependent variables.

Figure 11 displays the Social Justice model of Fig. 10 extended to uncomfortably cold temperatures. Under some circumstances, such as when neither provocation nor strategic control motives overwhelm temperature effects, provoked people may be especially punitive in hot and cold conditions at the first retaliation opportunity—the initial outburst effect. Across the entire temperature range, then, the initial outburst would show up as a quadratic temperature effect on aggression in the initial trial—a "U"-shaped function.
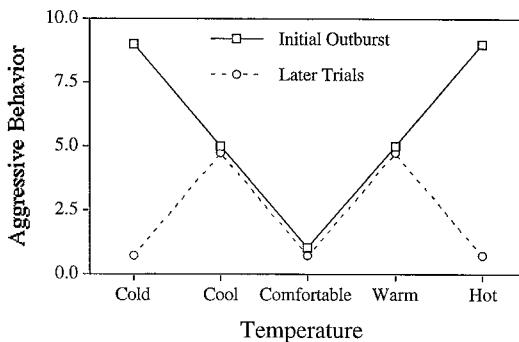
Fig. 11. Social Justice model applied to cold and hot temperature effects on aggression.

Having justly punished their provocateur on this initial trial, these same people may then become relatively less punitive on later trials. Those in extreme hot and cold temperatures may also be more likely to assume that their opponent is highly uncomfortable and is therefore less deserving of subsequent punishment. Across the entire temperature range, this would show up as a quartic temperature effect—an ''M''-shaped function (i.e., two adjacent inverted ''U''-shaped functions).

V. Experimental Studies of the Temperature–Aggression Hypothesis

A. SUMMARY AND OVERVIEW

As described earlier, results of laboratory experiments on temperature and aggression have been inconsistent and confusing. The results of the following five experiments and the theoretical explanations provided may shed light on the issues involved in the inconsistencies. There are several theoretical reasons for expecting curvilinear relations between temperature discomfort and aggressive behavior. The five experiments reported in this section were designed to address the following questions. First, what beliefs do people hold about the likely effects of uncomfortably hot and cold temperatures on affect and behavior (Expt. 1)? Second, what are the effects of temperature variations (from cold through comfortable to hot) on affect, physiological arousal, and perceived arousal (Expt. 2)? Third, what are the effects of temperature variations on hostile perceptions and on attention to hostility cues (Expt. 3)? Fourth, what are the effects of temperature variations on escape motives (Expts. 4 and 5)? Fifth, what are the effects of temperature variations and provocation on aggressive behavior in a standard Taylor Competitive Reaction Time paradigm (Expt. 4)? Sixth, what are the effects of temperature variations and ambiguous provocation on initial aggressive outbursts and on subsequent aggressive behavior trials when the goal of controlling one's provocateur is eliminated (Experiment 5)?

B. EXPERIMENT 1: SOCIAL THEORIES OF TEMPERATURE EFFECTS

The goal of Experiment 1 was to assess the social theories of our participant population concerning the relation of temperature to the several variables of interest in this domain: affect, arousal, and aggression. A question-

naire was developed to measure participants' social theories concerning the relation of both hot and cold temperatures to these variables.

1. Method

a. Procedures.   Fifteen female and seven male undergraduates at a large midwestern university participated in this experiment. Participants were given the two-page questionnaire, which was titled "Beliefs about temperature, emotions, and behavior." They were instructed to "Indicate your beliefs by circling a number for each item below." After completing the questionnaire, participants were thoroughly debriefed and thanked for their assistance.

b. Temperature Questionnaire.   Participants' beliefs about the effects of hot and cold temperatures, compared to normal temperatures, were assessed on three dimensions: "alertness and energy level," "feelings of hostility and anger," and "aggression and violent behaviors." Each question was answered on a 5-point rating scale, with "−2" indicating a belief that the temperature (hot or cold) would decrease the target variable (i.e., alertness, hostility, or aggression), "0" indicating a belief in no temperature effect, and "+2" indicating a belief that the temperature would increase the target variable. The three questions concerning effects of hot temperatures were presented on one page. The corresponding three cold temperature questions were on another page. Participants were randomly assigned to completing the hot or the cold page first. This order manipulation allowed examination of the possibility that thinking about one type of temperature effect (e.g., hot) would influence participants' responses on the other (e.g., cold).

2. Results and Discussion

The six items and results are presented in Fig. 12. There were no reliable effects of task order or of sex ($ps > .05$), so subsequent tests ignored these factors.[3] A *t* test was performed on each item mean to see whether it differed reliably from the scale midpoint of 0, which corresponded to a belief in no effect of temperature. As can be seen, hot temperatures were expected to have a very large impact on all three target variables. Compared to normal temperatures, hot temperatures were expected to produce a significant decrease in alertness and energy level [$M = -1.50$, t (21) =

[3] A larger study ($N = 55$) was also conducted using these same procedures and items. However, the order of hot versus cold questions was not varied. The result was a practically identical set of means, each of which differed significantly from the scale midpoint of "No Effect."
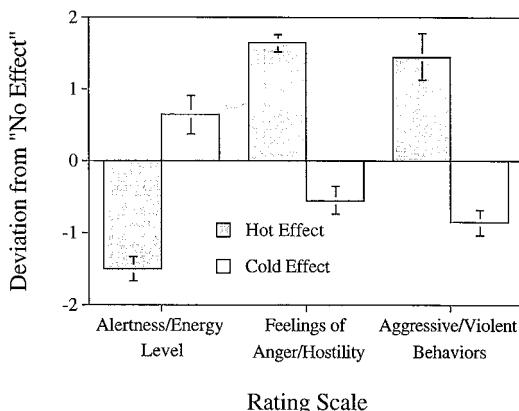
Fig. 12. Participants' beliefs about the effects of hot and cold temperatures. Negative scores indicate a belief that the temperature would decrease the target variable, whereas positive scores indicate a belief that the temperature would increase the target variable. Adapted from Anderson and Anderson (1998).

-8.77, $p < .001$], a significant increase in anger and hostility [$M = 1.64$, t (21) = 13.24, $p < .001$], and a significant increase in aggressive and violent behavior [$M = 1.45$, t (21) = 10.14, $p < .001$].

Cold temperatures also were expected to have systematic effects on the target variables, but the size was much smaller. Also note that in every case the direction of the expected cold temperature effect was opposite of the expected hot temperature effect. Compared to normal temperatures, cold temperatures were expected to produce a significant increase in alertness and energy level [$M = 0.64$, t (21) = 2.32, $p < .05$], a significant decrease in anger and hostility [$M = -.55$, t (21) = -2.83, $p < .01$], and a significant decrease in aggressive and violent behavior [$M = -.86$, t (21) = -4.84, $p < .001$].

Overall, these results confirm that people do have social theories relating temperature to a host of aggression-related variables. Past inconsistencies in laboratory research may be due, in part, to artifactual participant reactions based on these social theories. Future research may benefit from these findings by designing experiments that reduce participant suspicions and by including assessments of suspicion. The finding of opposite social theories for the effects of uncomfortably cold temperatures may also prove useful in future research on the effects of temperature on aggression. Specifically, when theory predicts similar behavioral responses to comparably uncomfortable cold and hot temperatures, if the results are similar for cold and

hot temperatures then a participant-suspicion alternative explanation based on underlying social theories is effectively ruled out.

C. EXPERIMENT 2: HOT AND COLD EFFECTS ON COMFORT AND AROUSAL

In order to accurately test for the effects of both hot and cold discomfort on other dependent variables such as aggressive behavior, it is necessary to know with some precision what hot temperatures are equivalently uncomfortable to what cold temperatures. Obviously, thermal comfort depends not only on temperature but also on clothing and type of physical activity. Our current laboratory experiments involve minimal physical activity, so this factor is essentially controlled. In addition, to control for clothing factors all participants in our temperature studies are required to wear long pants and a short-sleeved shirt. Under these conditions, we sought in Experiment 2 to discover equivalently uncomfortable "hot" and "cold" temperatures.

In addition, Experiment 2 assessed the effects of differing temperatures on both physiological and perceived arousal. Prior work on heat effects suggests that we should expect perceived arousal to be negatively related to temperature, heart rate to be positively related to temperature, and blood pressure to be unrelated to temperature (Anderson, Deuser, & De-Neve, 1995). However, because that work did not include cold temperatures, we included blood pressure measures even though we did not expect large temperature effects on them.

Experiment 2 also provided a test of effects of hot and cold temperatures on general positive and negative affect. There are theoretical reasons for expecting uncomfortable temperatures to increase negative affect, though it is not clear whether such effects should occur on general negative affect measures or only on more specific ones related to annoyance, anger, and hostility. Thus, we had no strong prediction about the relation between temperature and general negative affect.

Prior work is also silent on the effects of discomfort on positive affect. Because positive affect is often uncorrelated with negative affect (Watson, Clark, & Tellegen, 1988), we had no firm expectations or predictions for temperature effects on positive affect; it was included for purely exploratory purposes.

1. Method

a. Participants.   One hundred seventy-two students from a large midwestern university participated in the experiment. Sample size in reported

analyses varies slightly because of occasional missing values. Participants wore short-sleeved shirts and long pants in order to minimize the effects of clothing differences on the effectiveness of the temperature manipulation. Participants were run in pairs, with the first participant arriving 15 min before the second participant. Each received credit for course requirements in introductory psychology classes. The procedure took approximately 45 min to complete.

b. Design and Apparatus. The experiment employed five target temperature conditions (55°, 65°, 75°, 85°, and 95°F). Participants were assigned to one of two identical temperature rooms, where a Macintosh IIcx computer was set up to run a nonaggressive video game (called ''Tetrix''). One temperature room was randomly set at a target temperature, while the other room was yoked. Specifically, the cold air outlet of a heat pump was ducted into the ''cold'' room; the hot air outlet was ducted into the ''hot'' room. In this way, if one room was randomly set to be 85°F, the other temperature room was yoked to be approximately 65°F.

The main dependent measures were perceived arousal, assessed by the Perceived Arousal Scale (PAS; Anderson et al, 1995); perceived comfort, assessed by the Perceived Comfort Scale (PCS; Anderson et al., 1996); and heart rate, blood pressure, and positive and negative affect, assessed by the Positive and Negative Affect Scales (PANAS; Watson et al, 1988).

The Perceived Arousal Scale was presented to participants as the ''Current Feelings and Emotions'' scale. Participants rated 23 adjectives on a scale of 1 (very slightly or not at all) to 5 (extremely) to indicate ''the extent you feel this way right now, that is, at the present moment.'' Ten of the items indicate arousal (e.g., energetic), whereas 13 items indicate a lack of arousal (e.g., sleepy).[4]

The Perceived Comfort Scale (PCS) consists of 10 adjectives rated on a 1 (very slightly or not at all) to 5 (extremely) scale to indicate ''the extent you feel each word describes the room right now, that is, at the present moment.'' Six items indicated comfort (e.g., comfortable), whereas the remaining four indicated discomfort (e.g., uncomfortable).

Heart rate and blood pressure were assessed by an oscillometric automatic constant-air-release blood pressure meter with a digital display (A & D Engineering, Model UA-701). Participants were not allowed to see their physiological measures until after the experiment was completed.

The PANAS consists of 10 general positive and 10 negative affect adjectives. Each is rated on a 5-point scale ranging from 1 (very slightly or not at all) to 5 (extremely) to indicate ''. . . the extent you feel this way right now . . . .''

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[4] The Perceived Arousal Scale has 24 items. One item (weary) was inadvertently omitted.

Several additional variables were recorded to see if their inclusion in the statistical analyses made any difference. These were sex, humidity, and the outside temperature. Because the latter two variables had no important effects in preliminary analyses, they are not discussed further.

c. Procedures. The experiment began in a room set at a comfortable temperature (approximately 72–75°F). Participants were led to believe that the research involved the effects of temperature on physiological arousal as related to video game performance. After participants signed consent forms, their heart rate and blood pressure were measured.

Participants were then led to one of two temperature rooms. The participant who arrived first was randomly assigned to either the target or the yoked temperature room. The second participant was assigned to the remaining temperature room. Participants then played the nonaggressive video game "Tetrix", writing down their score after each game. After 30 min heart rate and blood pressure were assessed a second time. Then participants completed the PAS, the PANAS, and the PCS.

2. Results from Preliminary Analyses

a. Temperature Control. Actual temperatures varied somewhat from the target temperatures, especially in the yoked room. For this reason, regression analyses were performed with temperature used as a continuous factor, and all figures are based on the slopes derived from these regressions. The actual range was from 58° to 96°F. Two statistical advantages to utilizing temperature as a continuous variable are that regression analyses make full use of the temperature IV and that predicted curvilinear effects (e.g., the "U"-shaped function) can be easily tested with polynomial terms (e.g., a quadratic temperature term).

b. Perceived Comfort Scale. The "comfortable" and "uncomfortable" subscales of the PCS were strongly correlated ($r = -.60$). Thus, they were combined into one overall Perceived Comfort score after reverse scoring the negative items. The internal reliability was quite high (coefficient $\alpha = .90$).

c. Perceived Arousal Scale. The "aroused" and "unaroused" subscales were strongly correlated ($r = -.51$). Therefore, they were combined (after appropriate reverse scoring of the "unaroused" items) to form one overall Perceived Arousal score. The internal reliability for the PAS was also quite high (coefficient $\alpha = .93$).

d. PANAS. As expected, the positive and negative affect scales were only slightly correlated ($r = .16$). Thus, they were analyzed separately. The internal reliability was sufficient for both scales (coefficient $\alpha = .89$ and .78, respectively).

3. Results from Main Analyses

Regression analyses were conducted with sex, linear temperature, and curvilinear temperature effects as the independent variables. Temperature was first centered (i.e., converted to deviation score form) by subtracting the mean temperature, which was 76.7°F. Curvilinear temperature effects were assessed by inclusion of a quadratic temperature term. For all regression models, an alpha level of .05 was used for the effects of the theoretically relevant temperature tests. Because of the large number of theoretically irrelevant effects that were tested in this analysis, a Bonferroni correction was used for these irrelevant effects to protect against possible Type I errors.

a. Physiological Arousal. To examine the effects of temperature on physiological arousal, heart rate and blood pressure measures taken immediately after the signing of consent forms (Time 1) were compared to the measures taken after 30 min in the temperature room (Time 2). Specifically, we analyzed the change scores (T2-T1) to assess whether changes in the physiological measures were associated with the temperature manipulation.

As expected, heart rate changes were positively related to temperature [$F(1, 158) = 7.27, p < .01$]. The regression line relating temperature to heart rate change revealed that hotter temperatures led to a relative increase in heart rate ($b = .23, a = -2.67$). On this measure, then, hot temperatures increased physiological arousal, whereas cold temperatures decreased it. None of the sex or curvilinear temperature effects approached significance.

Interestingly, changes in diastolic blood pressure were negatively related to temperature [$F(1, 163) = 7.17, p < .01$]. As temperature increased diastolic blood pressure decreased ($b = -.13, a = -3.48$). Presumably, this was a result of vasodilation in hot temperatures and vasoconstriction in cold temperatures as a thermoregulatory mechanism. The change in systolic pressure analysis did not produce any significant effects.

b. Perceived Arousal. As anticipated, the main effect for linear temperature was significant [$F(1, 166) = 15.55, p < .0001$]. Perceived arousal decreased as temperature increased ($b = -.20, a = 3.14$). No other effects approached significance.

c. Perceived Comfort. We expected that participants in the extremely cold and extremely hot conditions would be the least comfortable. Therefore, we expected a curvilinear relation between temperature and comfort. This was confirmed, as both the linear and the quadratic temperature terms were significant [Fs$(1, 165) = 9.71$ and $51.90, p$s $< .01$ and .0001, respectively]. No other effects were significant. The regression line relating linear and quadratic temperature terms to comfort indicated that temperatures in the mid to high 70s were most comfortable, ($b_{lin} = .0135, b_{quad} = -.0037, a = 3.21$). These results are similar to Anderson et al.'s (1996),

but are shifted a few degrees toward the hot end. Similarly, temperatures in the low 60s were about as uncomfortable as was 96°F. Figure 13 displays the best fitting regression line. As can be seen, the coldest temperatures were slightly more uncomfortable than the hottest ones.

d. Positive and Negative Affect.   The temperature manipulation had no reliable effects on either positive or negative affect. It is not clear from this result whether temperature effects on affect are limited to comfort, whether more specific types of negative affect are influenced by extreme temperatures, or whether more power is needed to reliably detect a true effect of temperature on general affect.

4. Discussion

Experiment 2 yielded several interesting findings. The perceived comfort results showed that the PCS reliably measures comfort and that given the clothing restrictions and low level of activity typical of laboratory research, temperatures in the low 60s (°F) are as uncomfortable as temperatures in the mid-90s. This is important because it instructs researchers on the range of temperatures to use in future studies involving both hot and cold discomfort.

The arousal results of Experiment 2 are also valuable in directing future research. The heart rate results suggest that hot temperatures are somewhat arousing but that cold temperatures are not. However, the blood pressure results were considerably more complex. Certainly, additional research is needed.

The perceived arousal results were quite strong in showing decreases at hot temperatures and increases at cold ones. Taken together with the heart
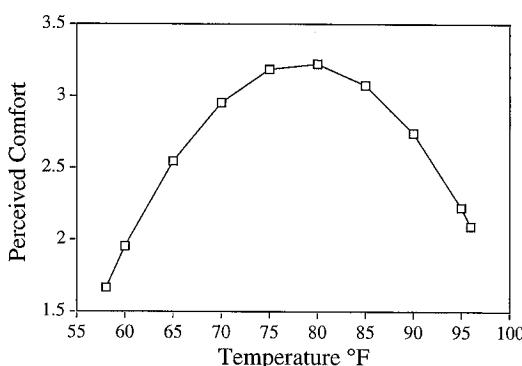
Fig. 13.   Perceived comfort as a function of temperature.

rate findings, these results suggest that hot temperatures may produce optimal conditions for increased aggression. Specifically, in accord with Zillmann's excitation transfer theory (e.g., 1983a, 1983b), people in hot conditions may experience increased arousal without being aware that they are in fact aroused. If a salient anger-producing event or person were present, then the heat-based increase in arousal may be transferred (misattributed), increasing the experienced anger. If this pattern holds up in further research, then we may see excitation-transfer-based increases in aggressive behavior primarily in hot temperatures rather than cold ones. Additional research is needed to confirm these preliminary arousal findings, as well as to more clearly explicate the roles of physiological versus perceived arousal.

Finally, the general affect results were instructive. We thought that general negative affect might increase in both hot and cold temperatures. It may well be that negative affect, as measured by PANAS, is too general in this context.

D. EXPERIMENT 3: TEMPERATURE EFFECTS ON PERCEPTIONS OF HOSTILITY

This experiment was designed to examine two factors related to the various models of temperature effects, rated perceptions of hostility and attention to hostility-related cues. Participants watched four brief video tapes, each of which showed a different couple interacting. The interactions varied in amount of aggressive content. After each tape, participants rated the couples on a large number of items, 10 of which were related to perceptions of hostility.

1. Method

a. Participants.   Sixty-one males and 88 females were recruited from undergraduate general psychology courses via sign-up sheets. They received extra credit for their participation.

b. Procedures.   Participants were always scheduled to be run in groups of between two and four in each of two temperature-controlled lab rooms. Participants were greeted by an experimenter and were told that they were participating in a study concerned with the effects of lighting and temperature on several different cognitive tasks. Participants were informed that they would be randomly assigned to one of five temperature conditions (cold, cool, comfortable, warm, or hot). After being randomly assigned to a temperature room, participants were seated at a desk or cubicle that had

a consent form and four envelopes containing the stimulus materials for the various tasks. All of the seats were arranged so that participants would be facing a television monitor approximately 7 feet away from them. Each of the temperature rooms were preset to a randomly determined temperature for a particular session. Each temperature room had its own digital thermostat allowing it to be set to one of the five target temperatures. The targeted room temperature (in Fahrenheit degrees) was 57° for the cold condition, 65° for the cool condition, 75° for the comfortable condition, 85° for the warm condition, and 97° for the hot condition. The actual temperature was recorded at the end of each session by the experimenter and recorded on a data sheet.

After obtaining informed consent, the experimenter went to an adjacent control room and gave tape-recorded instructions by way of an intercom system. Participants understood that both audio and video from their room was being monitored and that they could ask questions (by raising their hand and addressing the experimenter) at any time during the experiment. The first task was a word-scanning filler task. This task was included for two different reasons: (1) to start the study with an attention-demanding task to assist with the cover story and (2) to allow participants to experience the temperature of the room for 10 min before completing the main tasks of interest. The instructions for the filler task asked participants to:

> Carefully read the three-page article about fresh-baked bread. As you carefully read the article, count the number of times the word "flour" and the word "baked" appear as text anywhere on the three page article and write the correct answers on the appropriate line of the small sheet of paper. Please do not make any marks anywhere on the article. Accuracy is the primary concern for this task. This is a timed task, and you will have 10 minutes to complete the task. When the time is up, place the article and the word count form back in envelope "A."

After the 10 min had elapsed, recorded instructions announced that time was up and that the materials should be placed back into envelop "A."

The second task was a video interpretation task previously used and reported in Dill, Anderson, Anderson, and Deuser (1997). Participants watched four different video scenarios. The videos each contained one male and one female having a conversation. The male and female "actors" in the videos were actually psychology graduate students acting out rehearsed scenarios. Each scenario contained a different pair of actors. One of the videos, a neutral video, was always shown first and was used as a practice video. The remaining three videos were shown in random counterbalanced orders (three different orders were used). These three videos varied with respect to ambiguity of their aggressive content. The "neutral" video contained virtually no aggressive content. The "ambiguous" video

contained a moderately small amount of aggressive content. The "aggressive" video contained more clearly aggressive content (verbal).

The task of participants was to view each video and then to rate both the male and the female in the video on 28 adjectives using a 7-point Likert-type rating scale. Participants were given 4 min to rate each video. Ten of the items were aggression related (e.g., bitter, hostile, aggressive). For details on the creation, selection, and content of the video interpretation task see Dill et al.(1997). Finally, all participants were debriefed and any questions that participants had were addressed by the experimenter.

2. Results

a. Data Preparation and Preliminary Analyses.   The main dependent variable of interest was perceived hostility, based on participants' ratings of the two actors in each of the three video tapes on 10 aggression-related adjectives. As in Dill et al. (1997), for each adjective we averaged each pair of ratings within each video taped dyadic interaction and then averaged these across the 10 adjectives to get each participant's hostile perception score for each of the three video tapes. Thus, from each participant we obtained three hostility scores, one for each of the three video interactions. These scales proved to be internally consistent; coefficient alphas were .87, .90, and .92 for the neutral, ambiguous, and aggressive videos, respectively.

Recall that participants were randomly assigned to one of five temperature conditions: cold, cool, comfortable, warm, and hot. We also recorded the exact temperature at which each person actually participated, which often varied from the assigned temperature by 1° to 3°. There was no overlap in actual temperature between the five assigned temperature conditions.

For all analyses the actual temperature was used as a continuous independent variable rather than the assigned temperature. Temperature was first centered. Then, three additional temperature terms were created to allow a test of the hypothesis that the relation between temperature and hostile perceptions would be "M" shaped. Specifically, quadratic, cubic, and quartic temperature terms were created from the temperature z scores. By centering temperature before creating the three curvilinear terms, we reduced the artifactual multicollinearity between these four predictors. It should be noted that one misconception held by some scholars in this area is that centering eliminates the multicollinearity problem. However, the linear term and the cubic term will still be very highly correlated, as will the quadratic and the quartic terms. In the present study the linear and cubic terms still correlated at .94; the quadratic and quartic terms correlated at .97. Because the underlying distribution of temperatures was not perfectly symmetric, remaining possible pairs of temperature terms were also corre-

lated; they ranged from .26 to .44. Therefore, the proper method for testing for the effects of these temperature predictors is to do so hierarchically. In other words, each temperature term is tested with all lower order terms but none of the higher order terms in the statistical model.

A repeated-measures regression analysis was performed, with type of video (neutral, ambiguous, aggressive) as the repeated variable, the four temperature terms as continuous predictors, and order-of-videotape presentation as a categorical variable.

Preliminary analyses revealed no sex differences in hostile perceptions. Therefore, this variable was dropped in subsequent analyses. Order-of-videotape presentation yielded a significant (and uninteresting) main effect, $F(2, 142) = 3.81$, $p < .03$. However, order-of-videotape presentation did not interact with the temperature variables, so these interaction terms were dropped from the final model. There was also a significant main effect of video tape on hostile perceptions [$F(2, 284) = 219.36$, $p < .001$]. As expected, participants perceived the least hostility in the neutral video ($M = 1.35$), the most in the aggressive video ($M = 5.09$), and a moderate amount in the ambiguous video ($M = 3.20$).

b. Temperature and Hostile Perceptions. Overall, only the quartic temperature term yielded a significant effect on perceptions of hostility [$F(1, 142) = 4.27$, $p < .05$]. As predicted by the Negative Affect Correction model, hostility ratings were lowest at comfortable temperatures, highest at uncomfortably warm and cool temperatures, and slightly elevated at hot and cold temperatures. Figure 14 displays these results. None of the other temperature effects were significant ($ps > .5$).
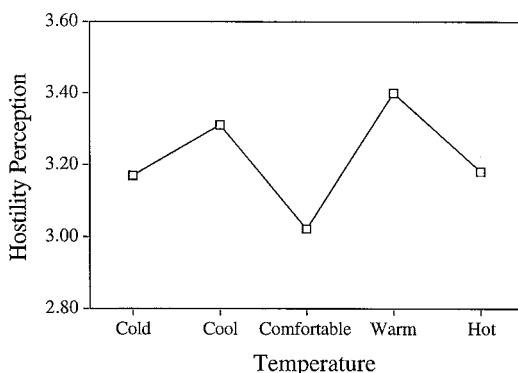
Fig. 14.   Mean perception of hostility in three dyadic interactions as a function of temperature.

The video tape $\times$ quartic temperature term was not significant ($p > .4$), suggesting that this temperature effect did not reliably differ for the neutral, ambiguous, and aggressive videos. However, we expected that the temperature effects on hostile perceptions would be most pronounced on the ambiguous video. Supplementary analyses of temperature effects on each video separately revealed that the quartic effect was individually significant for the ambiguous video [$F(1, 142) = 5.10$, $p < .03$], but not for either of the other two videos ($ps > .2$).

It is also interesting to note that the magnitude of the video tape effect on hostile perception did not differ in the different temperature conditions. The attention-deficit model predicts that participants in the more extreme temperature conditions would have more difficulty attending to the video tapes and thus would be less likely to notice differences in the aggressiveness of the three tapes. But, this quadratic temperature $\times$ video tape interaction was not significant, suggesting that the attention explanation does not apply in this context.

E. EXPERIMENT 4: PROVOCATION AND TEMPERATURE EFFECTS IN THE TAYLOR COMPETITIVE REACTION-TIME PARADIGM

In this experiment college students participated in a competitive reaction-time task modeled after Taylor's paradigm. Specifically, participants were led to believe that they were competing against another person on a reaction-time task. Supposedly as a means of motivating everyone to do their best, the contestants received punishment after each reaction-time trial that they lost. The punishment consisted of white noise delivered via headphones (see Bushman & Geen, 1990). The level of punishment was to be set by each contestant's opponent prior to each trial. The level of punishment for each trial that the participant set for his or her opponent was the indicator of aggressive behavior. Several theoretically meaningful affect measures were also assessed.

1. Method

a. Participants and Design. Two hundred thirty-three undergraduates enrolled in introductory psychology courses participated. To control for possible effects of sex of the opponent, participants were run in same-sex dyads. A second experimenter of the same sex as the participants acted as a confederate when only one participant arrived. Participants were not allowed to sign up or participate with an acquaintance or friend. Participants

wore short-sleeve shirts and long pants so that the temperature manipulation would be similarly experienced.

The design may be conceptualized as a $2 \times 2 \times 5$ factorial with between-participant factors of sex of participant, provocation (high versus low), and temperature (55°, 65°, 75°, 85°, and 95°F). As in Experiment 2, half of the participants were randomly assigned to an experimental room that was set at one of the five target temperatures. The other half were assigned to a room that was yoked to the experimental room.

b. Apparatus. The two temperature-controlled rooms were identical. Each contained a Macintosh IIcx computer, monitor, keyboard, and mouse. A third room was used to give initial instructions and to take the initial measures of physiological arousal. Ambient temperature in a hallway that led from this ''Start'' room to the two temperature rooms was maintained between 68° and 70°F by window-unit air conditioners and space heaters. White noise was generated by the Macintosh computers and was amplified through two Sony SRS-5 Speakers to two pairs of Labtec LT101 stereo headphones. Heart rate and blood pressure readings were obtained by a Takeda medical UA-701 blood pressure meter.

c. Competitive Reaction-Time Task. At the beginning of each of 25 trials a green square on the computer screen signaled the participant to set the noise level for his or her opponent. A yellow square then appeared to alert the participant for the upcoming tone. The tone (approximately 65 db) signaled for the participant to press the mouse button as quickly as possible.

Once a trial was completed, the participant saw the level of noise feedback that the opponent had supposedly set for them. This feedback was presented in a bar graph on the computer screen. The participant also received the noise on 12 ''lose'' trials. If the participant took too long to respond (greater than 500 ms), that trial became a ''lose'' trial even if the computer had originally scheduled it to be a ''win'' trial. This was necessary to maintain the viability of the cover story because pretesting indicated that some participants would intentionally wait for several seconds on a few trials just to see if they were truly playing against another person.

d. Provocation Manipulation. The provocation manipulation took place during the reaction time task. The 10 levels of noise intensity ranged between 60 and 105 dB (in 5-dB increments). The duration of experienced noise blasts ranged from .25 to 2.50 s.

In the High Provocation condition, noise intensity increased from level 4 (75 dB) to level 10 (105 dB) across the three blocks of trials (eight trials in each block). The first block average intensity was level 6 (85 dB), the second block averaged level 7 (90 dB), and the third averaged level 8 (95 dB). Duration of the noise, also supposedly set by the opponent, in-

creased from an average of 1.5 s on the first block to 1.75 s in the second and 2.00 s in the third.

Noise feedback in the Low Provocation condition ranged between the three lowest intensity levels (60, 65, and 70 dB) and the three lowest durations (.25, .50 and .75 s) across all of the trials. The order in which the levels and durations were presented across trials were randomized for each participant within each of the three blocks of trials.

e. Dependent Variables. One set of dependent variables consisted of the punishment intensity levels set by participants for their opponents. Several affect measures, some filler items consistent with the cover story, and a belief questionnaire were administered after completion of the competitive reaction-time task. Of most theoretical interest were the state hostility and the escape motives scales. State hostility was measured with a 35-item scale labeled "Current Mood" (Anderson et al., 1995). Statements such as "I feel angry" were rated on Likert-tyle scales anchored at "strongly disagree" (1), "disagree" (2), "neither agree nor disagree" (3), "agree" (4), and "strongly agree" (5). Eleven items were reverse scored so that high scores on each item indicate higher levels of state hostility. A composite score of state hostility was obtained by summing across items.

Escape motives were assessed by a newly developed "Current Motives Scale." This measure lists 19 escape-related verbs such as "exit" and "retreat" and four unrelated words. The instructions asked participants to indicate on a 5-point scales—anchored at "very slightly or not at all" (1) and "extremely" (5)—to what extent they felt like performing the behaviors that the words suggest (see the Appendix).

Perceived arousal was once again measured with the Perceived Arousal Scale (Anderson et al., 1995). One item (passive) was added to the original 24 items in this scale.

Physiological arousal was measured by obtaining the participants' heart rate and blood pressure both before they entered the temperature room and after completion of the competitive reaction time task. Heart rate and blood pressure were measured twice at each time period to ensure accurate readings.

f. Assessment of Suspicion. After all of the dependent measures were collected, a structured interview was conducted with each participant individually. The experimenter asked a series of questions about the participant's reaction to the procedures. The first questions were general in nature such as, "Did you know anything about what the experiment was about before you came in to participate today?" The questions gradually increased in specificity about the independent and dependent variables. The goals of this interview were to (a) determine if the participant suspected that the purpose of the task was to measure aggressive behavior, (b) assess whether

the participant believed that he/she was actually setting noise levels for and receiving noise from the other participant, and (c) lead into the debriefing in such a way that the participant eventually ''guessed'' the hypothesis. ''Discovering'' the hypothesis has been shown to be a particularly effective way to alleviate negative effects produced by deception in experiments (Aronson, Ellsworth, Carlsmith, & Gonzales, 1990).

  g. Procedure. Two participants could sign up for each experimental session. The experimenter randomly assigned participants to either the temperature-controlled room or to the yoked-temperature room. Each participant was also randomly assigned to either the high- or low-provocation condition. When one participant failed to attend, a confederate was used.

  Upon arrival, two same-sex participants were led to the ''Start'' room, which was kept at a comfortable temperature (between 70° and 72°F). The participants were told that the experiment was on the effects of environmental stressors on performance on a reaction-time task. Temperature and noise were described as the environmental stressors under current investigation.

  After completion of the consent procedures, the experimenter measured participants' heart rates and blood pressures and then led them to their proper temperature rooms. Two experimenters separately described the competitive reaction-time task to the two participants. These instructions included all necessary details about how to set their opponent's punishment levels and a reminder that their opponent would be doing the same for them. In addition, sound levels 1, 3, 5, 7, and 9 were demonstrated. When participants indicated that they understood the task, the experimenters told participants that subsequent instructions would be given over an intercom system. The experimenters then left the rooms and used the intercom to instruct participants to begin.

  At the end of the reaction-time task the computer instructed participants to signal the experimenters via an intercom system. At this point in time, the affect questionnaires were brought to both participants and were completed in the temperature rooms. After participants completed the questionnaires, their heart rate and blood pressures were again measured, this time in the temperature rooms rather than in the ''Start'' room.

  Finally, participants were led into separate comfortable temperature rooms by two different experimenters. Their suspicion of the experiment was assessed by a structured interview and they were thoroughly debriefed. If a confederate was used because one of the participants did not arrive, the purpose of the confederate was fully explained. Care was taken to ensure that the participant did not leave the experiment feeling upset. Table III summarizes the sequence of events.

TABLE III

Procedural Summary of Experiment 4

1. Start room (70°–72°F)
   Cover story
   Consent procedure
   Baseline heart rate and blood pressure measurement
2. Temperature rooms (56°–98°F)
   Competitive reaction-time task explained and conducted
   State hostility, perceived arousal, and escape motives questionnaires completed
   Posttask heart rate and blood pressure measurements
3. Start room
   Suspicion assessment (orally administered)
   Oral and written debriefing

3. Results

Participants' suspicions about the noise intensities they received and about the temperature–aggression relation were assessed during the debriefing interview. Notes made during the interview were later examined by the chief experimenter, who then assigned a rating between 0 (no suspicion) and 4 (highly suspicious) for each participant. Only 12 participants were highly suspicious; they were evenly distributed across the temperatures. Preliminary analyses performed both with and without these participants' data yielded no major differences. These suspicious participants were not included in the final analyses. Thus, the final sample contained 221 participants, 115 males and 106 females. Occasional missing values on some of the questionnaires resulted in a slightly smaller sample for some dependent variables.

a. Analysis Strategy. Five target temperatures (55°, 65°, 75°, 85°, and 95°F) were sought in both of the experimental rooms. As anticipated, the actual temperatures deviated somewhat from the target temperatures, especially in the yoked room. Actual temperatures ranged from 56° to 99°F. Due to the dispersal of temperatures within this range, temperature was treated as a continuous variable. Temperatures were first centered (i.e., converted to deviation scores). Linear, quadratic, cubic, and quartic temperature terms were created from these scores.

Hierarchical regression analyses were conducted on all of the dependent variables with linear, quadratic, cubic, and quartic temperature terms, provocation level, sex of participant, and all possible interactions as predictor variables. Sex was dropped from the analyses whenever it had no reliable impact. The intensity-of-noise-level setting for Trial 1 was analyzed separately, both because it is the first opportunity for the participant to aggress

and because it occurred before the high- or low-provocation manipulations began. Intensity-of-noise settings for the remaining 24 trials were grouped into 3 blocks of 8 trials. These three blocks were treated as a repeated-measures factor in the regression ANOVAs on intensity.

State hostility, escape motives, perceived arousal, heart rate, and blood pressure change were also tested for effects of temperature, provocation, and sex. For all regression models, an alpha level of .05 was used for the effects of the theoretically relevant provocation and temperature manipulations. A Bonferroni correction was performed on all nonpredicted tests to protect against possible Type I errors.

The questionnaire measures were taken after completion of the TCRT task. We therefore predicted a main effect of the provocation manipulation and a quadratic effect of the temperature manipulation on the main affective measures of state hostility and escape motives. Finally, we predicted a linear temperature effect on perceived arousal, with higher scores in the colder temperatures.

b. State Hostility. This 35-item scale was highly internally reliable (coefficient α = .95). As expected, participants in the high-provocation condition reported higher levels of state hostility (adjusted M = 2.19) than those in the low-provocation condition (adjusted M = 1.91) [$F(1, 212)$ = 15.21, $p < .0001$].

Also as expected, there was a "U"-shaped relation between temperature and state hostility, as shown by the significant main effect of the quadratic temperature term [$F(1, 212)$ = 7.00, $p < .01$]. Hot and cold temperatures created increases in state hostility as can be seen in Fig. 15. None of the provocation $\times$ temperature interactions, sex effects, or effects of the linear temperature term approached significance.
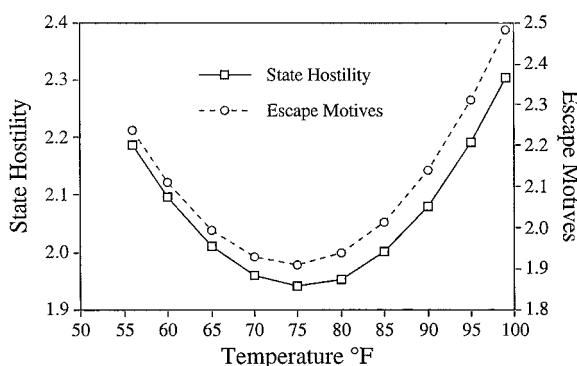
Fig. 15. State hostility and escape motives as a function of temperature.

These results demonstrate that both cold and hot temperatures can increase feelings of state hostility. Note that other temperature effects (linear, cubic, quartic) were not expected to be significant on this measure, and they were not.

c. Escape Motives. Internal reliability of this newly created 19-item scale was high (coefficient α = .95). As predicted, the quadratic temperature term was significantly related to escape motives [$F(1, 219)$ = 5.65, $p < .02$]. Desire to escape increased at uncomfortable ambient temperatures. None of the other effects approached significance. Figure 15 also displays these results.

d. Perceived Arousal. This 25-item scale had high internal reliability (coefficient α = .92). Perceived arousal was influenced by uncomfortable temperatures. Main effects were revealed for both the linear temperature term [$F(1, 214)$ = 13.77, $p < .001$], and for the quadratic temperature term [$F(1, 214)$ = 8.87, $p < .005$]. As Fig. 16 illustrates, participants who were in the colder temperatures reported that they felt more aroused than those in hotter temperatures. The linear effect was expected (see Anderson et al., 1996). However, the modest downturn in perceived arousal at the coldest temperatures was unanticipated (and unreplicated in our other work). None of the other effects approached significance.

e. Heart Rate and Blood Pressure. As in Experiment 2, change in heart rate was positively linearly related to temperature [b_{lin} = .141, a = −.643, $F(1, 202)$ = 5.98, $p < .02$]. None of the other effects approached significance. In addition, none of the effects on blood pressure reached significance by the Bonferroni-corrected criterion.

f. Aggressive Behavior on Trial 1. Only the sex main effect on the noise-intensity punishment level set by participants for the first competitive
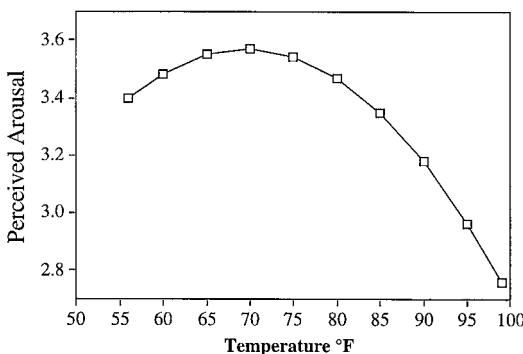
Fig. 16.   Perceived arousal as a function of temperature.

reaction-time trial was significant [$F(1, 217) = 8.92$, $p < .005$]. Males set a higher punishment level than did females, Ms = 4.44 and 3.67, respectively. Of course, in the standard TCRT paradigm used in this experiment no provocation occurs until after Trial 1, so the lack of provocation effects are not surprising.

g. Aggressive Behavior on Later Trials.   Repeated-measures regression ANOVAs were performed on the average noise intensity settings of the three blocks, with eight trials in each block. The main effects of block [$F(2, 434) = 10.21$, $p < .0001$] and provocation [$F(1, 217) = 184.42$, $p < .0001$] were both highly significant. Intensity settings increased across blocks and were greater in the high-provocation than in low-provocation conditions. In addition, the block $\times$ provocation interaction was also significant [$F(2, 434) = 57.37$, $p < .0001$]. Intensity settings increased across the blocks in the high-provocation condition and decreased slightly across blocks in the low-provocation condition (see Fig. 17). No other effects were significant.

4. Discussion

These results show that this noise version of the TCRT paradigm was sensitive to provocation. Thus, the lack of temperature effects cannot be attributed to this modification (i.e., from shock to noise punishment). In addition, the significant quadratic effects of temperature on state hostility and escape motives demonstrate that at least some of the underlying conditions necessary for temperature effects on aggression were met.

As discussed earlier, though, there are at least two reasons for expecting the relatively fragile effects of uncomfortable temperatures on aggressive behavior to be overwhelmed or hidden in this paradigm. First, because the
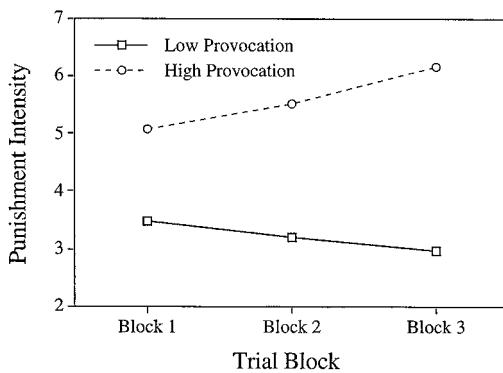
Fig. 17.   Punishment level as a function of trial block and provocation.

participants believe that both they and their opponent will continue to set punishments for each other on subsequent trials they may be more concerned with controlling the opponent's behavior than with aggressive retaliation. Second, the high and low provocation conditions are so clear to participants and exert so powerful an effect that there is little room left for the relatively smaller effects of uncomfortable temperatures.

F. EXPERIMENT 5: TEMPERATURE EFFECTS IN A REVISED COMPETIVE REACTION-TIME PARADIGM

Experiment 5 was designed to circumvent both of these potential problems with the TCRT paradigm of aggressive behavior. The first problem—concern with controlling the opponent's punishing behavior on subsequent trials—was handled by changing the competitive reaction time task itself. Specifically, the Revised Competitive Reaction Time paradigm (RCRT) split the trials into two phases. In the first phase, participants were to receive punishment set by their opponents on ''lose'' trials, but the opponents were not to receive punishment for their ''lose'' trials. In the second phase, the roles were reversed: Participants set the punishment levels that the opponents were to receive on ''lose'' trials, but were no longer to receive punishments themselves. Thus, the punishment levels set by participants could not be seen as an attempt to control the punishing behavior of their opponents.

The second problem—the clarity of the opponent's intentions in the standard high- and low-provocation conditions—was handled by replacing the low-provocation condition with a different type of high-provocation condition. This *ambiguous-provocation* condition had exactly the same intensities and durations of opponent-set punishments delivered to the participant during phase one as the high-provocation condition of Experiment 4. However, whereas the high-provocation condition in Experiment 4 consisted of a systematic increase in punishment levels across 25 trials, the ambiguous-provocation condition in Experiment 5 delivered the punishments in an apparently random fashion. Thus, the opponent's intentions were less clear in the ambiguous condition. The *clear-provocation* condition in Experiment 5 also used the RCRT paradigm, but differed from the ambiguous-provocation condition in that the high-provocation pattern of punishments from Experiment 4 were used in phase one.

If the change to the RCRT two-phase paradigm is sufficient, then we should see temperature effects on aggressive behavior in both the ambiguous- and the clear-provocation conditions. However, we expected temperature effects would be most pronounced in the ambiguous condition. Further-

more, the Social Justice model predicts a "U"-shaped function relating temperature to aggression on Trial 1 and an "M"-shaped function on later trials.

1. Method

a. Participants. Sixty-seven female and 65 male college students participated in the experiment in exchange for partial course credit. As in Experiment 4, participants were run in same-sex dyads and acquainted participants were not allowed in the same sessions. Each participant wore a short-sleeve shirt and long pants. When only one participant came to the session, a confederate of the same sex was waiting as the alleged other participant. If the confederate was not needed, he/she served as a second experimenter to explain the task.

b. Procedure. The same laboratory, cover story, and temperature-manipulation procedures were used as in Experiment 4. After informed consent was obtained, blood pressure and heart rate were obtained. Physiological readings were taken twice in succession, and responses were averaged to provide more reliable measures.

Participants were next led to separate temperature-controlled rooms, each containing a computer. Experimenters explained the modified competitive reaction-time task. It was explained that there would be two phases of the reaction-time task and that for the first phase, the participant was "randomly assigned" to receiving white noise punishment if they lost (i.e., responded slower to the tone than their opponent). They were further informed that the length and intensity level of the noise would be set by their opponent prior to each trial. It was explained that for the second phase their roles would be reversed. They were told that they would be setting the length and intensity of noise that their opponent would hear if he/she lost and that they (the participant) would no longer be receiving any noise punishment. All participants were given sample noise blasts of levels "1" (60 dB), "3" (70 dB), "5" (80 dB), "7" (90 dB), and "9" (100 dB). Finally, it was explained that during the task there would be a square in the middle of the screen that would turn yellow as a warning that a tone would soon sound. As soon as participants heard the tone, they were to click on the mouse button as quickly as possible. If they won, they would not hear any noise, but if they lost, they would hear a noise of the length and level that their opponent set for them. They would also see the level of noise that was set for them by their opponent for each trial, whether they won or lost. After answering questions, the Experimenter left the room and told participants (over the intercom) when to begin. Participants then completed the 25 trials of phase one.

After participants completed several filler questionnaires, the second phase was explained to them once again. They were shown how to set the noise punishment level for each of the 25 trials to follow. After answering questions, the Experimenter left the room and again told participants (over the intercom) when to begin.

Upon completion of phase two, heart rate and blood pressure were reassessed. Finally, as in Experiment 4, participants completed some filler items consistent with the cover story and an expanded version of the escape motives scale used in Experiment 4.

c. Provocation Manipulation.   To manipulate provocation we varied the noise-intensity levels and duration, supposedly set by the opponent. There were two conditions: clear provocation and ambiguous provocation. In both conditions, the participant lost the first trial and received a noise-level 1 punishment for the minimum duration of .25 s. In each of the remaining three blocks of eight trials, the participants won four and lost four in a random pattern. The noise intensities (displayed on each trial, delivered on ''lose'' trials) and durations (delivered on ''lose'' trials) varied by provocation condition.

The first block (not counting trial 1) in the clear-provocation condition consisted of noise-intensity levels of 2, 3, and 4 with durations of .5, .75, and 1.0 s. The second block consisted of intensity levels 4, 5, 6, and 7 at durations of 1.0, 1.25, and 1.5 s. The third block consisted of intensity levels 7, 8, and 9 at durations of 1.5 and 1.75 s.

The ambiguous-provocation condition consisted of exactly the same intensities and durations as the clear-provocation condition. Instead of systematically increasing across block, however, the pattern was random.

d. Dependent Measures.   Noise-intensity levels set for opponents during phase two served as the measure of aggressive behavior. Trial 1 intensity settings were analyzed separately because of our interest in the potential temperature-induced outburst effect. The remaining intensity settings were averaged within each of the three blocks and analyzed in a repeated-measures regression ANOVA. The escape motives scale contained 28 items (plus 4 fillers), 9 more than the version used in Experiment 4. The Appendix lists these additional items.

2. Results

a. Aggressive Behavior on Trial 1.   The effects of temperature and provocation on aggressive behavior were assessed by hierarchical-regression ANOVAs, as in Experiment 4. Quadratic (U-shaped), cubic, and quartic (M-shaped) effects of temperature on aggression were assessed. Preliminary

analyses yielded no reliable effects of sex of participant, so it was dropped from all subsequent analyses.

To examine punishment set by participants on their first retaliation opportunity (Trial 1), a series of multiple-regression analyses were conducted. None of the cubic or quartic effects approached significance. However, the quadratic temperature × provocation interaction was statistically significant [$F(1, 126) = 7.29$, $p < .01$]. This indicates that the quadratic temperature effect differed in the two provocation conditions.

To explore this interaction we examined the linear and quadratic temperature effects within each provocation condition separately. The quadratic effect of temperature was statistically reliable in the ambiguous-provocation condition only [$F_{amb.}(1, 63) = 5.45$, $p < .02$; $F_{clear}(1, 63) = 2.23$, $p > .10$]. The linear temperature effect was nonsignificant in each of these analyses ($ps > 25$).

The continuous line with squares in Fig. 18 displays the best fit line for Trial 1 intensity settings in the ambiguous-provocation condition, with linear and quadratic terms in the model. What we see is the predicted ''U''-shaped function, with more aggression occurring at the hot and cold temperatures. This curve is slightly tipped because of higher aggression at the 55° temperature than at 95°F. This fits well the findings from Experiment 2 that 60° is about as uncomfortable as is 95° in our particular laboratory context. Figure 18 shows that the aggression levels displayed by participants in the ambiguous provocation condition was about the same at these two temperatures.

b. Aggressive Behavior on Later Trials. To test temperature effects on aggressive behavior in later trials, we conducted repeated-measures
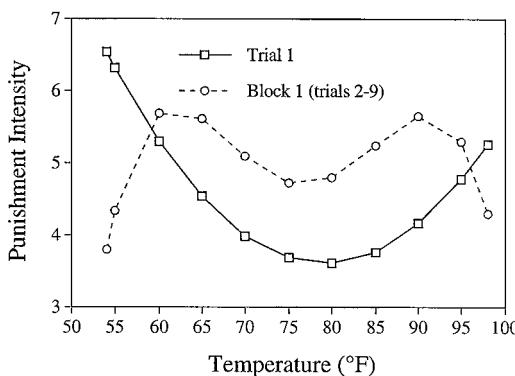
Fig. 18. Punishment levels set by ambiguous provocation participants on Trial 1 and Block 1 as a function of temperature.

ANOVAs with the punishment intensities from trials 2 to 25 divided into 3 blocks of 8 each. Thus, there was a 3-level repeated factor (Block); the provocation manipulation; the four temperature terms; and the various block, provocation, and temperature interactions as predictors in the various regression models.

We were most interested in the possibility of obtaining an "M"-shaped quartic effect of temperature on intensity settings, either as a main effect or as an interaction with block or provocation. We believed that this downturn in aggression at the most uncomfortable temperatures was most likely to occur in the ambiguous-provocation condition in the first or second block of trials.

The Block $\times$ Quartic temperature effect was significant [$F(2, 252) = 3.12, p < .05$]. To further examine this interaction we analyzed the quartic effect for each block separately. Block 1 yielded a significant quartic effect [$F(1, 126) = 4.70, p < .03$]. Further analyses of each separate provocation condition revealed that the quartic effect was significant for ambiguous provocation [$F(1, 61) = 4.95 \ p < .05$], but not for clear provocation [$F(1, 61) < 1$]. The Block 1 temperature effects on punishment intensities set by participants who had been ambiguously provoked are displayed in Fig. 18, along with the Trial 1 effects discussed previously.

In Block 2 the quartic effect was considerably weaker (nonsignificant) [$F(1, 126) = 2.16, .10 < p < .15$]. However, as in Block 1 the "M"-shaped quartic temperature effect was significant for ambiguous provocation [$F(1, 61) = 4.00 \ p < .05$], but not for clear provocation [$F(1, 61) < 1$]. By Block 3 the quartic temperature effect had disappeared from both provocation conditions ($ps > .2$).

c. Aggressive Behavior Summary. The combination of a "U"- (Trial 1) and an "M"-(Blocks 1 and 2) shaped function relating temperature to aggression in the ambiguous condition best fits the Social Justice model discussed earlier. Participants in the most extreme temperature conditions tended to "get even" with their provocateurs on Trial 1 and then reduced their retaliation on subsequent trials (Blocks 1 and 2). The "M" function is also consistent with the Negative affect Correction model as well as the attention-deficit model.

d. Escape Motives. There was a reliable quadratic effect of temperature on escape motives [$F(1, 128) = 4.74, p < .04$]. As predicted, escape motives increased in the most extreme hot and cold temperatures. No other effects approached significance, $Fs < 1$.

e. Physiological Arousal. We assessed the effects of temperature, provocation, and their interactions on heart rate, systolic blood pressure, and diastolic blood pressure separately. As in previous research, change scores were created by subtracting the pretest readings (taken before entering the

temperature-controlled room) from the posttest readings (taken at end of second CRT session).

Temperature had a linear effect on heart rate [$F(1, 127) = 8.51$, p $<$ .005], such that hotter temperatures produced a higher heart rate than did cold temperatures. None of the remaining effects on heart rate approached significance (Fs $<$ 1). As in Experiment 4, none of the blood pressure effects were significant.

G. DISCUSSION OF THE FIVE EXPERIMENTS

The five experiments presented in this chapter yielded several major findings. First, we verified that people do have ''social theories'' about temperature effects on arousal, affect, and behavior. Specifically, people believe that hot temperatures (relative to comfortable ones) increase feelings of anger and hostility, decrease alertness and energy, and increase aggression and violence. In addition, people believe that cold temperatures have exactly the opposite effects. These findings highlight the utility of examining cold temperature effects as well as hot temperature effects in a lab setting. If hot and cold temperatures produce similar effects on aggression, then a simple ''demand characteristic'' interpretation becomes implausible.

Second, the actual effects of uncomfortable temperatures on arousal varied depending upon whether physiological or psychological measures of arousal were used. The heart rate indicator of arousal was positively related to temperature across studies and experimental contexts. Hot temperatures increased heart rates, whereas cold temperatures decreased heart rates. Subjective perceptions of arousal generally showed the opposite relation. This complex pattern of results suggests that excitation-transfer effects may occur under some circumstances. However, if excitation transfer is the dominant process underlying the temperature–aggression relation, then hot and cold temperatures that are equally uncomfortable should produce very different patterns of aggressive behavior. But, Experiment 5 yielded essentially the same aggression pattern in hot and cold conditions. Thus, in the present laboratory context excitation transfer apparently was not operative. Nonetheless, we believe that such effects may occur in other temperature related contexts, especially those in which temperature is not so salient a feature.

Third, we found that uncomfortable temperatures, both hot and cold, increase hostile feelings and a desire to escape the situation. This supports the affective underpinnings of the Negative Affect Escape model of the temperature–aggression relation (e.g., Anderson & DeNeve, 1992; Baron,

1979) and suggests that escape motives might play a role in decreasing aggression in those contexts where escape behavior is both possible and incongruent with aggressive behavior. These affect results also support aspects of the major cognitive models of affective aggression in that they all assume that negative affect either primes aggressive inclinations, energizes aggressive behavior, or removes inhibition to aggression (e.g., Anderson et al., 1996; Berkowitz, 1993; Geen 1990). However, it is important to keep in mind that escape was not possible in our two experiments on aggressive behavior and the Experiment 5 yielded two very different patterns of aggression depending upon whether it was on the first trial (an outburst effect) or on later trials. Thus, the behavioral results of our experiments provide no support for the NAE model.

Fourth, as predicted by the Negative Affect Correction model, hostile perceptions were related to temperature in an ''M''-shaped function. As temperatures deviated from the most comfortable, perception of hostility in the videotape interactions first increased and then decreased.

Fifth, our Social Justice analysis of temperature effects was supported by the initial temperature-aided outburst of aggression and the subsequent decline in further aggression in the ambiguous provocation condition of Experiment 5. Participants who had received an ambiguous pattern of provocation and who were in the hot or cold temperature conditions gave the highest punishments to their antagonist on Trial 1. The outburst was shortlived, however, suggesting that once the ''injustice'' had been punished, participants were willing to cease further delivery of heightened punishments.

These five experiments, along with the naturalistic studies of the temperature–aggression hypothesis, strongly support the conclusion that hot temperatures can and do increase aggression in many contexts. An important practical issue arising from these findings concerns the likely impact of global warming on violent crime rates. Anderson, Bushman, and Groom (1997) recently showed that hotter years in the United States yield higher assault and murder rates (summed) than cooler years. This result held true even when a variety of statistical and social control variables were added to the model. We recently added more data to that data set; the following section provides adjusted estimates of the likely effects of global warming on violent crime.

VI. Global Warming and Violent Crime

A. HOT YEARS AND HIGH VIOLENCE RATES

Anderson, Bushman, and Groom (1997) reported two studies on how hotness of year affects violent crime. Study 1 used time-series regression

procedures to test the effects of yearly average temperature and age distribution on violent crime in the United States from 1950 to 1995. As expected, a significant ($p < .05$) positive relation between temperature and violent crime rate was observed, even after time series, age, and linear year-to-year trend effects were statistically controlled. Study 2 examined the effects of number of hot days ($\geq 90°F$) on the usual summer increase in violence. As expected, years with more hot days produced a bigger summer increase in violent crime than years with fewer hot days. Nonviolent crime was unaffected by number of hot days. Before updating those two studies, we present a look at changes in the U.S. murder/assault rate over the years 1950–1997 and changes in the average temperature during this same period.

The murder/assault rate data in Fig. 19 reveal a dramatic increase from the mid-1960s to the early 1990s, with a brief hiatus in the early 1980s and a small decline in the last few years. The temperature data in Fig. 20 are much less consistent, but there is evidence of an upward trend, consistent with the global warming trends we have all read so much about in recent years.

B. HOT SUMMER EFFECT

The summer effect is the oft-replicated finding that violent crime rates are higher in the summer than in any other quarter of the year (Anderson, 1989; Anderson & Anderson, 1998). If the summer effect is in fact a result of more hot days, rather than an artifact of school schedules or vacation days or other seasonal activities, then hotter summers (i.e., those with more hot days than typical) should produce a larger summer effect. In this updated study, we examined the relation between the hotness of summers
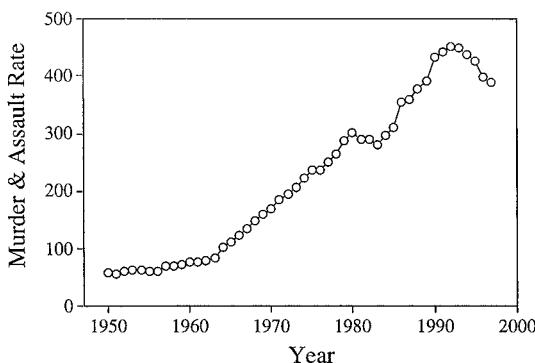
Fig. 19.   Murder and assault rates in the United States (1950–1997).
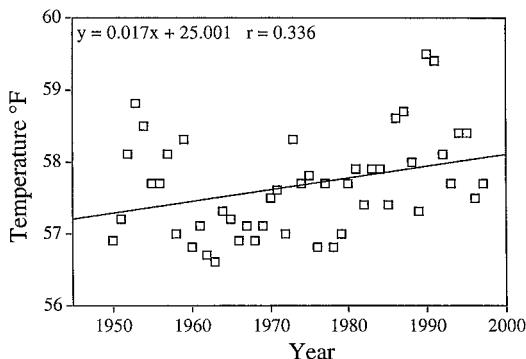
Fig. 20.   Average temperature in the United States (1950–1997).

and the magnitude of the summer effect for the combined murder/assault rates in the United States from 1950 to 1997. Hotness of summer was measured by averaging the number of hot days (i.e., days which reached at least 90°F) experienced in 50 of the largest U.S. cities. The summer effect for murder/assault was computed as the proportion of all U.S. murders and assaults committed during the year that occurred during July, August, and September minus the averaged proportion for the other three quarters of that year, adjusted to equate quarters for number of days. Thus, if the summer proportion for a given year is the same as in the other quarters (i.e., is exactly 25%) then the summer effect is zero. If the summer proportion of murders/assault is greater than the average of the other quarters, the summer effect is greater than zero. If relatively fewer murders/assaults occurred in the summer, the summer effect would be less than zero. Over this 48-year period the summer effect was quite robust [$M = 2.55$, $d = 2.41$, $t(47) = 16.71$, $p < .001$].

To further test the heat hypothesis, we ran a number of regression analyses. The main finding, as predicted, was that hotter summers produced larger summer effects than cooler ones [$b = .071$, $r = .39$, $t(47) = 2.88$, $p < .01$]. In other words, hot summers produce a disproportionate amount of murders and assaults. Figure 21 displays this result.

C. HOT YEAR EFFECT

The average annual temperatures of the same set of 50 U.S. cities were used to estimate how hot each year was during this same 48-year period of time. The overall U.S. murder/assault rate for each year constituted the
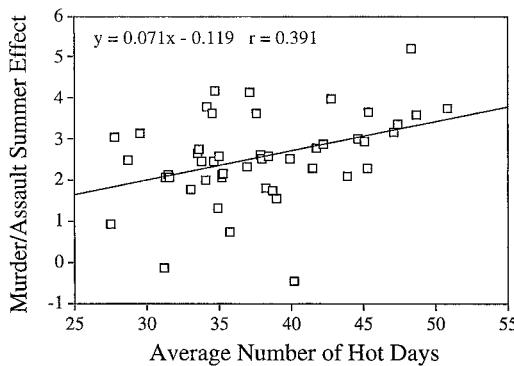
Fig. 21.   The summer effect for murder and assault as a function of average number of hot days.

dependent variable. A set of time-series regressions were run to test whether temperature was a significant predictor of this type of violent crime and, if so, to estimate the magnitude of the hot year effect. As in our previous hot year study, three autoregressive parameters were needed to deal with autocorrelations in the residuals. Year was also included as a predictor variable to help control for systematic shifts in violent crime rates across time. We also tested for possible effects of shifts in age distribution (proportion of the U.S. population in the 15- to 29-year age range) and in prison population (proportion of the U.S. population in prison). These latter two variables had no appreciable impact on the murder/assault rate when year and autoregressive parameters were in the statistical model, so they were dropped from the final analysis.

As in our earlier study, hotness of year was significantly related to murder/assault rate, but with a slightly steeper slope ($b = 4.58$, $t = 3.03$, $p < .01$). The slope reveals that for each 1°F increase in average temperature, the United States experienced 4.58 additional murder/assault crimes per 100,000 population.

D. GLOBAL WARMING EFFECT

One reason we so carefully reexamined the Minneapolis studies earlier in this chapter is that if the initially published conclusions were accurate (i.e., that violence decreases at hot temperatures), the implications of global warming on violent crime might not be so serious. But all of the evidence, including the Minneapolis data (when analyzed more appropriately), points

to the same conclusion—increasing temperatures will increase violence. The hot year effect gives us a means of predicting just how much of an increase in murder and assault we can expect given a particular increase in average temperature from global warming. Figure 22 displays these estimates for four global warming estimates, three estimates of the true causal impact of temperature on murder and assault, and assuming a population of 270 million (which the United States will reach in a few years).

The left vertical axis displays the results in terms of the rate per 100,000 population, whereas the right vertical axis displays the same results in terms of absolute numbers of murders and assaults based on an overall U.S. population of 270 million. Global warming predictions for the next 50 to 100 years vary considerably, so we've chosen some typical figures to display in Fig. 22. Using the best slope estimate from the earlier time-series regression analysis (i.e., 4.58), we see that a 2°F increase in average temperature predicts an increase of about 9 more murders/assaults per 100,000 people, or over 24,000 additional murders/assaults per year in a population of 270 million. If global warming is as high as 8°F, we get a predicted increase in murder/assault totals of almost 100,000 per year in a population of 270 million.

Of course, the true slope may be somewhat greater or smaller than 4.58, so Fig. 22 includes prediction lines for other estimates. It should be kept in mind that the 4.58 slope estimate may well be too small because of the conservative nature of the time-series regression analyses used to generate it.

It is also important to keep in mind that if significant global warming does occur, then the many other serious consequences to the physical
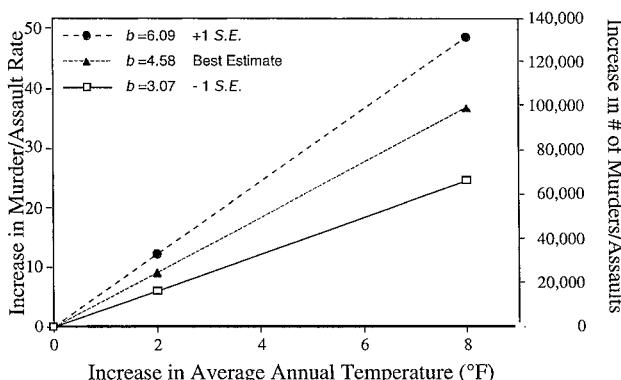
Fig. 22.   Global Warming Effect on murders and assaults per year in the United States, based on a population of 270 million.

environment will also dramatically alter our social environments. These estimates of increases in violent crime due solely to the effects of hot temperatures are just one additional factor to consider when contemplating the seriousness of global warming.

VII. General Discussion

Overall, the results of recent studies of the temperature–aggression hypothesis have produced considerable insight into the age-old phenomenon of high temperatures being associated with increased rates of violence. The Negative Affect Escape model of Baron and colleagues has not fared very well in terms of empirical tests. The predicted decrease in aggression at hot temperatures has been elusive in the lab and nonexistent in naturalistic settings. Those few lab studies that have obtained a decrease under some conditions have, in other ways, yielded data that contradict the NAE model (e.g., Palamarek & Rule, 1979). Nonetheless, that pioneering work has successfully accomplished one of the most important goals of any theory—stimulating additional research and theory and leading to a better understanding of the phenomenon.

Of course, there remain a number of unanswered questions in this domain. A few reasoned speculations may point the way to further advances.

A. DYNAMIC INTERPERSONAL PROCESSES

We believe that discomfort in general can produce short-lived aggressive outbursts in a variety of settings, much like the one displayed on the noise-intensity settings in Experiment 5. A question of obvious importance concerns how a short-lived outburst induced by hot or cold temperatures (which apparently lasted for only one trial) could influence violent behavior in real-world settings. The answer lies in a difference between most laboratory paradigms of aggression and dyadic interactions in the real world. In most laboratory paradigms there is no real dyadic interaction. That is, aggressive behavior by a participant is not actually received by another real participant. When people aggress against someone in the real world, that person receives our provocation and reacts to it. Any factor that increases the perceived ''provocativeness'' of an act will also increase the target's anger and the likely aggressiveness of the behavioral response. This cycle of escalating provocations is exactly what happens in most arguments and fights leading to assault and murder. Thus, even short-lived increases in

aggression may translate into substantial increases in violence in naturalistic settings. We believe that this is why hot temperatures are monotonically associated with increased violence across a wide range of studies. We also believe that modifying standard laboratory aggression paradigms to include this dynamic interpersonal process would allow better examination of a variety of aggression and violence phenomena under controlled conditions.

B. HOT AND COLD REVISITED

This dynamic explanation of temperature effects also raises another question concerning the effects of cold temperatures. If the same discomfort–outburst process is at work in both hot and cold temperatures, why don't the field studies on violent crime yield comparable increases in aggression in cold temperatures? As noted earlier in this chapter, the simplest explanation is that people are better able to protect themselves from cold discomfort (e.g., more layers of clothes, heated buildings) than they are from the heat. Thus, people are seldom uncomfortably cold long enough for a cold-induced increase in real-world violence to appear. As use of modern air conditioning expands, this difference in ability to escape hot versus cold temperatures may be greatly reduced and may eventually reduce the magnitude of the heat effect in field studies of aggression (cf., Harries & Stadler, 1988). Indeed, this possibility suggests that we may be able to substantially reduce aggression in some contexts by providing better temperature control. Prisons, factories, and schools are all environments where violence is a problem and where air conditioning might realistically be capable of reducing the violence problem.

C. NEW DIRECTIONS FOR TEMPERATURE EFFECTS

Although the studies examined in this chapter answer a number of important questions about aggression processes in general and the temperature–aggression relation in particular, we should also point out a number of remaining issues. Research has shown that thermal stress can have significant effects on attention and judgment (e.g., Hancock, 1986; Shanazarov, Makhnovskii, & Kuzyuta, 1989; Razmjou & Kjellberg, 1992). For example, attentional capabilities decline under heat-stress conditions, as do quality of judgments. One of our "filler" items given just prior to debriefing in Experiments 4 and 5 asked participants to indicate "How easy was it to concentrate in the room you were in?" Analysis of responses to this item

yielded a strong quadratic temperature effect in both experiments [$F(1, 217) = 32.12$ in Experiment 4; $F(1, 128) = 11.91$, in Experiment 5, $ps < .001$]. This ''U''-shaped effect was the same as we have seen for state hostility and escape motives in several studies. Participants in the extreme temperatures (hot or cold) found it harder to concentrate than did those in more moderate temperature conditions, thus replicating the more cognitive work in this area. Further work on this attention deficit effect seems warranted, particularly in terms of social perceptions, social action, and aggression.

It is also worth noting that participants in the hostile perception experiment (Experiment 3) were sensitive to the differences in amount of interpersonal aggression built into the three different videotapes, arguing against an attention deficit process in that particular study. Perhaps in other contexts, with more subtle aggression cues being varied, the cognitive deficits created by extremely uncomfortable temperatures would influence hostile perceptions.

How would such effects influence the aggression processes? Attentional deficits of any kind may increases, decrease, or have no impact on aggressive behavior depending upon the situation. For example, reducing an annoyed person's attentional abilities may well reduce his or her ability to suppress aggressive inclinations and thus increase aggressive behavior. Or, it may reduce the ability to perceive and take into account mitigating circumstances, thereby increasing aggression. In other contexts, reduced attentional capacity may result in a person not fully perceiving or understanding a personal insult. In this circumstance, the attentional deficit would reduce aggression by decreasing the perceived provocation. Finally, aggression-enhancing and aggression-inhibiting processes may well cancel each other out in yet other circumstances.

Other fruitful directions for future work on the temperature–aggression hypothesis involve pitting various motives against each other. What happens when escape and aggressive motives can be satisfied only by engaging in mutually exclusive behaviors? At what point do escape motives dominate? Similarly, what happens when these two motives can be satisfied by the same behavior? Do we see heightened aggression in these latter circumstances? We believe that additional research along these lines will improve our understanding of affective aggression in general while providing cleaner tests of NAE.

The present set of studies raises additional questions about processes underlying temperature effects. The aggression results in Experiment 5 most clearly support the Social Justice model. The NAE model is contradicted by the Trial 1 quadratic effect in that study. However, the hostile perception results of Experiment 3 best fit the Negative Affect Correction

model. As negative affect increased (in uncomfortably cool and warm conditions), so did reported hostile perceptions. But when temperatures became even more extreme the salience of the temperature effect on mood may have led Experiment 3 participants to try to correct their social judgments for this potentially biasing factor. The Social Justice model is contradicted by this quartic temperature effect on hostile perceptions. It is possible, of course, that all of these processes are operative, either across participants or within the same participant but at different times in the aggression cycle. Clearly, additional work is needed to identify when (and in which people) these various processes are most likely to operate.

Finally, the temperature effects on physiological and psychological indicators of arousal invite use of temperature manipulations to explore key questions in excitation transfer theory. Generally, manipulations that increase indicators of sympathetic arousal such as heart rate also increase psychological feelings of arousal. For example, exercise increases heart rate and perceived arousal. The paradoxical effects of hot and cold temperatures on heart rate and perceived arousal would seem ideal for further tests of the limits of excitation transfer phenomena in a variety of contexts, including aggression.

Appendix

ESCAPE MOTIVES SCALE

The following are several verbs. Please indicate to what extent you feel like doing what they suggest right now. Although some may be impossible actions for you to do right now, please mark how much you feel like performing them.

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

__ abandon	__ avert	__ avoid
__ begin[b]	__ depart	__ desert
__ disappear	__ escape	__ evacuate
__ evade	__ exit	__ forsake
__ improve[b]	__ listen[b]	__ leave
__ move	__ quit	__ release
__ relax[b]	__ resign	__ retreat

__ vanish   __ withdraw   __ continue[c]
__ extend[c]   __ persist[c]   __ prolong[c]
__ approach[c]   __ confront[c]   __ delay[c]
__ explore[c]   __ pursue[c]

[a] The scale is labeled "Current Motives Scale" when given to research participants. The authors retain the copyrights to both versions of the Escape Motives scale. We grant permission to researchers to use either version of the Escape Motives scale for research purposes.
[b] Indicates a filler item not scored as part of the Escape Motives Scale.
[c] Items added for Experiment 5. All nine of these newer items were reverse scored.

Acknowledgments

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Note. References marked with an asterisk indicate studies included in the meta-analysis.

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THE IMPORTANCE OF BEING SELECTIVE: WEIGHING THE ROLE OF ATTRIBUTE IMPORTANCE IN ATTITUDINAL JUDGMENT

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I. Introduction

Attitudes have been defined in a variety of ways, but all definitions share the notion of evaluation. Social psychologists have traditionally conceptualized attitudes as an enduring, relatively stable evaluative response to an object, person, issue, or event (Allport, 1935; Eagly & Chaiken, 1993; Zanna & Rempel, 1988). One traditional theme in attitude research concerns the investigation of the *structure* of these summary evaluations. In the present chapter we focus on a rather neglected aspect of attitudes, namely the *belief structure* underlying attitudes. Belief structure generally refers to the cognitions that underlie an individual's attitude or behavioral choice, but can also refer to affective and cognitive components of attitudes as well as the interplay between these two components. As noted by Petty, Wegener and Fabrigar (1997), much recent work on the structure of attitudes has focused on attitude strength. Issues such as attitude extremity, ambivalence, salience, accessibility, and affective–cognitive consistency have all been studied under the general rubric of "attitude strength." In our view, research on the belief structure of attitudes can help to improve our insight into a number of issues related to attitude strength. These include attitude ambivalence, the accessibility of attitudes, and differences in reactions to counterattitudinal information between individuals holding identical attitudes in terms of their overall evaluative response.

Attitudes and decisions differ in importance. Attitudes about trivial issues and most decisions in familiar situations tend to be based on impulse, habit,

or rule, without much reflection. Probably many attitudes and everyday decisions are of this nature. However, more important attitudes and decisions are presumably based on more careful and deliberate information processing. Our approach focuses on these more important attitudes and decisions. We assume that these attitudes are based on more than one belief or attribute. Answering questions about these attitudes is expected to be preceded by several steps including the selection of beliefs or attributes that are of relevance, assessing these attributes, and integrating these assessments into an overall evaluative judgment, preference, or choice. We thus assume a bottom-up process in which beliefs are combined to form an overall attitudinal judgment.

This more controlled mode of operation can be contrasted with more automatic processes (i.e., processes that operate without much cognitive effort and that are usually unintentional; see, e.g., Bargh, 1989). Research in social cognition over the past 2 decades has enhanced our understanding of automatic processes in social judgment and attitudes. These processes have also been studied in the context of research on attitude strength. The best known effort in this regard is the work of Fazio and his associates (Fazio, 1989, 1990; Fazio, Sanbonmatsu, Powell, & Kordes, 1986; Fazio & Zanna, 1978). Fazio's (1990) MODE model acknowledges controlled and more deliberate information processing, but most of the research inspired by this model has focused on automatic, more spontaneous information processing. In this approach attitudes are assumed to guide behavior in a spontaneous fashion when motivation to engage in extensive information processing is low or when people are not capable of engaging in more extensive deliberations. Recent research on attitudes has paid considerable attention to automaticity in attitudinal processes, whereas more controlled attitudinal information processing has received only limited attention. The most notable exception concerns work on dual-process models of attitude change, an issue we turn to later in this chapter. We focus on attitudes that are associated with more deliberate information processing and investigate the attributes or belief structure underlying individual attitudes.

N. H. Anderson's (1971, 1982) information integration and functional measurement theory is an early example of an approach focusing on the relations between beliefs and attitudes. Models of attitude–behavior consistency such as Fishbein and Ajzen's (1975) theory of reasoned action and Ajzen's (1985, 1991) theory of planned behavior also pay explicit attention to the belief structure underlying attitudes. More specific theories in the area of health psychology such as the health belief model (Janz & Becker, 1984) and protection motivation theory (Rogers, 1975, 1983; Rippetoe & Rogers, 1987) follow a similar approach and decompose behavioral prefer-

ences into various sets of beliefs concerning the costs and benefits of behavioral actions.

In most of these approaches belief structure is assessed in terms of the likelihood and evaluation of various attributes of an object or person or various consequences associated with behavioral actions. In the present chapter we propose an additional measure of belief structure, focusing on *belief* or *attribute importance.* The main purpose of assessing belief or attribute importance is to differentiate between beliefs that are relatively important or consequential in influencing attitudes versus those that are not, i.e., to identify the considerations that underlie an individual's attitude.

There have been numerous studies designed to identify the important considerations that underlie attitudes relating to topics such as smoking behavior, consumer purchase decisions, AIDS-related risk behavior, family planning behavior, the introduction of new technologies, and dieting, to name just a few. Interestingly, the issue of attribute or belief importance has received only limited attention in the prevailing expectancy–value models of attitude–behavior consistency such of those of Ajzen and Fishbein. Most of these models adopt a framework in which attribute importance is not separately assessed. Our approach is based on expectancy–value approaches to attitudes and decision making, but it allows for individually assessed attribute importance. It is best characterized as an idiographic approach permitting the assessment of cognitive structure and attitude–behavior correspondence on an individual basis.

We intend to show that assessing attribute importance improves the predictive power of composite attribute-based attitude measures and provides better insight into the structure of the beliefs that underlie these attitudes. The belief structure underlying attitudes also generates information about how to change these attitudes. Moreover, in our view, assessing attribute importance can also help to improve our understanding of attitude strength and ambivalence.

First, we introduce the general framework within which we investigate attribute importance, and provide a definition of the concept of attribute or belief importance. Next we discuss several measures of importance, and the efficacy of these measures is investigated. We also relate the importance of attributes to their accessibility and to the speed with which important versus less important attributes are judged. We then turn to the benefits of assessing attribute importance at the individual level and discuss the predictive power of attitude measures based on important versus less important attributes. In this section we also investigate the sensitivity of composite attribute-based attitude measures that incorporate attribute importance in detecting differences between attitude groups. Next we discuss the issue of attitude structure and relate attribute importance to the belief structure

underlying attitudes. Implications for attitude change research and practice are then discussed. Finally, attribute importance is related to attitude ambivalence and attitude strength.

II. Attribute-Based Theories of Attitude–Behavior Consistency

The two prevailing attitude–behavior models in social psychology are the theory of reasoned action (Fishbein & Ajzen, 1975) and the theory of planned behavior (Ajzen, 1985, 1991). Both are expectancy–value approaches and are based on subjective expected utility (SEU) theory (Edwards, 1954). Subjective expected utility theory presents a simple mathematical model of decision making in which people are assumed to assess the expected utility or desirability of alternative actions and to select the action with the highest SEU. The SEU is the sum of the perceived likelihood of each outcome multiplied by the utility or desirability of that outcome:

$$\text{SEU}_j = \sum_{i=1}^{N} P_{ij} \cdot U_{ij} \tag{1}$$

where SEU_j is the SEU of action or behavioral alternative j, P_{ij} is the perceived probability of outcome i of action j, and U_{ij} is the subjective utility or desirability of outcome i of action j. The SEU of an action thus depends on the likelihood and evaluation of the various consequences of that action. Basically, expected utility principles seem to be in accordance with much of our decision behavior and rest on the following three basic ideas. First, the theory assumes that how we value potential outcomes affects our decisions; the more highly valued an outcome is, the more favorably disposed we are toward behavioral actions that will deliver that outcome. Second, there is the effect of uncertainty: Good chances of desirable outcomes move us closer to a behavioral option than do poorer chances. Obviously, probabilities associated with undesirable outcomes have the opposite effect. Finally, there is the notion of combining the influences of both value and uncertainty. The combination rule is multiplicative, which implies that differences in the probabilities of outcomes matter little unless the outcomes are of significant value to us. Similarly, differences in the value component will be enhanced if they are accompanied by larger probabilities.

These basic principles were applied to attitudes and attitude–behavior consistency by Fishbein in the 1960s (Fishbein, 1963). The most comprehensive overview of this approach can be found in Fishbein and Ajzen (1975). Fishbein (1963, 1967) argued that an attitude toward a behavioral alternative is a summative function of the subjective probability (b) and evaluation (e) products for each relevant belief or attribute. A $b \times e$ product is

computed for each consequence or attribute and then summed to yield an index of attitude, in the same manner as in SEU theory (see Eq. 1). The multiplication of the scores of the score on the two rating scales assumes approximately ratio level measures. This assumption is basic to both SEU theory and the expectancy–value models of Ajzen and Fishbein.

Ajzen (1985, 1991) incorporated "perceived behavioral control" into his revised model of the theory of reasoned action (the theory of planned behavior), and his extension generally leads to improvements in the prediction of intentions and/or behaviors when behavior is not totally under volitional control (Madden, Ellen, & Ajzen, 1992; Petty, Wegener, & Fabrigar, 1997). Both the Fishbein-Ajzen theory of reasoned action and Ajzen's extension conceptualize attitudes as belief based. Ajzen (1996) reports over 250 empirical investigations based on the two theories dealing with a wide range of behaviors. Overall, both theories have received good support whenever their constructs were carefully operationalized (see e.g., Eagly & Chaiken, 1993; Van den Putte, 1991).

In sum, in both models attitudes are assumed to be based on the summed products of the likelihood of the various possible consequences of behavioral actions and the evaluation of these consequences; the more positive the consequences that are associated with a specific behavior and the more likely their occurrence, the more attractive the behavior is. The basic rule of this approach is a compensatory, multiplicative rule. Compensatory rules are those in which positive attributes can be offset by negative attributes and vice versa. In other words, both theories assume that attitudes are based on a rational and more-or-less complete cost–benefit analysis of the various (possible) consequences of behavioral alternatives. This analysis requires extensive information processing and it is to that issue that we now turn.

A. LIMITS ON CONTROLLED INFORMATION PROCESSING

Initially, research on social cognition tended to conceptualize the social perceiver as a "naive scientist" who gathers all relevant information, weighs it carefully, and integrates it into an overall judgment or preference (see, e.g., Fiske & Taylor, 1984). The often implicit assumption of this research was that both the availability of time and the cognitive capacity of the social perceiver are more or less unconstrained. This viewpoint is also evident in expectancy–value approaches to attitudes and behavior such as those of Ajzen and Fishbein. Generally, these approaches assume that substantial amounts of information are being processed; moreover this information is assumed to be combined using a relatively complex, multipli-

cative rule. It should be added that Fishbein and Ajzen (1975) did pay some attention to the limits on the human capacity for processing information. On the basis of Miller's (1956) work they assumed that people generally base their attitudes on five to nine salient beliefs. Unfortunately this view did not always have consequences at measurement level; thus participants in studies in this research tradition are often presented with considerable numbers of attributes to be rated in terms of their likelihood and valence (Van der Pligt & Eiser, 1984).

In the 1980s, social psychologists began to take greater account of the cognitive constraints of human on-line information processing and short-term memory. These constraints affect both the *amount* of information that can be processed and the *way* in which information is integrated to form an overall evaluative judgment. Generally, people can hold only a limited amount of information in short-term memory (Miller, 1956). Moreover, processing information, and especially information that has to be integrated in a relatively complex manner, as in expectancy–value models, requires considerable cognitive effort. It seems inevitable that people use satisfying strategies with respect to the *amount* of information that they process and with respect to *how* they integrate the relevant information. As argued by Taylor (1998), the serious limitations of short-term (as opposed to long-term) memory, and of on-line processing, led to the recognition that human inference is often accomplished through rapid, efficient, or even unconscious methods of relating current data to representations stored in long-term memory. Earlier research on human decision making by Hammond and his colleagues (Hammond, Stewart, Brehmer, & Steinmann, 1975) distinguished between analytical and intuitive decision making. These authors argued that the strategies available to a decision maker can be placed on a continuum ranging from intuition (with rapid and limited data processing, low cognitive control, and limited awareness of processing) to analysis (slow data processing, high levels of control, and high awareness of processing). Generally, attitudinal research in the 1970s emphasized one end of this continuum (analysis or controlled information processing), whereas more recent research has tended to emphasize the other end of the continuum (intuition), as exemplified by research on the automaticity of attitudinal judgment.

Limitations of our information-processing capabilities have been known to cognitive psychologists for some time (Fischhoff, 1976; Tversky & Kahneman, 1974), but it took a while before these considerations were explicitly discussed in the context of expectancy–value models of attitudes and behavior. Fischhoff, Goitein, and Shapira (1982) and Van der Pligt and Eiser (1984) argued that the assumptions of expectancy–value models such as those of Fishbein and Ajzen are not supported by results obtained in the

area of cognitive psychology and decision making. The multiplicative rules presumed by SEU theory and expectancy–value approaches to attitudes are quite difficult, and it seems unrealistic to expect people to apply these rules, especially when there are many relevant outcomes or consequences and varying probabilities associated with each of these outcomes. As argued by Jaccard, Radecki, Wilson, and Dittus (1995) the use of these compensatory rules seems to be the exception rather than the rule.

Strictly speaking, the inclusion of considerable numbers of attributes in one's attitude measure does not pose a problem for Fishbein and Ajzen's expectancy–value approach to the measurement of attitudes. Composite scores based on the subjective probability and evaluation of a set of attributes can (and often do) provide adequate estimates of a person's attitude, but they should not be seen as reflecting the actual decision-making process underlying the attitude. This is in accordance with research on subjective expected utility (Edwards, 1954, 1961; Savage, 1954). As noted by Yates (1992), no one ever took seriously the idea that people literally perform the calculations implicit in SEU theory. Instead it is often argued that people behave *as if* they make these computations; the details of how they exactly arrive at their decisions are likely to be different from the arithmetic of multiplicative models. On the other hand, it seems reasonable to argue that it would be preferable to develop attribute-based assessments of attitudes that are more in line with human information-processing capabilities.

More detailed studies of how people assess probabilities and values, and integrate these two constituents to form an overall evaluative judgment, show various flaws in SEU theory and related expectancy–value approaches of attitudes and behavioral choice (e.g., Dawes, 1998; Fischhoff, Goitein, & Shapira, 1982; Luce, 1992). The conclusion to be drawn from this line of research is that people often base their decisions on pragmatic decision-making strategies and use simplifying heuristics and/or decision rules that take a limited number of attributes or consequences into account. One of the aims of the present chapter is to investigate the possibility of developing attribute-based composite measures of attitudes that are more in accordance with our information-processing capabilities.

B. HEURISTICS IN ATTITUDINAL JUDGMENT

Although attitude research has paid some attention to heuristic information processing, this has been largely in the context of attitude change processes. As noted by Chaiken and Stangor (1987) and Fishbein and Middlestadt (1995), expectancy–value approaches to the study of attitude formation and change were challenged in the 1980s. Since then, most re-

search has distinguished between two types of persuasion, one emphasizing controlled information processing and the other deemphasizing detailed cognitive processing. Thus, Petty and Cacioppo (1986) introduced two distinct routes to attitude change: A *central route* with an emphasis on the information a person has about the attitude object or issue under consideration and a *peripheral route* in which attitude change tends to occur ''without any active thinking about the attributes of the issue or object under consideration'' (pp. 255–256). The peripheral route refers to a wide variety of mechanisms of attitude change, including classical or operant conditioning, suboptimal information processing, affect-based mechanisms, and responding to less relevant, superficial cues associated with the persuasive message.

Chaiken (1980, 1987) also distinguishes two routes to persuasion which she calls *systematic* and *heuristic processing.* Her usage of the term systematic processing is virtually identical to what Petty and Cacioppo (1981, 1986) term central processing. The term heuristic processing refers to persuasion that is mediated by simple decision rules such as the ''length–strength'' heuristic: The longer the persuasive message, the more likely it is to be correct. All in all the *peripheral route* and *heuristic information processing* refer to a wide variety of suboptimal cognitive and noncognitive processes, but research in these traditions has paid only limited attention to the cognitive short-cuts used to process information about attributes associated with the attitude–object (see also Manstead & Van der Pligt, 1999). Thus, strategies that limit the number of attributes to be considered or that rely on simplified rules to integrate the various attributes into an overall evaluative judgment have attracted only limited attention in recent research on attitudes. Research on behavioral decision making more explicitly addresses the issue of simplified strategies in judgment and choice.

Research in this tradition has emphasized the point that people use a variety of (simplified) decision rules when confronted with a choice between alternatives that can be described in terms of several attributes. Most of these require less cognitive effort than a complete cost–benefit analysis of the available alternatives. The *conjunctive decision rule* is an example of such a simplifying rule. It requires the decision maker to specify a criterion value for each attribute (e.g., a car should have at least four airbags, room for five passengers, etc.). Any alternative that does not meet this minimally required value on one or more attributes is dropped from the list of remaining possible alternatives. The *disjunctive decision rule* is the mirror image of the conjunctive rule. In this case the chosen alternative must have at least one attribute that meets the criterion, whereas the remaining, rejected alternatives fail to meet the criterion value. Thus an alternative is chosen because it meets the criterion value on one outstanding attribute. Another example is the *elimination by aspects rule* (Tversky, 1972). First, the most

important attribute is selected. All alternatives that fail to meet the criterion on this attribute are eliminated, and then this procedure is repeated for each of the remaining attributes, until only one alternative remains.

These decision rules require considerably less cognitive effort than the rule required by SEU models and expectancy–value models of attitudes. Simplifying rules appear to be used quite often in everyday decision making and can provide adequate short-cuts in complex decision environments. In this context Payne, Bettman, and Johnson (1992, 1993) stress the constructive nature of human decision making. Both personal experience and characteristics of the problem at hand will determine the decision strategy. Payne et al. (1992) use the term contingent decision making to describe the process by which people select a strategy by weighing up the cognitive costs and benefits of the various strategies they might use. Basic questions in this choice concern the balance between cognitive *effort* and *accuracy,* but factors such as decisional avoidance and accountability also influence strategy selection.

The three simplified decision rules discussed above focus on *choice* as opposed to (attitudinal) *judgment.* They could in principle be applied to attitudinal judgment, however. For instance, people could be favorably inclined to an attitude object/behavior if it has a specific positive attribute or is associated with a particular consequence (disjunctive decision rule) or could be unfavorably inclined to an attitude object or behavioral action if it has a specific negative attribute. The three rules discussed above are most likely to be applied when the attributes or consequences are considered important for one's choice or preference.

This brings us to the issue of attribute importance. Focusing on a limited number of important outcomes or attributes could be a functional and quite rational way of making attitudinal decisions. Although it now seems to be generally accepted that research methods requiring respondents to combine large sets of behavioral beliefs and outcome evaluations do not provide an adequate description of the *processes* by which people form attitudes or make decisions (see also Baron, 1994; Edwards, 1992; Fischhoff, Goitein, & Shapira, 1982; Fishbein, 1993; van der Pligt, 1996), research practice suggests otherwise. Studies using the models of Ajzen and Fishbein often require respondents to rate 20 or more possible consequences of their behavior. In their overview, Van der Pligt and Eiser (1984) described studies that included as many as 50 consequences to be rated in terms of their probability and desirability. They argued that it is difficult to know the significance of being able to predict behavior on the basis of such large numbers of consequences associated with behavioral alternatives because it is extremely unlikely that respondents actually use all these aspects in their decision making. Van der Pligt and Eiser proposed that we should assess which

attributes are seen as *important* or *salient* for specific individuals. They argued that such an approach could improve our insight into the *structure* of attitudes and reduce the analysis of the decision-making process to more manageable and more realistic proportions.

In the next section we turn to the salience or importance of beliefs or attributes. Assessing the subjective importance of attributes could help to simplify the decomposition of attitudes and relate overall evaluative judgments to a limited number of attributes. This would be more in line with what we know about the limitations of our information-processing capabilities.

III. Defining Attribute Importance

There are many ways of defining belief or attribute importance. Most theorists would agree with Fishbein and Ajzen's (1975) view, in which beliefs are conceptualized as a stimulus–response association. These associations are organized according to Hull's concept of a habit–family hierarchy (Fishbein, 1967, pp. 389–390), with stronger stimulus–response associations having a more dominant position within the hierarchy. Fishbein and Ajzen (1975, pp. 220–222) described three different ways in which the term "importance" has been used in the research literature. These are (a) the perceived importance of a specific attribute for the person, (b) the perceived importance of an attribute as a defining characteristic of the attitude object, and (c) the perceived importance of an attribute as a determinant of the person's attitude. In their view, the first usage is likely to be highly related to the polarity of the attribute's evaluation, whereas the second usage is closely (but not perfectly) related to the subjective probability of an association between the object and the attribute. In their view the third usage (the impact of an attribute on one's overall attitude) cannot be adequately assessed because people have only limited insight in what determines their attitudes.

We focus on the third usage of the term, i.e., the perceived importance of a belief or attribute of the attitude object as a determinant of one's attitude. We expect these important attributes to be closely related to the overall attitudinal response. In terms of the $b \times e$ scores described earlier, one would expect the $b \times e$ scores for important attributes to be more closely related to a direct measure of attitudes than the $b \times e$ scores of less important attributes.

Our usage of the term "attribute importance" is closely related to how Jaccard et al. (1995) approach this issue. They refer to the strength of the

belief–attitude object association and prefer to assess attribute importance at the individual level. In terms of what Jaccard et al. (1995) call the relational approach to the assessment of attribute importance, an attribute is seen as important for an attitude if it is a primary cause of that attitude. Some beliefs about attribute–attitude object links, when changed, yield little or no change in attitude, and these can be regarded less important than those that, when changed, yield substantial changes in attitude. We also expect important attributes to have this characteristic; i.e., changes in subjectively important attributes should be accompanied by more attitudinal change than changes in less important attributes.

Our definition thus refers to the subjective importance of an attribute as a determinant of one's own attitude. Moreover, we opt for an idiographic approach to assessing attribute importance.

IV. Measuring Attribute Importance

A variety of approaches to measuring attribute importance have been used in research on attitudes and behavioral decision making. Here we briefly review the prevailing methods in the two literatures. Interestingly, there is hardly any research in the context of expectancy–value models of attitudes on the assessment of subjective importance. Fishbein and Ajzen (1975) concluded that none of the three interpretations of belief importance discussed in the previous section can be used to derive measures that will identify individually important versus less important attributes. They reject direct meta-attitudinal measures of belief importance. Another possible way of assessing the perceived importance of an attribute as a determinant of one's attitude would be to rely on the outcomes of statistical analyses. Fishbein and Ajzen, however, also reject the standard statistical way of deriving an index of importance, i.e., correlate the $b \times e$ (belief $\times$ evaluation) outcome of each attribute with the overall attitude. These correlations are often considered to be objective indices of importance (at group level) but provide no evidence about causality. Fishbein and Ajzen (1975) stated that it is "inappropriate to assume that a high correlation indicates an important *determinant* of attitude, or that a low correlation is evidence that the belief is *not* an important determinant of attitude" (p. 222, italics as in original). Moreover, Fishbein and Ajzen (1975, Chapter 5) argued that subjective estimates of perceived importance in this sense, or relative weights, bear little resemblance to empirically derived weights. Thus, subjective estimates of the relative importance of an attribute are not likely to exhibit a high correspondence with the weights obtained in a multiple-

regression analysis. It is worth noting that Fishbein and Ajzen's approach to attitudes was developed in a period in which the quality of introspection was very much in doubt. The work of Nisbett and Wilson (1977), Nisbett and Ross (1980), and Zajonc (1980) raised considerable doubts about the accuracy of self-knowledge about the determinants of our actions, beliefs, and feelings. This distrust of introspection is also reflected in Fishbein and Ajzen's view on the assessment of belief importance. They argued against assessing the subjective importance of beliefs because of the assumed limited insight into the importance of the various considerations for one's attitude.

The main strategies that have been used to assess attribute importance vary on a number of dimensions. A first category relies on free elicitation methodology. Second, a number of techniques derive subjective importance from a series of decomposed judgments (e.g., conjoint measurement, paired comparisons). A third strategy relies on direct assessments of perceived importance and thus on introspection (e.g., rating or ranking the various attributes in terms of their importance). Finally, some methods rely on statistically derived weights. Some of these methods require categorical information, others ordinal or even ratio-scale information.

A. FREE-ELICITATION METHODS

One often-used procedure for identifying the attributes or beliefs that underlie an individual's attitude is based on free elicitation. Generally, individuals are asked to spontaneously generate outcomes, consequences, or attributes that they think are associated with the attitude object. Important or salient attributes are expected to be elicited first.

Fishbein and Ajzen (1975) presented considerable evidence in support of this approach, which is partly derived from Hullian learning theory. As noted above, Fishbein conceptualized beliefs as a stimulus–response association. These associations are organized according to Hull's concept of a habit–family hierarchy, with stronger stimulus–response associations having a more dominant position within the hierarchy. Beliefs that are elicited by an individual in a free elicitation procedure are therefore likely to be those that are highest in the habit–family hierarchy and will be most likely to determine the individual's attitude or decision. This usage can also be related to Krech and Crutchfield's (1948) description of how a person's beliefs and attitudes vary in ''salience,'' whereby salient beliefs are more prominent in the cognitive field and enter thought more readily. Bruner (1957) also argued that more *accessible* knowledge is more likely to be used in judgment.

There is some evidence suggesting that the *order* in which attributes or beliefs are spontaneously generated is also related to their relative importance. Kaplan and Fishbein (1969) found that the earlier a belief is elicited, the higher its position in the habit–family hierarchy. The presumed relationship between order of elicitation and importance is consistent with research on the availability heuristic (Tversky & Kahneman, 1974). More recent research findings also provide some support for this view (e.g., Jaccard & Sheng, 1984; Szalay & Deese, 1978). Following this reasoning one could also use response latencies to assess the salience of beliefs or attributes (see e.g., Bargh, Bond, Lombardi, & Tota, 1986). We discuss this issue in more detail in the next section of this chapter.

This general method of eliciting attributes or beliefs that ''come to mind'' in relation to an attitude–object or behavioral action has often been used to assess salient attributes of attitudes (e.g., Breckler, 1984; Cronen & Conville, 1975a, 1975b; Eagly & Mladinic, 1989; Hackman & Anderson, 1968; Jaccard & Fishbein, 1975). Eagly, Mladinic, and Otto (1994), and Esses, Haddock, and Zanna (1993) applied this technique to the measurement of both cognitive beliefs and affects underlying attitudes and behavioral preference. The free-elicitation procedure is also frequently used in survey research where individuals are asked to generate the advantages and disadvantages of behavioral actions or to list reasons why they have a specific behavioral preference. Examples of such research are Rosenberg and Oltman (1962), Johnson and Jaccard (1981), and Cunningham and Lopreato (1977). The underlying assumption of this strategy is that the consequences mentioned by an individual are important in determining his or her attitude and behavioral preference and that consequences not mentioned are less (if at all) important.

Free-elicitation techniques are used in two different ways. Some of the above studies rely on an open response format allowing respondents to generate their own set of attributes which in turn are related to their overall attitude and/or behavior. Fishbein and Ajzen (1975), however, conclude that it is impossible to obtain a precise measure of the set of beliefs that determine an individual's attitude because the number of salient beliefs may differ between people. (Their summative rule does not allow for different numbers of beliefs for different individuals.) They therefore developed an adaptation of the free-elicitation method for use in their expectancy–value approach. Individually important beliefs or attributes are derived in a free-elicitation task in order to compile a *modal set* of attributes that incorporates most of the attributes regarded as important by the population under investigation. In other words, expectancy–value approaches generally do not assess belief or attribute importance at the individual level. Modal importance is assessed at group level and it is basically assumed that all these

modally salient attributes are equally important or that their subjective importance is reflected in the perceived probability and/or evaluative ratings of the attributes.

B. FUNCTIONAL MEASUREMENT TECHNIQUES

Information integration theory (Anderson, 1971) was the first approach to the study of social judgment that explicitly addressed the importance of attributes or beliefs. In its simplest form, information–integration theory states that an attitude toward a behavioral option is a function of the information the individual has with respect to that alternative. More specifically,

$$A_o = \sum_{i=1}^{N} w_i \cdot s_i / \sum_{i=1}^{N} w_i, \tag{2}$$

where A_o refers to the attitude toward behavioral option o, s refers to the scale value of the ith piece of information or attribute, w is a weighting coefficient reflecting the importance of the ith attribute, and N is the number of attributes. One drawback of this research tradition is that the nature of information-integration processes has typically been assessed in situations in which respondents were confronted with a hypothetical choice situation. A typical analysis involves presenting descriptions of hypothetical objects based on the factorial manipulation of a limited set of attribute dimensions. For example, a set of five personal computers might be described in terms of three dimensions (cost, speed, size of hard disk), each with three levels. Each stimulus is then related to a response dimension (e.g., favorability), and the relative importance of each attribute is statistically derived. For instance, Zhu and Anderson (1991) used N. H. Anderson's (1981, 1982) approach and derived attribute weights by systematically varying the levels of three attributes and also assessing the overall evaluation of each configuration.

Jaccard and Becker (1985) also used N. H. Anderson's information-integration theory to assess attribute importance and compared it to an expectancy–value model solution. Their findings largely supported Anderson's theory, but it should be added that the procedures entailed in functional measurement methodology are difficult to apply to large-scale attitudinal research, due to their complexity and time-consuming nature.

C. PAIRED COMPARISONS

A third method involves presenting respondents with pairs of attributes and asking them to indicate which member of each pair is more important

to them in evaluating an object or issue. All possible pairs of a set of attributes are presented, and then paired-comparison analysis is used to yield importance scores at interval level. One can also obtain a complete ranking of attributes from a set of pairwise comparisons. An important drawback of this method is its time-consuming nature; the required number of pairwise comparisons needed to obtain a complete ranking increases rapidly as a function of the number of attributes. For instance, for 15 attributes one would need 105 paired comparisons, and for 10 attributes one would still need 45 paired comparisons.

D. DIRECT-WEIGHT ASSESSMENTS

A fourth group of approaches to measuring belief importance relies on direct assessments of attribute weights. One method simply requires respondents to *rate* the importance of each attribute on a continuum ranging from extremely unimportant to extremely important. These ratings have been used to compare subjective assessments of attribute weights with statistically derived, objective attribute weights (e.g., Wiggins, 1973). They have also been compared to a related measure of attribute importance, namely the *allocation of points* to attributes. One standard procedure for doing this is to distribute 100 points over the attributes so that the points reflect the relative ''share'' of importance (see, e.g., Edwards & Newman, 1982; Von Winterfeldt & Edwards, 1986). A further variant requires respondents to *rank* attributes in terms of their importance. Ranking is generally seen as easier than allocating precise weights and is possibly more reliable (see Eckenrode, 1965). Moreover, there is doubt about whether people are willing and/or able to assign sufficiently precise numerical weights in methods such as point allocation (see, e.g., Kirkwood & Sarin, 1985).

Some researchers (e.g., Eckenrode, 1965) argued that ranking attributes in terms of their importance is easier for respondents and is likely to be more reliable than methods that require the assignment of precise numerical weights. This is also reflected in research showing that people tend to ignore the range of presented attributes. Weights should be sensitive to scale changes. For instance, if the range of an attribute is reduced by one-half, its effective weight should be doubled to compensate for this reduction. Research on the sensitivity of elicited weights to the range of presented attributes shows that they do not vary greatly as a function of attribute range (see for instance Fischer, 1995; Mellers & Cooke, 1994).

Ranking has also been compared to rating. Evidence in the context of the measurement of values is mixed with some studies showing superior validity of rating (e.g., Maio, Roese, Seligman, & Katz, 1996) and others

indicating that ranking is superior (e.g., Krosnick & Alwin, 1988). Ranking versus rating has also been studied in the context of comparing alternative courses of action or objects. Findings obtained in this field of research generally show that rankings yield higher quality data than ratings. Rankings are more reliable and have higher discriminant and predictive validity than ratings (Krosnick, 1999).

Several methods have been developed for determining *approximate* weights that make explicit use of rank information (e.g., Barron & Barrett, 1996; Stillwell, Seaver, & Edwards, 1981). The formulae used in this field of research help to differentiate between the importance of the first selected attribute, the second selected attribute, and so on. Some, however, argue that assigning equal weights to attributes produces (predictions of) decisions that are as good as solutions based on more complicated weighting techniques (e.g., Dawes, 1979; Dawes & Corrigan, 1974).

E. OBJECTIVE WEIGHTS

A fifth set of approaches to the assessment of attribute weights is based on *correlational analysis.* These weights are often called *objective* weights, as opposed to the *subjective* weights, described above. In the context of expectancy–value approaches this means correlating the $b \times e$ score associated with a specific attribute with the overall attitude. In this case the absolute correlation gives an indication of the objective weight or importance of an attribute at group level. Similarly, the various $b \times e$ scores could be entered into a multiple-regression equation. The standardized regression coefficients could be seen as reflecting the importance of each attribute in determining the attitude. Jaccard (1981) describes a number of problems with the use of regression weights as indices of importance and points to the mixed evidence in the literature, with some studies exhibiting high degrees of convergence between regression-based and subjective weights (e.g., Birnbaum & Stegner, 1981) and others revealing low levels of convergence (e.g., Summers, Taliaferro, & Fletcher, 1970). Dawes (1979, p. 571), on the other hand, advocates the use of regression analysis. Regression weights are probably the most common way of deriving true weights at group level; the predictor variables are weighted in such a way as to maximize the correlations between the subsequent weighted composite score and the criterion (see also Dawes & Corrigan, 1974; Einhorn & Hogarth, 1975).

Most of the methods discussed so far fall into the category of what Jaccard et al. (1995) call structural approaches. There is one method often used in behavioral decision-making research that comes close to what they term the relational approach, namely the *swing-weight method.* Here the

decision maker rank orders the attributes in terms of their associated value ranges. This is accomplished as follows: Assuming that each attribute is at its worst possible level, the decision maker is asked which attribute (s)he would most prefer to change from its worst to its best level; this is then asked for the remaining attributes, and so on. The order of the selected attributes is assumed to reflect their subjective importance.

In sum, research on attribute importance has resulted in a wide variety of direct and indirect measures of attribute importance. The methods vary enormously in terms of their complexity; some require information at categorical level only, others at ordinal, interval, or at ratio-scale level. Some methods (e.g., swing-weight method, point-allocation, rank-based approximation methods) are used most often in research on multiattribute utility (Barron & Barrett, 1996; Doyle, Green, & Bottomly, 1997; Weber & Borcherding, 1993). Others are used more often in social psychology (conjoint measurement, direct-rating, free elicitation); examples of applications of these techniques in social psychology research are Jaccard and Sheng (1984) and Esses, Haddock, and Zanna (1993). Methods such as direct rating and ranking have also been used in survey research (see, e.g., Infante, 1973; Knapper, Cropley, & Moore, 1976). A number of studies have compared two or more of the techniques described in this section. The general conclusion of this research is that the obtained weights tend to be highly dependent upon the elicitation method. As suggested by Slovic (1995), weights seem to be constructed in the actual process of elicitation. This conclusion has been derived from a large number of studies, both in social psychology and in behavioral decision making (Borcherding, Schmeer, & Weber, 1995; Doyle, Green & Bottomly, 1997; Einhorn & McCoach, 1977; Horsky & Rao, 1984; Jaccard & Sheng, 1984; Jaccard, Brinsberg, & Ackerman, 1986; Jia, Fischer, & Dyer, 1998; Johnson & Jaccard, 1981; Schoemaker & Waid, 1982; Weber & Borcherding, 1993). However, closer inspection of the results of these studies also suggests that simpler ways of assessing attribute weights are both more reliable and more valid. The superiority of more complicated methods of assessing attribute weights has mainly been ascertained in simulation studies focusing on how well the various methods *can* perform. Empirical studies tend to favor simpler methods due to their reliability and validity. In the next section we propose a simple direct measure of attribute importance that could easily be incorporated in expectancy–value approaches to attitudes. This method is also compared with other techniques for assessing attribute importance.

F. A SIMPLE SOLUTION

As noted in the previous paragraphs, there is some evidence that the more complex methods of deriving precise numerical weights reflecting

attribute importance are simply beyond the average respondent. Thus there are good reasons for using a simpler task than the elicitation of precise weights. These reasons are both theoretical and practical. Theoretically there is some doubt about whether the decision maker is willing and/or able to assign sufficiently precise numerical weights. Practically, some of the elicitation methods are quite demanding and time consuming. Some are demanding in terms of the complexity of the task (e.g., the swing-weight method, allocating points to reflect attribute weights); others are simpler but take considerable amounts of time (e.g., paired comparisons, conjoint-measurement, functional measurement techniques).

We propose the use of a simple selection task in which a limited set of attributes is selected from a larger set. The larger set constitutes the modal set of attributes; depending on the purpose of one's research, one could vary the maximum number of attributes to be selected or leave the maximum number to be selected to the respondent. We have used this measure in a number of studies (e.g., Eiser & Van der Pligt, 1979; Van der Pligt, Eiser, & Spears, 1986a, 1986b; Van der Pligt & De Vries, 1998a, 1998b; Van der Pligt, De Vries, & Van Harreveld, 1999a; Van Harreveld, Van der Pligt, & De Vries, 1999a; Van Harreveld, Van der Pligt, De Vries, & Andreas, 1999). Overall, the results of these studies show that a composite attitude measure based on an individually selected subset of attributes adequately predicts attitudes and behavior. In a series of studies Van der Pligt, De Vries, and Van Harreveld (1999a) showed that more complicated techniques such as direct rating, point allocation, and rank-based approximation weights do not perform better than our simple measure that relies on a straightforward categorical judgment (i.e., does an attribute belong to a subset of important attributes or considerations?). The studies included attitudinal issues such as safe sex, student selection, and smoking cigarettes. For each of these issues respondents were asked to select a subset of either three or five important attributes out of a larger set of 15 or more attributes, and to rank these in terms of their importance. They were also asked to rate all attributes in terms of their importance and to allocate points to their selected subset of 3 or 5 selected attributes. In sum, participants were required (a) to select important attributes out of a larger set, (b) to rank these attributes, and (c) to allocate points to these selected attributes. Finally, they were asked (d) to rate all presented attributes in terms of their importance on a 9-point scale.

First, Van der Pligt et al. investigated the correspondence between an equal-weights solution; rank-based approximate weights (varying in the extent to which differential weights are assigned to attributes as a function of rank-order position); point allocation; direct rating; and objective, statistically derived weights. Direct rating was included because it is one of the

few methods that exhibited some convergent validity with one or more other measures in Jaccard and Sheng's (1984) study. Generally, respondents enjoy this task more than ranking and are more satisfied with its (subjective) validity, despite the evidence indicating that ratings yield lower quality data than rankings (Krosnick, 1999). A final reason for including this task is that direct rating is a simple task that can be applied to larger sets of attributes. Ranking more than 10 attributes and allocating points to such a set of attributes is difficult and time-consuming.

Overall, statistically derived weights showed modest levels of differentiation between the selected attributes. For instance, correlating the $b \times e$ score of each of the *selected* attributes with a direct attitude measure showed that statistically derived weights for the first three attributes were all around .30, whereas both rank-based approximate weights and the allocation of points resulted in a much wider range of weights. Rank-based approximate weights varied from .61 for the first selected attribute to .11 for the third selected attribute. Point allocation resulted in a similar profile (.52 for the first selected attribute, .19 for the third attribute). Direct rating resulted in only marginal differences between the weights; the most important attribute received a weight of .35, the third selected attribute a weight of .32. These weights were very similar to the statistically derived weights. Van der Pligt et al. also related weighted and unweighted composite attribute-based attitude scores to a direct attitude measure and to behavior. Table 1 summarizes the results of one of their studies. As can be seen, the predictive value

TABLE I

CORRELATIONS OF WEIGHTED AND UNWEIGHTED ATTRIBUTE-BASED SCORES WITH
ATTITUDE AND BEHAVIOR

Method of weighting	Attitude	Behavior
1. Equal weights (EW)	0.687	0.586
2. Rank-sum weights (RS)	0.668	0.577
3. Reciprocal of ranks (RR)	0.665	0.573
4. Rank-order centroid weights (ROC)	0.649	0.566
5. Elicited weights by point allocation (PA)	0.683	0.552
6. Direct rating selected attributes	0.697	0.593
7. Direct rating all attributes	0.670	0.465

Note. Methods 2–4 are techniques to derive precise numerical weights from rank values. The methods vary in the steepness of the distribution of weights. Direct rating 6 refers to a $b \times e \times i$ (importance) score for the three selected attributes. Direct rating 7 refers to a composite score based on the $b \times e \times i$ scores of all attributes in the modal set. Adapted from Van der Pligt, De Vries, and Van Harreveld (1999a).

of the various measures hardly differed at all. In this particular study an equal weights solution for the selected attributes was compared with three rank-based approximate weights, the allocation of points to the selected attributes, and a direct rating of importance of the selected attributes and of all attributes included in the modal set. The results of this study supported the use of the selection task, a task that is based on a simple categorical judgment, entails minimal measurement assumptions about response metrics, yields composite scores that are as predictive as measures based on more complex attribute weighting methods and is hence more efficient than these other methods.

In other words, it is not necessary to take the whole set of modal attributes into account when predicting attitudes and/or behavior. Adequate prediction can be achieved on the basis of a subset of individually selected, important attributes. Assigning precise numerical weights to these selected attributes by means of more elaborate measures is not likely to improve the predictive power of composite attribute-based measures of attitude. Similarly, methods that require respondents to rank the selected attributes or to rate all or the selected attributes in terms of importance do not improve the predictive power of the composite measure. Although respondents generally find rating a simpler and more pleasant task than ranking, rating tends to result in lower quality data (Krosnick, 1999). This might explain the finding that a composite score based on the importance ratings of all attributes is not more predictive of attitudes and behavior than a composite score based on a small unweighted set of selected, important attributes.

One final issue concerns the possible redundancy of a measure of attribute importance with the perceived likelihood of the attribute-attitude object link and/or the evaluative extremity of the attribute. As noted in Section III of this chapter, Fishbein and Ajzen (1975) expected that adding a measure of attribute importance could well result in scores that are closely related to either the evaluative extremity of the attribute, or its perceived likelihood, or both. Some other researchers have also argued that the overlap between importance and the perceived likelihood and/or evaluative extremity reduces the usefulness of a separate measure of perceived importance (see e.g., Eagly & Chaiken, 1993; Eagly et al., 1994).

To test this Van der Pligt, De Vries, and Van Harreveld (1999b) correlated the importance score of each of the 15 attributes included in their study with its likelihood score and the extremity of the evaluative rating. Similar analyses were carried out by Van der Pligt and De Vries (1998), and Van Harreveld, Van der Pligt, De Vries, and Andreas (1999). Mean correlations between importance ratings and likelihood scores were generally in the .30 to .40 range, with lower point-biserial correlations between likelihood scores and attribute importance if importance was measured in

terms of whether the attribute was selected as one of the subset of individually important attributes. These latter correlations were usually in the .20 range. Similar correlations were obtained when correlating attribute importance with evaluative extremity. Generally, these correlations were significant, but their magnitude did not warrant the conclusion that one should discard attribute importance due to the overlap between this measure and the attribute's perceived likelihood and/or evaluative extremity.

In sum, we conclude that it is useful to add a simple measure of individual importance to the usual measures of the likelihood of attributes and their evaluation in order to derive a belief-based measure of attitude that takes account of known limitations in cognitive capabilities. We still assume a compensatory rule, but this rule is limited to a small number of attributes. In the next section we show that individually selected, important attributes are also more accessible and that judgments of these attributes are associated with shorter response times than judgments of non-selected, less important attributes.

V. Attribute Importance, Accessibility, and Processing Speed

A number of recent studies claim that meta-attitudinal measures of attitude properties such as our measure of attribute importance can differ significantly from operative measures of those same properties (see Bassili, 1996; Krosnick et al., 1993; Visser & Krosnick, 1998; see also Greenwald & Banaji, 1995 on indirect versus direct measures). Meta-attitudinal measures rely on people's perceptions of their attitudes, whereas operative measures describe the operation of the attitudes more directly, unmediated by perceptions. Some argue that operative measures of attitude properties are superior to meta-attitudinal measures (see Bassili, 1993; Bassili & Fletcher, 1991).

In order to validate our measure of attribute importance we also investigate the correspondence between our measure and several operative measures of attribute importance. We anticipate that the selection task we proposed in the previous section whereby individually important attributes are distinguished from less important attributes will be corroborated by operative measures of attribute importance. In this section we relate attribute importance to accessibility and response times for judging important versus less important attributes.

As argued above, attribute importance can be related to older work on salience and accessibility (e.g., Bruner, 1957; Krech & Crutchfield, 1948). Free elicitation methods for generating important attributes also assume

that the attributes mentioned in these tasks are more accessible due to their salience or importance. We intend to show that this relation between accessibility and attribute importance also holds for attribute importance as assessed in our selection task. We assume that people are able to select the attributes that are important for their attitude. One way to validate our measure is to investigate whether the selected important attributes are also more accessible than the nonselected remaining attributes. In a series of studies we presented respondents with a set of modal beliefs or attributes and asked them to *select* a subset of attributes that they considered to be important. Our measure of attribute importance would be supported by increased accessibility of these individually selected, important attributes.

This prediction is in line with theorizing about *attitude importance* and accessibility. Fazio, Sanbonmatsu, Powell, and Kardes (1986) argued that attitude importance is related to accessibility from memory, and a number of studies in the recent literature support this suggestion (Krosnick, 1989; Roese & Olson, 1994; see also Fazio, 1989; Boninger, Krosnick, Berent, & Fabrigar, 1995). Doll and Ajzen (1992) related the accessibility of attitudes to attitude–behavior consistency. More accessible attitudes were associated with improved attitude–behavior consistency. Their results confirm earlier findings of Fazio and colleagues (e.g., Fazio, 1990; Fazio & Williams, 1986; Fazio, Powell, & Williams, 1989). These studies all concerned the relation between *attitude importance* and accessibility, and doubts have been raised about whether the same relation exists between *attribute importance* and accessibility. For instance, Tourangeau and Rasinski (1988) argued that attribute importance and accessibility are not necessarily related and conclude—referring to Tversky and Kahneman's (1981) availability heuristic—that information retrieval from memory is unreliable and subject to various distortions.

As a consequence, Tourangeau and his colleagues focus on immediate context effects such as recency of use and topical distance between the target and prime (see, e.g., Tourangeau, Rasinski, & D'Andrade, 1991). Tourangeau et al. conceive of attitudes as a set of related feelings, memories, and beliefs about the attitude object, which can be represented by J. Anderson's (1983) associative network notation. Basically, such a network represents what Tourangeau and Rasinski (1988) called the static component of attitudes—the component that resides in long-term memory and serves as the basis for answering specific questions about the attitude object. Tourangeau and Rasinski acknowledge that answering questions about an attitude object may be based on existing structures. However, they also argue that the response process need not be a very reliable one. Support for this point of view is derived from Higgins and King (1981), who stress short-term differences in accessibility, the literature on the elicitation of

preferences in decision making (e.g., the literature on framing effects; Van Schie & Van der Pligt, 1995), and the survey literature (Bradburn, 1982; Hippler, Schwarz, & Sudman, 1987; Schuman & Presser, 1981) focusing on context effects on attitudinal judgment. It should be added that Tourangeau and Rasinski's primary focus is on processes of answering attitude questions in survey interviews in which interest on the part of respondents is often low, whereas time pressure is typically high. In these circumstances the response process is most likely to be carried out superficially. Not surprisingly, it seems that context effects in attitude surveys are moderated by attitude strength. For instance, Lavine, Huff, Wagner, and Sweeney (1998) found that respondents with weak attitudes exhibited larger context effects.

Unlike Tourangeau and Rasinski (1988), we focus on the *long-term* strength of attribute–attitude object links and assume that important attributes are more accessible than less important attributes. Moreover, we expect response time facilitation when important attributes are judged. Important attributes entail stronger stimulus–response associations and, hence, should be judged more quickly than less important attributes. One could also relate this prediction to theories such as those of J. R. Anderson (1987) in which reduced response time (RT) in judgments is attributed to the formation and use of content-specific attribute–behavior links. Smith, Stewart, and Buttram (1992) and Stewart, Doan, Gingrich, and Smith (1998) applied J. R. Anderson's framework to the investigation of the effects of prior impressions and stereotypes on social judgments, and their findings confirmed J. R. Anderson's theory.

We expect increased accessibility of important attributes and expect this to be relatively stable, reflecting the static component of attitudes. We also expect RT facilitation in attitudinal judgment beyond that enabled by increased accessibility of a particular attribute due to prior exposure in the task presented to participants and assume that this RT facilitation is due to the long-term strength of the association between the attribute and the attitude object. This chronic accessibility of attribute–attitude links should be reflected in judging these important, more accessible attributes. Thus, judgments of important attributes are expected to be faster than judgments of less important attributes, even when both important and less important attributes have been made accessible. In accordance with Smith et al. (1992) and J. R. Anderson (1987), we expect RT facilitation for judgments of important attributes to be the result of repeated, and hence firmer, attribute–attitude links.

Accessibility and response times in judging attributes as a function of attribute importance have rarely been investigated in the context of expectancy–value models of attitudes. One exception is a study by Ajzen, Nichols, and Driver (1995) in which the accessibility of modally salient attributes

was compared with the accessibility of attributes not related to the attitude object. Ajzen et al. selected sets of 16 beliefs about the consequences of each of six leisure activities by means of free elicitation. These sets included salient and nonsalient beliefs at group level (defined in terms of the frequency-of-elicitation in a pretest). They also tested the effects of response format (binary versus 5-point scale), type of belief, and belief valence. Overall, their findings revealed the predicted main effect for salience: Response times were shorter for salient than for nonsalient beliefs. This applied both to the binary response in which respondents were presented with 16 statements for each attitude object and were asked to indicate whether they agreed or disagreed with each of the statements and to the ratings on 5-point scales. It should be added that Ajzen et al. (1995) compared two relatively extreme categories: Attributes that were frequently mentioned by the participants in their study versus attributes that were hardly mentioned at all. The latter were generally seen as less relevant for the attitudinal issue at hand, and would probably not be included in the set of modally salient attributes.

Another exception is a study by Roskos-Ewoldsen and Fazio (1997). They also proposed that attribute salience or importance is related to accessibility and that the accessibility of attributes determines their role in the *formation* of attitudes. In their study attribute accessibility was manipulated by frequently presenting an attribute in conjunction with the attitude object (novel objects such as a theater, a café, or a fitness spa). Some attributes were presented five times, others only once. Their findings showed that repeated exposure to positive attributes of the attitude object led to more favorable attitudes than repeated exposure to negative attributes. In other words, they found a close relationship between the valence of the more accessible attributes and the overall attitude. Interestingly, they did not find a relationship between attribute accessibility and the perceived likelihood of the attribute being true of the attitude object. This is in accordance with our own findings showing modest correlations between attribute importance and likelihood (see Section IV). However, Roskos-Ewoldsen and Fazio did not directly assess the importance or accessibility of the various attributes and did not measure RTs for attribute ratings and the overall attitudinal response. Next, we discuss some of our own research in which these measures were included.

In a series of studies (Van Harreveld, Van der Pligt, & De Vries, 1999a; Van Harreveld, Van der Pligt, De Vries, & Andreas 1999; Van der Pligt, Manstead, Van Harreveld, & Janssen, 2000) we presented respondents with sets of modally salient attributes related to an attitude object. These sets contained between 8 and 16 attributes and were based upon pilot research and/or existing literature. We employed our selection task to assess attribute

importance. Respondents were typically asked to select 3–5 attributes out of the larger set, in order of their importance. In all studies we assessed response times for the evaluation and likelihood ratings of the complete set of attributes (on 9- or 100-point scales) and also assessed response times for a dichotomous agree–disagree judgment concerning each attribute–attitude link. The latter was measured following Fazio's (1990) recommendations, i.e., respondents were asked to keep two things in mind: ''First, and above all, be accurate. Don't be in such a hurry to respond that you regret your decision. Second, whereas being accurate, try to respond as quickly as possible. So, you should try to maximize both the speed and the accuracy of your responses.'' For all questions a computer recorded the response given and the response time from presentation of a question to depression of the response key. Where the distributions of response latencies were found to be positively skewed we followed the practice of Fazio and his associates (Fazio, Chen, McDonel, & Sherman, 1982; Powell & Fazio, 1984) and log transformed the scores. However, for the sake of simplicity we report statistics in terms of the original latencies.

Overall we found strong support for our prediction that selected, important attributes are associated with shorter response latencies. Table II summarizes the results of Van der Pligt, Manstead, Van Harreveld, and Janssen (2000). In this study respondents were presented with a series of attitudinal issues. After being introduced to the attitudinal issue, they were asked

TABLE II
REACTION TIMES FOR IMPORTANT VERSUS LESS IMPORTANT ATTRIBUTIONS
(DICHOTOMOUS TASK)

Attitudinal issue	Important attributes	Remaining attributes
Abortion	2.169	2.179
Blood donation	1.165	1.979**
Use of softdrugs	1.708	2.065**
Genetic modification	1.524	2.287**
Bill Clinton	1.634	1.814**
Wim Kok	1.263	1.615**
Frits Bolkestein	1.674	1.862*
Patrick Kluivert	1.024	1.839*

Note. Wim Kok is the present prime minister of the Netherlands. Frits Bolkestein is a right-wing liberal politician, and Patrick Kluivert a soccer player who is a member of the Dutch national team. Adapted from Van der Pligt, Manstead, Van Harreveld, and Janssen (2000).
  * $p < .05$.
  ** $p < .001$.

to indicate whether they agreed or disagreed with each of the attribute statements related to the issue, and RTs for these dichotomous responses were recorded. We then assessed the evaluations and likelihood scores for each attribute and asked respondents to report their overall attitude on four Likert-type scales and also asked them to select the three most important attributes out of the total set of attributes. The findings displayed in Table II show that for seven of the eight attitudinal issues the average response latency for the selected important attributes was significantly shorter than the average for the nonselected attributes.

As predicted, these findings were generally confirmed for the likelihood ratings and evaluations of the various attributes on 9-point scales ranging from *unlikely* to *likely* and *bad* to *good.* These ratings took place *after* the initial dichotomous response task, which should have made all attributes accessible. These probability and evaluative judgments generally took more time than the dichotomous responses did, but important attributes were still associated with RT facilitation beyond that due to increased accessibility of the attributes. Similar effects were obtained by Van Harreveld, Van der Pligt, De Vries, and Andreas (1999), who focused on two attitudinal issues (smoking and safe sex). In their study attributes and attitudes were rated on 100-mm lines with labeled end points. Respondents were required to place the cursor at a position on the line that best represented their opinion. This task resulted in longer RT's than the dichotomeous responses presented in Table II. Results revealed RT facilitation for both probability and evaluative judgments of the various attributes after each of the attributes had been made accessible in a previous task. In these studies the attribute-related judgments consisted of probability ratings, evaluative ratings, and importance ratings (in that order). Not surprisingly, evaluative ratings were associated with slightly lower RTs than probability ratings, and importance ratings had even shorter RTs. More important, for all these ratings RTs for the selected important attributes were significantly faster than for the nonselected attributes, and these differences were more pronounced than those due to repeated exposure (see Fig. 1). These findings can also be related to the additive nature of chronic and temporary sources of accessibility (see Bargh, Bond, Lombardi, & Tota, 1986). Bargh et al. focused on the role of temporary and long-term sources of construct accessibility in person perception and memory and examined the joint influence of these two sources of accessibility on impression formation. In our study we found reduced RTs as a function of both chronic accessibility of attributes (due to their subjective importance) and temporary accessibility (due to frequency of exposure in the experimental task).

Findings presented in Table II and Fig. 1 thus show that selected important attributes are more accessible and are judged more quickly than the
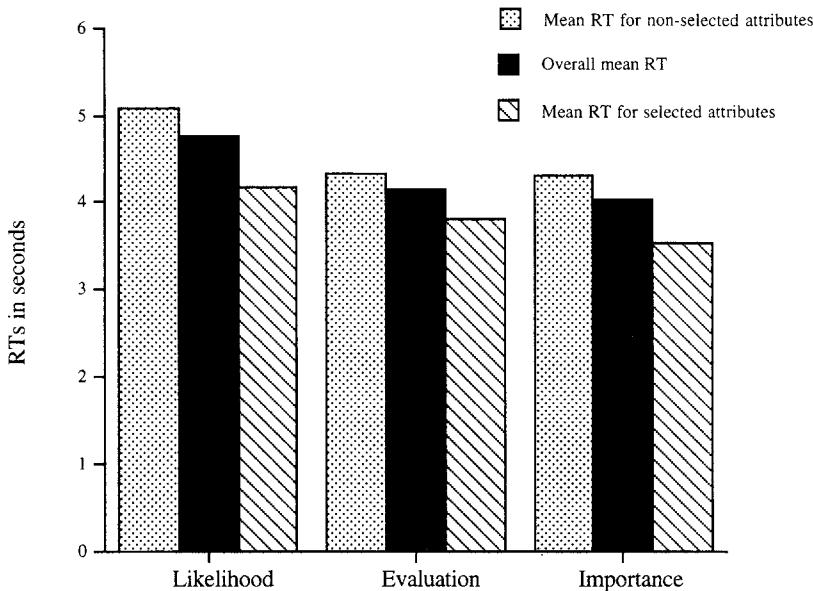
Fig. 1. Response times as a function of attribute importance and repeated exposure to attributes. Likelihood ratings were assessed first, followed by evaluative and importance ratings. Adapted from Van Harreveld, Van der Pligt, De Vries, and Andreas (1999).

remaining nonselected attributes. In a series of additional analyses we investigated the scope of this relation between accessibility, speed of judgment, and attribute importance. More specifically, we related RTs of judging the selected attributes to their rank order, and we correlated RTs of the various attribute related judgments to their importance as assessed on a 9-point rating scale ranging from 1 (not at all important) to 9 (extremely important). First, results did not reveal a systematic relation between the rank value of the selected attributes and RTs of judging these attributes. Thus, the differences at categorical level (important versus less important attributes) were not obtained at ordinal level within the set of selected attributes. Apart from this within-subjects analysis we also did a between-subjects analysis and investigated for each attribute whether importance ratings were related to reduced RTs. Only two of the 30 correlations were significant. All in all these results support our proposal that attribute importance should be assessed at categorical level, rather than relying on seemingly more precise measures of attribute importance such as ranking values or simpler, but possibly less reliable measures such as ratings (see also Krosnick, 1999).

In sum, these findings confirm our prediction that more important attributes are more accessible and that judgments about the various attributes underlying the overall attitude are made faster for individually selected, important attributes than for nonselected, less important attributes. The latter effect indicates RT facilitation beyond that enabled by increased (temporary) accessibility, as indicated by shorter RTs for important attributes even after being exposed several times to the whole set of attributes. Our point is that in the context of a particular attitudinal issue some attributes are *chronically* more accessible than others and have firmer associations with the attitude object.

In one study we explicitly addressed this enduring component of the belief structure underlying attitudes. Van Harreveld, Van der Pligt, De Vries, and Andreas (1999) presented respondents with 15 attributes of cigarette smoking. As in the studies reported above, respondents were asked to select the five most important attributes out of the larger set. Judging the likelihood of these selected attributes and evaluating them took less time than judging the remaining attributes. One week later respondents returned to the laboratory to participate in the second part of the study. This follow-up study was announced as part two of the study on cigarette smoking and entailed two tasks. The first was a lexical decision-making task in which respondents were presented with a total of 90 words and were asked to determine (as quickly as possible) whether each of these words was a proper or nonexistent Dutch word. In order to obtain maximum speed during this task, respondents were asked to keep their hands near the response keys throughout the task. Each word was visible on the screen until the ''yes'' or ''no'' button was pressed on the keyboard. A few seconds after participants pushed the button, the next word appeared on the screen. Of the 90 presented words, 66 were existing words in Dutch. This set of 66 included words that referred to the 15 attributes included in the first part of the study (e.g., *smelly, heart-disease, relaxation, unhealthy, addictive, concentration, fitness, social facilitation*). The sequence in which the words were presented was randomized. Response latencies were assessed and corrected for word length (number of characters) and frequency of usage. Response latencies were significantly lower for the individually selected important attributes than for the remaining nonselected attributes of smoking cigarettes. Thus, one week after the first session, important attributes of smoking were still more accessible than less important attributes. Respondents were also asked to list a maximum of three attributes of smoking presented in part 1 of the study, in the order in which they came to mind. Although the literature on the impact of attitudes on memory is inconclusive (Eagly, Chen, Chaiken, & Shaw-Barns, 1999), we expected enhanced recall for individually important attributes, and our results indeed revealed better

memory for individually important attributes than for less important ones. Both findings confirm the expected chronic accessibility of important attributes associated with the attitudinal issue.

Some of our studies also allowed us to test another assumption of our approach. As argued earlier, we focus on relatively important attitudes and assume a *bottom-up* process, as opposed to *automatic activation* of the overall attitude. Thus, we assume that attitudes are structures in long-term memory and that answering attitude questions is likely to involve processes such as activating the relevant attributes and integrating this information into an overall attitudinal judgment. Generally it is regarded as unlikely that respondents retrieve some or all of their beliefs on an issue. Some research emphasizes automatic activation of overall attitudes without much deliberation (e.g., Fazio, 1990; Bargh, Chaiken, Govender, & Pratto 1992), whereas other studies assume that the retrieval process is likely to yield a sample of pertinent beliefs, the sampling being primarily determined by immediate situational cues (e.g., Tourangeau & Rasinski, 1988). Basically, this literature on the constructionist nature of attitudes (e.g., Strack & Martin, 1987; Tourangeau, 1984, 1987; Tourangeau & Rasinski, 1988; Tourangeau, Rasinski & D'Andrade, 1991; Wilson & Hodges, 1992; Zaller & Feldman, 1992) assumes that when an evaluative attitudinal response is required, people retrieve relevant information and integrate it to form a coherent evaluative judgment. This retrieval process is seen as unreliable and largely determined by contextual cues. In other words, expressions of attitudes are often assumed either to be a function of automatic processes or to be based on biased retrieval of relevant attributes in which situational factors such as question wording and/or the context provided by preceding questions guide the retrieval process.

Both our approach stressing the enduring elements of attitudes and the literature in which doubts are expressed about whether attitudes consist of stable, enduring evaluative responses share one important assumption, namely that it is not overall attitudinal judgments that are stored in memory, but rather features of the attitude–object (i.e., attributes and feelings associated with the object). Thus, overall attitudinal responses are assumed to be generated by a *computational* process rather than a *direct retrieval* process. This computational process underlying attitudinal responses may be influenced both by the external context and by internal, introspective processes. We focus on the latter and expect the overall attitudinal response to take longer than the response to specific beliefs and feelings underlying the attitudinal response. Van Harreveld, Van der Pligt, De Vries, and Andreas (1999) assessed response times for overall attitudinal judgments on a set of Likert-type items (e.g., *favorable–unfavorable, good–bad*) both before and after assessing judgments on the various attributes underlying

the overall attitude. Thus after respondents rated the various beliefs in terms of their likelihood and valence and selected the beliefs or attributes they considered the most important determinants of their attitude, they were again asked to indicate their overall attitude on the set of Likert-type items. Van Harreveld et al. compared the speed of the overall attitudinal response with the speed of judgment of the various attributes underlying the overall attitude.

The direct overall attitude measure took significantly longer than the attribute-related ratings, irrespective of whether it was assessed before or after rating the attributes in terms of their likelihood and value. Assessing the overall attitude measure took significantly less time after having judged all attributes than before judging these attributes, but RTs for this overall measure were still slower than for judging the various attributes. It should be noted that the questions concerning the evaluation of the attributes and the likelihood that they were associated with the attitude object were generally considerably longer than the questions with which we assessed the direct attitude score (four semantic differential scales preceded by the sentence "My attitude toward issue/object is . . ."). Thus, despite the fact that the target stimulus was shorter, and took less reading time than the typical belief item, response latencies were significantly longer for the over-all attitudinal response even when the latter was assessed after having judged all attributes (see Fig. 2). Not surprisingly, these differences were even more pronounced when comparing the response latencies of the over-all attitudinal response with those of individually selected, important attributes. Similar findings were obtained for other attitudinal issues such as genfood and English as the language of instruction in Dutch universities, with RTs for the overall attitudinal judgment being significantly longer than for judgments of the attributes (Van Harreveld, Van der Pligt, De Vries, Wenneker, & Verhue, 2000). Our results are therefore consistent with the notion of a bottom-up process in which attributes are combined and integrated to form an overall attitude judgment.

The study by Van Harreveld, Van der Pligt, De Vries, and Andreas (1999) also allowed us to investigate the moderating role of attitude strength. In accordance with Fazio (1989, 1990) we classified attitudes as relatively strong or weak on the basis of RTs for the direct attitude score at time 1. Additional analyses on the basis of a median split on these RTs allowed us to investigate whether the substantial differences between attribute ratings and attitude ratings (see Fig. 2) were moderated by attitude strength. Results of these analyses showed that RTs for both attribute and attitude ratings were shorter for strong than for weak attitudes. However, for both groups RTs were faster for attribute ratings than for attitude ratings. Both groups thus seemed to rely on a bottom-up, computational construction of
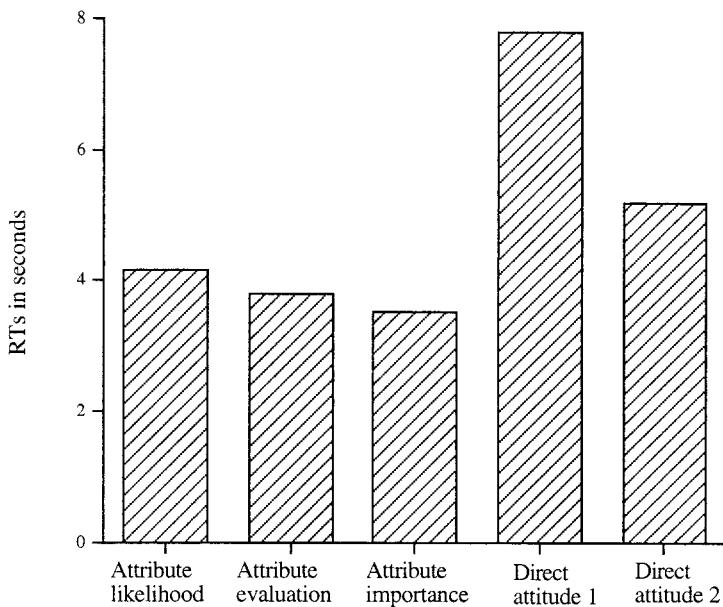
Fig. 2. Response times for attribute ratings and direct attitude assessed before and after rating the attributes. Direct attitude 1 refers to attitude assessed before rating the attributes, Direct attitude 2 to attitude assessed after rating the attributes. Scores are averaged over the 15 attributes or the four semantic differential scales (Direct attitudes 1 and 2). Adapted from Van Harreveld, Van der Pligt, De Vries, and Andreas (1999).

the overall attitude. This difference was, however, much more pronounced in those with weak attitudes than in those with strong attitudes. Figure 3 shows the overall mean RT for the 45 attribute ratings (15 attributes rated in terms of their likelihood, evaluation, and importance) and for the set of four Likert-type items used to assess the overall attitude. As can be seen, the increased difference between RTs among attribute and attitude ratings for those with a weak attitude was mainly due to increased RTs for the overall attitudinal response; i.e., those with a weak attitude needed slightly more time to judge the various attributes and considerably more time to integrate these attributes into an overall attitude, as compared with participants who had a strong attitude.

These additional analyses therefore suggest a bottom-up process for both strong and weak attitude holders, but also indicate that attitude strength moderates the difference between attribute and attitude ratings. If people with strong attitudes rely to a lesser extent on bottom-up processing, one would expect a stronger relation between RTs for attribute judgments
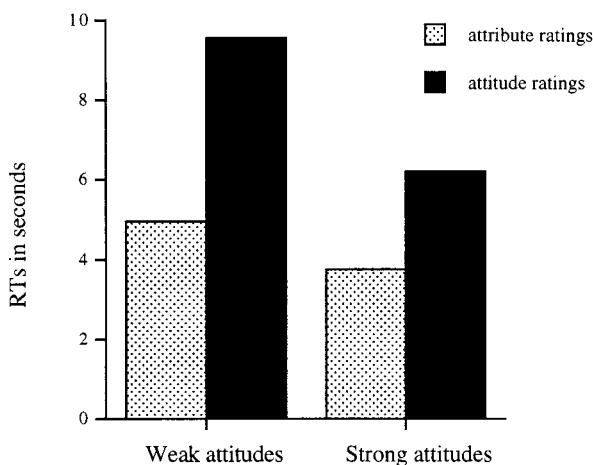
Fig. 3. Response times for attribute and attitude ratings as a function of attitude strength.

and the overall attitudinal response for those with weak attitudes, simply because attitudes can be "computed" faster when attributes are judged faster. Table III shows the correlations for the two groups and these confirm our predictions: Correlations between attribute ratings and attitude ratings were nonsignificant (.14) or modest (.38 and .39) for the strong attitude group and (significantly) stronger for respondents with a weak attitude (.68, .60, and .75 respectively).

In sum, our results show that, contrary to the suggestion made by Tourangeau and Rasinski (1988), important attributes are more accessible than less important attributes, that judging these attributes requires less process-

TABLE III
CORRELATIONS BETWEEN (LOG TRANSFORMED) RTS OF ATTRIBUTE RATINGS AND RTS OF
OVERALL ATTITUDE AS A FUNCTION OF ATTITUDE STRENGTH

	1	2	3	4
1. Overall attitude rating	(−)	.68**	.60**	.75**
2. Attribute likelihood	.14	(−)	.78**	.72**
3. Attribute evaluation	.38*	.53**	(−)	.78**
4. Attribute importance	.38*	.48**	.35*	(−)

Note. Correlations for weak attitude holders ($N = 37$) are above the diagonal; those for strong attitude holders ($N = 39$) are below the diagonal.

  * $p < .05$.
  ** $p < .01$.

ing time, and that they are recalled more accurately. Moreover, judging (important and less important) attributes is associated with shorter RTs than is the overall attitudinal response, suggesting a computational construction of the overall attitude as opposed to a direct retrieval. This applied to both strong and weak attitudes, for both groups attributes were judged faster than was the overall attitude, but this difference was more pronounced for respondents with weak attitudes. Weak attitudes were associated with substantially longer RTs for the overall attitude, indicating that information integration in order to derive one's overall attitude was more ''cumbersome'' and more time-consuming for those with weak attitudes. Thus a limited number of attributes or beliefs seems to constitute a frame of reference within which the attitude object is evaluated, and these attributes are presumed to be the prime determinants of the attitude and subsequent behavior. Knowledge of other possible attributes may be present or available, but it is less accessible and less likely to be used in the construction of an attitudinal judgment (cf. Higgins, 1996).

VI. Attribute Importance and the Prediction of Attitudes and Behavior

In the previous two sections we showed that (a) attribute importance can be measured by asking participants to select a subset of individually important attributes out of the larger set of modal attributes and that (b) individually selected important attributes are more accessible in memory and that judging these attributes takes less time than does judging nonselected attributes of the modal set. In the present section we focus on another operative measure of attribute importance, i.e., the predictive power of a composite attribute-based attitude measure based on individually selected, important attributes versus that of nonselected less important attributes. We expect important attributes to be more predictive of overall attitudes and behavior than less important attributes. The predictive power of important attributes is compared with a composite measure based on a larger set of modal, but nonselected attributes. As argued in Section IV, we opt for an unweighted composite score based on a limited subset of attributes. Integrating these considerations into an overall judgment requires less information processing than is usually assumed to be the case in expectancy–value approaches. A second way to achieve a composite attitudinal measure that is more in accordance with the notion of limited information-processing capabilities would be to simplify the *operations* presumed by SEU theory and expectancy–value approaches such as those of Fishbein and Ajzen. As argued in Section II, the multiplicative rule that is central

to these approaches is quite complex and people find it difficult to apply the rule, even after receiving a full explanation (e.g., Slovic, 1974). We first focus on attribute importance and the way it reduces the *amount* of information that needs to be processed. Then we turn to the issue of using *simpler decision rules* than the multiplicative rule presumed by SEU theory and expectancy–value approaches to attitudes.

A. PREDICTING ATTITUDES AND BEHAVIOR

We have used the attribute selection task described above in a series of studies. In all cases attitudes were decomposed into a modal set of attributes and respondents were required to select a subset of individually important attributes. In all these studies we employed an expectancy–value framework and compared (a) the correlations between a composite attitude score based on selected important attributes and a direct measure of attitudes and behavior or behavioral intentions with (b) the correlation between the remaining attributes of the modal set and a direct measure of attitudes and behavior or behavioral intentions. Generally, the modal set consisted of between 10 and 18 attributes, and respondents were required to select between three and five of these. In some studies respondents were free to select as many (important) attributes as they wished.

Table IV summarizes the results of 10 studies in which selected and nonselected attribute-based measures of attitude were correlated with a direct attitude measure and/or behavior. The studies shown in this table embrace a wide range of attitudinal issues, including smoking cigarettes, practicing safe sex, teaching in English (as opposed to Dutch), organ donation, student selection, and nuclear energy. The results exhibit a very stable pattern. In all cases correlations were significantly higher for the selected important attributes than for the remaining attributes. Composite scores based on the remaining attributes showed either modest correlations or did not correlate at all with attitudes and/or behavior.

As can be seen in Table IV, it is not unusual for composite scores based on the remaining, nonselected attributes to be uncorrelated or negatively correlated with attitudes or behavior. Moreover, in several studies the composite score based on important attributes was more predictive than the score based on the *total* set of modal salient beliefs or attributes (*including* the selected important attributes). For instance, Van der Pligt and De Vries (1998b) reported a correlation of .37 between the composite score based on all attributes and behavior, significantly lower than the .52 for the composite score based on selected attributes reported in Table IV. Similar findings were obtained by Van der Pligt, De Vries, and Van Harrev-

TABLE IV
Correlations between Composite Scores Based on Selected, Important versus Unselected Attributes and Direct Attitudes and Behavioral Intentions

Study (issue)	Correlation with attitude	Correlation with behavior/ intention
Eiser and Van der Pligt (1979) (nuclear power)		
Selected attributes (5)	.86	—
Nonselected attributes (6)	.44	—
Budd (1986) (smoking cigarettes)		
Selected attributes (5)	.62	—
Nonselected attributes (13)	.07	—
Van der Pligt and De Vries (1998) (smoking cigarettes)		
Selected attributes (3)	.63	.52
Nonselected attributes (12)	.15	.06
Van Harreveld, Van der Pligt, De Vries, and Andreas (1999)		
Study 1 (safe sex)		
Selected attributes (3)	—	.33
Nonselected attributes (7)	—	.19
Study 2 (smoking cigarettes)		
Selected attributes (3–5)	.65	.56
Nonselected attributes (10–12)	−.01	−.1.5
Van Harreveld, Van der Pligt, and De Vries (1999b)		
Study 1 (English as language of instruction)		
Selected attributes[a]	.66	.71
Nonselected attributes	−.08	−.11
Study 2 (smoking cigarettes)		
Selected attributes (5)	.70	.47
Nonselected attributes (10)	−.08	.06
Study 3 (safe sex)		
Selected attributes (5)	.49	.50
Nonselected attributes (10)	.27	.04
Study 4 (organ donation)		
Selected attributes[a]	.46	.45
Nonselected attributes	.16	.13
Study 5 (student selection)		
Selected attributes (5)	.51	—
Nonselected attributes (11)	−.27	—

Note. In each pair, correlations differed at $p < .05$. Numbers in parentheses refer to the number of (nonselected) attributes. [a]Studies in which participants were free to select as many (important) attributes as they liked.

eld (1999b). It should be added that these significant differences were generally obtained for the correlations with behavioral intentions or behavior and not for the correlations with the direct attitude score. The latter correlations hardly differed for the composite scores based on selected attributes versus scores based on all attributes. Thus, including all beliefs can *dilute* the measure of attitudes, reduce the sensitivity of the belief-based attitude measure, and obscure differences between attitudinal groups. Nisbett, Zukier, and Lemley (1981) used the term ''dilution'' to refer to the fact that nondiagnostic information may weaken the implications of diagnostic information. In the present context we propose that the inclusion of less relevant attributes for a given individual or group can weaken the predictive power of attribute-based measures of attitude.

In some of these studies it was also possible to derive a composite score based on all $b \times e$ values weighted by their importance as assessed on a direct rating measure, with scores ranging from 1 (*not at all important*) to 9 (*extremely important*). These scores did *not* reveal higher correlations with attitudes and behavioral intentions than the unweighted composite score based on the smaller subset of selected attributes. All in all, these findings support the use of a simple measure of importance to derive composite attitude scores based on a limited number of individually selected attributes.

B. SENSITIVITY OF COMPOSITE MEASURES BASED ON IMPORTANT VERSUS LESS IMPORTANT ATTRIBUTES

Another way to illustrate the diluting effects of including too many modally salient, but individually less important, attributes is to compare the composite score for groups with different attitudes and/or behavioral preferences. In a series of studies Van der Pligt and colleagues (Van der Pligt & De Vries, 1998b; Van der Pligt, De Vries, & Van Harreveld, 1999b; Van Harreveld, Van der Pligt, & De Vries, 1999a) compared attitudinal differences between smokers and nonsmokers with respect to scores based on important attributes for each group: nonselected, less important attributes and the complete set of modal salient beliefs or attributes. Figure 4 summarizes some of these findings and shows clear-cut differences between the two behavioral groups when comparing them in terms of a composite attitude score based on their selected subset of important attributes. Although we also found significant differences in the composite scores based on the modal set of attributes, these were less pronounced. Moreover, these differences disappeared altogether when comparing the two groups in terms of the remaining, nonselected attributes. For instance, the $b \times e$ scores for
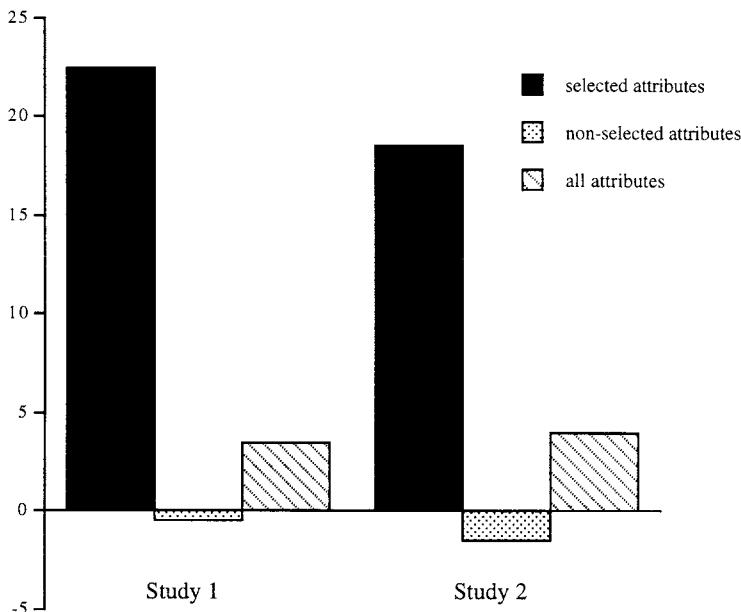
Fig. 4. Differences between smokers' and nonsmokers' composite attitude scores based on selected versus nonselected attributes. A positive score means that differences were in the predicted direction with smokers having higher $b \times e$ scores for smoking than nonsmokers, a negative score means that differences were in the opposite direction.

Study 1 is adapted from Van der Pligt and De Vries (1998).

Study 2 is adapted from Van der Pligt, De Vries, Van Harreveld, and Andreas (1999).

the important attributes in Study 1 were -11.55 (smokers) and -33.95 (nonsmokers). The $b \times e$ scores could range from -36 (negative) to $+36$ (positive), and scores for the two groups indicate a much more negative utility or $b \times e$ score for the nonsmokers than for the smokers. When comparing the two groups on the overall $b \times e$ score, these differences were far less pronounced (-4.80 and -8.29, respectively), and they disappeared entirely when focusing on the 12 remaining attributes (-3.30 vs -2.90). Similar findings were obtained for other attitudinal issues.

C. SIMPLIFYING DECISION RULES AND EXPECTANCY–VALUE MODELS

In this section we briefly compare different ways of combining attribute-related judgments (their probability, evaluation, and importance) in terms

of their predictive value. A number of researchers have argued that one needs only to assess the evaluative component of elicited important or salient attributes and suggested that one should ignore the probability component on the grounds that scores on this component tend to be quite high (see, e.g., Bell, Esses, & Maio, 1996; Cronen & Conville, 1975; Eagly & Chaiken, 1993; Eagly, Mladinic, & Otto, 1994). Others (e.g., Eiser & Van der Pligt, 1979; Van der Pligt, Van der Linden, & Ester, 1982) dichotomized the evaluation of the various attributes ($+1$ or -1) and multiplied these values by the obtained probability scores. In other words, they assumed that the evaluation of the selected attributes would be relatively extreme and focused on the assessment of the perceived probability of the selected attributes. Hom and Hulin (1981) found that the strength of the correlation between the summed $b \times e$ score and a direct attitude score was not different when one took only account of the sign of the e-score.

Van der Pligt, De Vries, and Van Harreveld (1999b) also tested the predictive power of a composite attitude score based on evaluations of the selected important attributes only versus a score based on their evaluation multiplied by their likelihood. As shown in Table III, the score based on the selected, important attributes correlated .56 with smoking status and .65 with the direct attitude score. A composite attitude score based only on the evaluative score of the selected attributes correlated .58 with smoking status and .64 with the direct attitude score. Thus, limiting the attitudinal measure to the subjective value (or evaluation) of selected, important attributes resulted in an attitude score that was as predictive as the score based on the product of evaluative and likelihood scores. On the other hand, the predictive value of an attitude measure based on the evaluative score of *all* attributes correlated only .34 with smoking status and .39 with the direct attitude score. Both these correlations are significantly lower than those just mentioned. In sum, the evaluative score of individually selected attributes resulted in an attitude measure that was as predictive as the $b \times e$ score of the selected attributes, and the composite scores based only on the evaluation of *all* attributes resulted in lower correlations. Contrary to Bell et al. (1996), weighting the e scores by importance did not improve the predictive value of the composite score. Correlations with behavior and direct attitude were .58 and .64, respectively. Van der Pligt et al. (1999b) conclude that the most efficient attribute-based measures of attitude in terms of predictive power are the unweighted $b \times e$ score based on a limited subset of selected attributes followed by the summed evaluation (e) of these selected attributes. By comparison with the traditional $b \times e$ measure based on all modal attributes, both measures are more efficient, they are equally predictive of attitudes, and are often more predictive of behavior. The suggestion made in the literature that one could limit the

attitudinal measure to the evaluative ratings of important attributes is also supported by our data. It should be added, however, that this is only the case for individually selected, important attributes.

One could argue that the most efficient way to derive a composite attribute-based attitude measure would be to combine our selection task with a simple measure assessing the evaluation of the selected attributes. This composite score does not rely on the (difficult) multiplicative rule assumed by expectancy–value models of attitudes combining probability and evaluation ratings. However, we have two reasons for preferring a solution in which both the likelihood and valence of attributes are assessed. First, the valence of attributes is usually assessed in general terms and reflects the evaluation of (sometimes) general values such as good health, fairness, equity, social relations, and so on. Second, assessing both the likelihood and evaluation of important versus less important attributes makes it easier to explain the difference between attitudinal groups. For instance, they might agree on the valence of specific attributes, but disagree about the firmness of the link between the attribute and the attitude object. Assessing both the likelihood and evaluation of the modal set of attributes, in combination with our selection task for assessing attribute importance, is likely to be more informative than simply assessing the evlauation of attributes in combination with our selection task. In the following section we discuss this issue in more detail.

VII. Attribute Importance, Attitude Structure, and Attitude Change

In the previous section we reviewed a number of studies showing that composite attitude-scores based on selected, subjectively important attributes are generally more predictive of directly assessed attitudes, behavioral intentions, and/or behavioral practice than are composite scores based on nonselected attributes. Moreover, these composite scores based on selected attributes can also be more predictive than composite scores based on all presented attributes. Not surprisingly, composite scores based on important attributes were also more sensitive in detecting differences between groups with opposing attitudes and/or behavioral preferences.

In the present section we focus on the added value of assessing attribute importance when investigating the structure of attitudes of groups with opposing attitudes. If opposing groups differ systematically with respect to the kinds of attribute they regard as important, this information could improve our insight into the ''how'' and ''why'' of attitudinal differences between these groups, especially when they differ either not at all or only

marginally with respect to the perceived likelihood and evaluation of these attributes. This is exactly what we have found in a number of studies. For instance, in a study on protective sexual behavior, Van der Pligt, De Vries, and Van Harreveld (1999b) found that people with safe versus less safe behavioral practices differed only marginally in the perceived likelihood and evaluation of hedonic attributes associated with condom use, such as reduced pleasure and sensitivity; however, the risky respondents more often *selected* these attributes as being important. More than 10 times as many respondents from the higher risk group selected the attribute *reduces sensitivity,* and nearly twice as many respondents from this group selected *decreases pleasure* as one of the three most important attributes. Thus, including a simple measure of belief importance helped to provide a better picture of how different groups perceived the pros and cons of condom use. Sometimes groups do not differ in their beliefs about (sets of) attributes of condom use, but do differ in the importance assigned to these attributes.

Van der Pligt et al. (1999b) obtained similar findings when investigating the attitudinal structure of smokers and nonsmokers. They found clear differences between smokers and nonsmokers with respect to the mean $b \times e$ scores for various attributes from a total set of 15. Smokers tended to give more extreme utility ratings to the positive consequences of smoking, whereas nonsmokers tended to give more extreme utility ratings of the negative consequences. However, these differences were more pronounced when considering attributes selected as important. Smokers tended to select the more hedonic, short-term consequences (reduces nervousness, helps one to relax, fosters social interaction), whereas nonsmokers emphasized the long-term health consequences (is addictive, is bad for one's health) and possible detrimental effects for others (causes discomfort to others, is smelly). Moreover, the task of selecting the most important attributes of smoking provides additional information about how the two groups (smokers versus nonsmokers) approached the issue. Smokers not only rated the negative attributes of smoking less extremely; they also found these attributes less important than the nonsmokers did. Not surprisingly, they found the immediate positive consequences of smoking more important than nonsmokers did. More interestingly, on some attributes the two groups did not differ in terms of their $b \times e$ score, but did differ significantly in terms of the importance attached to the attribute. For instance, smokers and nonsmokers had similar $b \times e$ scores for attributes such as *reduces nervousness* and *helps to conceal one's unease,* but smokers found these attributes significantly more important than did nonsmokers. Overall, the smokers acknowledged the adverse consequences for their health, but a significantly larger percentage of this group selected positive consequences of smoking, such as the relaxing properties and the social aspects of smoking,

as important attributes. These findings suggest that in trying to change the attitudes of smokers, one should not limit oneself to providing information about the seriousness of long-term consequences. Both smokers and non-smokers regard these possible consequences as serious. It would be better to try to change the *importance* smokers attach to these consequences and/ or to confront them with their emphasis on short-term as opposed to longer-term consequences. Moreover, it should be helpful to stress that some of the short-term benefits can also be achieved in other ways. A prerequisite of behavioral change is that people reassess the risk:benefit ratio of certain practices. This implies that they should appreciate their vulnerability and the seriousness of the consequences if they do not change their behavior. Attempts to change this risk:benefit ratio should not only address the likelihood of adverse consequences of existing habits and behavioral practices. They should also stress the *importance* of these adverse consequences, along with the fact that the perceived benefits of risky practices can also be achieved in other ways.

Research on expectancy–value approaches to attitudes and behavior generally emphasizes the importance of message content in changing attitudes and behavior (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1981). According to Fishbein and Ajzen (1981) arguments play a crucial role in attitude change processes, and these arguments should pertain to the important attributes underlying the attitude one wants to change. This can be achieved in a variety of ways. One could attempt to change the perceived likelihood of existing beliefs or attributes associated with the attitude object (Fishbein, Ajzen, & McArdle, 1980). One could also increase the importance or accessibility of new or existing beliefs about the object (Roskos-Ewoldsen & Fazio, 1997; Sanbonmatsu & Fazio, 1990). The latter strategy is most likely to be successful when the individual has not yet formed an attitude about the object. When applying this strategy to existing attitudes it is essential to motivate the individual to reconsider his/her attitude and to design information that increases the importance and accessibility of some specific attributes. Our main point is that assessing attribute importance increases the number of strategies one can use in persuading people to change their attitudes and behavior.

In sum, assessing attribute importance can help to provide more insight into the *structure* of attitudes and tell us which aspects of a behavior are regarded as salient or important. Our simple procedure for assessing the subjective importance of beliefs results in an adequate assessment of attitudes and behavior and could help us to understand the underlying decision-making processes of specific subgroups. In applied areas such as health psychology, it could also help to tailor health education interventions. Too often intervention programs appear to be based upon the frame of reference

of those who are already convinced of the value of the recommended behavior. Assessing the perceived likelihood, evaluation, and importance of possible consequences makes it possible to determine whether the primary aim of an intervention programme should be to change beliefs about the likelihood of specific consequences, the evaluation of these consequences, or their accessibility and perceived importance. Applied research and practice could therefore benefit from the improved insight into the frame of reference of individuals or groups when judging behavioral alternatives with different implications for one's health.

VIII. Attribute Importance and Attitude Ambivalence

Research on the relation between ambivalence and attitude strength has focused on the moderating effects of attitude ambivalence on attitude-intention consistency and attitude-behavior consistency. Some have argued that ambivalent attitudes should lead to reduced attitude-intention and/or attitude-behavior consistency. There is some evidence supporting this view (e.g., Conner, Sparks, Povey, James, & Shepherd, 1996; Moore, 1973, 1980; Sparks, Hedderly, & Shepherd, 1992). Jonas, Diehl, and Brömer (1997), on the other hand, found that ambivalent attitudes were more *consistently* related to behavioral intentions than were nonambivalent attitudes. In this section we focus on the impact of attitude ambivalence on information integration.

One of the implications of our conception of attitudes as a bottom-up process is that the integration of attributes in order to "compute" one's overall attitude should take more time for ambivalent attitudes than for nonambivalent attitudes because the former are based on a mix of evaluatively inconsistent attributes. The primary aim of the present section is to demonstrate that information integration takes more time for ambivalent attitudes. We also show that our measure of attribute importance can be used to derive a measure of attitude ambivalence. First, we present a brief history of research on attitude ambivalence, followed by an overview of the various measures used to assess such ambivalence. This provides a context for our own measure of attitude ambivalence based on our selection task of important attributes. We propose an attribute-based measure of attitude ambivalence and compare this measure with other measures of attitude ambivalence. Finally, we turn to the impact of attitude ambivalence on RTs associated with providing an overall attitudinal response versus RTs for judging individual attributes underlying the overall response. We expect a moderating role of ambivalence due to the increased effort re-

quired to integrate evaluatively incongruent attributes. We thus expect the overall response to take more time for respondents who hold ambivalent attitudes. Attitude ambivalence thus provides another opportunity to test our assumption that attitudes are based on a ''computational'' process in which various attributes are combined to form on overall attitudinal response.

Attitude ambivalence is often related to the distinction between a one-versus two-dimensional conception of the evaluative, attitudinal response. Lewin (1951) was one of the first researchers to refer to a state of tension within a system when there are opposing forces that produce conflict, as when equally strong positive and negative forces are encountered. He was referring to social psychological processes in general. Research on approach–avoidance conflicts (e.g., Miller, 1959) also focused on more general psychological processes. Most of this work stressed the importance of conflicts that arise when the pursuit of one goal might interfere with the attainment of another. This framework is of relevance to decision making and some have applied it to postdecisional processes that are motivated by the need to reduce dissonance (Festinger, 1957; Wicklund & Brehm, 1976). Although potentially relevant, the literature on goal conflicts has not been related to attitude ambivalence (see, e.g., Srull & Wyer, 1986).

Over the past decades a number of researchers discussed ambivalence in the context of attitudes and also addressed measurement issues. Scott (1966, 1968) was the first to discuss ambivalence in the context of attitudes. As argued by Thompson, Zanna, and Griffin (1995), one of the reasons for the limited impact of Scott's introduction of the concept of attitude ambivalence may have been the then prevailing measurement strategy. Generally, attitudes were measured using bipolar semantic differentials on which respondents were required to report their attitude. Unfortunately this measurement technique provides only limited opportunities for expressing ambivalent attitudes. Kaplan (1972) made a significant contribution to clarifying the concept of attitude ambivalence by stressing the need to distinguish between attitudinal *indifference* and *ambivalence*. The former arises from a lack of experience and/or involvement, whereas the latter reflects the holding of *both* positive *and* negative evaluations of the attitude object. Like Kaplan we focus on the latter form of attitude ambivalence. Kaplan also attempted to develop a procedure for assessing positive and negative evaluations separately. The procedure proposed by Kaplan had a clear impact on later developments in the measurement of attitudinal ambivalence. In order to collect positive and negative evaluations, Kaplan split semantic differential scales at the neutral point and asked respondents to indicate how positively and how negatively they evaluated the attitude object. This resulted in a measurement in which respondents were asked

to consider *only* the positive (or negative) attributes of an attitude object and to ignore the negative (or positive) attributes. This seems to be quite a task, and one might wonder whether people are capable of ignoring specific attributes with the opposite valence of those that they are asked to judge, especially when explicitly asked to do so. Research by Wegner (1989, 1992) on thought suppression suggests that this might be difficult to achieve. Moreover, it is unclear whether the opposite evaluation that one is asked to ignore serves as an anchor (leading to contrast) or whether respondents are likely to assimilate their evaluative judgment to the position on the evaluative dimension they are asked to ignore. Thompson et al. (1995) are nevertheless relatively optimistic about this issue and report only modest correlations between positive and negative scales.

Kaplan (1972) also proposed a measure of attitude ambivalence based on his procedure in which respondents are presented with two distinct unipolar scales. More formally, ambivalence = $A_p + |A_n| - |A_p + A_n|$. In this formula A_p and A_n denote the positive and negative attitude components. Katz and Hass (1988) proposed a similar measure, based on the similarity and the extremity of an individual's position on the positive and negative attitudinal components. Their view corresponds with that of Kaplan and is also based on the assumption that ambivalence implies that a person tends to have equally strong positive and negative evaluations of the attitude object. They do, however, propose a different way of *measuring* attitude ambivalence (see also Hass, Katz, Rizzo, Bailey, & Eisenstadt, 1991). In their view the product of the positive and negative component is more influenced by the extremity of, and the similarity between, the two components.

Both Kaplan's (1972) approach and that of Katz and Hass (1988) share a problem: Holding constant the less extreme component of the two, the difference between the more extreme and the less extreme component does not decrease the ambivalence score. In Kaplan's solution a person with a score of 2 on the positive component and a score of 2 on the negative component will have the same ambivalence score as a person with the same score on the positive component and a score of 6 on the negative component. As argued by Thompson et al. (1995), this counterintuitive outcome of Kaplan's measure is exacerbated by the formula proposed by Hass et al. (1991). Thompson et al. propose assessing attitudinal ambivalence by subtracting the absolute difference of the positive (P) and negative (N) components from the average of the two components. Expressed as a formula, this becomes $(P + N)/2 - |P - N|$.

In a series of studies Thompson et al. obtained support for the validity of their measure, which they call the "Griffin measure." The attribute selection task we described earlier can provide an attribute-based measure

of attitudinal ambivalence. We propose to base the positivity (P) and negativity (N) scores on the *number* of positive and negative attributes selected among the set of most important attributes. More formally we propose a measure of ambivalence that can be expressed as ($N_p + N_n$)/2 − |$N_p - N_n$|, where N_p refers to the *number* of selected positive attributes of the attitude object, and N_n to the number of selected negative attributes. In our view attitude ambivalence is primarily a function of the presence of inconsistent *and* important attributes.

Attitudinal ambivalence has also been related to a direct, self-report measure of ambivalence, generally showing modest but significant correlations in the .30 to .40 range (Thompson et al., 1995). As shown by Van Harreveld, Van der Pligt, De Vries, Wenneker, and Verhue (2000), our ambivalence measure performs as well as the Griffin measure and shows either similar or slightly better correlations with self-reported ambivalence. This finding was obtained in three different attitude domains (genfood, smoking, and English as a language of instruction). In two of their studies respondents were free to select as many attributes as they thought necessary out of a larger set of modally salient attributes. Van Harreveld, Van der Pligt, De Vries, and Andreas (1999) allowed respondents to select 5 attributes. Selecting a maximum of 5 attributes affects the range of our ambivalence measure (minimum is −2.5, maximum +1.5). Secondary analyses of these data again confirmed our prediction, and indicate that our measure can also do well with restrictions on the number of attributes respondents are allowed to select.

Because the ambivalence of attitudes is primarily determined by evaluative inconsistency of attributes associated with the attitudinal issue, Thompson et al. (1995) do not necessarily expect attitude ambivalence to be related to properties of attitude strength such as accessibility, importance, and commitment. One can hold ambivalent attitudes about important and unimportant issues, as well as to issues to which one is or is not committed. In their view decreased accessibility of the overall attitude is likely to be the result of the presence of two or more highly accessible and contradictory attributes. More recently, McGregor, Newby-Clark, and Zanna (1999) found support for this view and concluded that for individuals to experience a great deal of ambivalence their congitions should not only be inconsistent but also need to be simultaneously accessible. In accordance with this view we would expect increased RTs for the overall attitude response due to the increased effort needed to integrate evaluatively inconsistent cognitions. Bargh, Chaiken, Govender, and Pratto (1992) also argued that attitude ambivalence involves response competition between the positive and negative attitude components. They expected the latency in an attitudinal assessment task to be greater for more ambivalent attitudes. Bargh et al. followed

Kaplan (1972) by defining ambivalence in terms of low consistency of evaluation: Ambivalent attitudes are expected to have rather strong links in memory to both good and bad evaluations. Bargh et al. (1992) expected that it would take ambivalent respondents longer to report their attitude because of response competition. Interestingly, this suggests a bottom-up process as opposed to direct retrieval of the attitudinal response. Their respondents were required to choose between a positive or negative evaluation. This forced choice implies that one of the activated responses must be made and the other inhibited (see, e.g., Logan, 1980; Shallice, 1972). Suppressing a competing response requires attention and processing time (Katz, 1981) and should slow response times. Bargh et al. (1992) measured response latencies when attitudes were assessed on separate unipolar scales for positive and negative feelings toward the attitude object, each on 4-point scales ranging from *not at all* to *extremely*. Their findings confirmed their expectations in that response times were slower for more ambivalent attitudes. As noted above, Bargh et al.'s explanation is based on the time and effort associated with suppressing evaluatively inconsistent feelings. We follow a slightly different line of reasoning and argue that *information integration* takes more time for inconsistent than for consistent attributes. For this reason we assessed response latencies for the direct attitude score, as well as for evaluative and likelihood ratings of the attributes underlying the attitudes.

In sum, ambivalence is a function of the presence of contradictory or evaluatively inconsistent attributes and is—at least conceptually—independent of most other attitude strength variables. We expect the differences in accessibility of the various attributes versus the accessibility of the overall attitude to be more pronounced for ambivalent attitude holders. This could be due to increased accessibility of attributes for ambivalent as opposed to non-ambivalent attitude holders. On the other hand we also expect that integrating information (attributes) to derive an overall attitude takes more time for respondents with ambivalent attitudes than it does for those with less ambivalent attitudes. Generally, integrating inconsistent information takes more time than does integrating consistent, converging information. This finding has been repeatedly found in research on person perception and research on stereotyping (e.g., Rojahn and Pettigrew, 1992). Other research has shown that inconsistent information is generally studied longer than is consistent information (e.g., Belmore, 1987; Hemsley & Marmurek, 1982). We thus expect the difference between RTs for the overall attitudinal responses and the judgments of the various attributes underlying attitudes to be more pronounced for ambivalent attitude holders than for nonambivalent attitude holders.

To test this we (Van Harreveld, Van der Pligt, De Vries, Wenneker, & Verhue, 2000) compared RTs for a direct attitude measure (the average RT on four semantic differentials) with that for the various attributes (the average response time for likelihood and evaluative ratings for the set of attributes). Results confirmed our predictions and are summarized in Table V. In three domains we found reduced processing speed for the overall attitude measure as compared to processing speed for rating the various attributes in terms of their likelihood and evaluation, providing further support for our view that attitudes are the result of a bottom-up process in which various attributes are combined to form an overall attitudinal response. More importantly, this difference was more pronounced for ambivalent attitude holders. This was mainly due to the fact that information integration required more processing time for ambivalent than for non-ambivalent attitude holders.

IX. Summary and Conclusion

We have focused on the belief or attribute structure underlying attitudes and proposed a simple idiographic measure of attribute importance. We validated our simple meta-attitudinal measure of attribute importance with two sets of operative measures of attribute importance: Accessibility of

TABLE V
REACTION TIME AS A FUNCTION OF ATTITUDE AMBIVALENCE

Issue ambivalence	Attribute evaluation	Attribute likelihood	Direct attitude
Genfood			
High	3.40	4.13	5.29
Low	3.40	4.37	4.79
Smoking			
High	3.71	3.40	6.48
Low	3.70	3.56	6.08
English as language of instruction			
High	4.04	5.24	8.68
Low	4.23	5.44	7.17

Note. Differences between reaction times for attitude ratings and attribute ratings were more pronounced for ambivalent attitude holders. Adapted from Van Harreveld, Van der Pligt, De Vries, Wenneker, and Verhue (2000).

important versus less important attributes and RTs associated with judging these two categories of attributes and the ability of important versus less important attributes to predict directly assessed attitudes, behavioral intentions, and behavior. Next, we addressed the benefits of incorporating our measure into expectancy–value approaches to attitudes and attitude–behavior consistency. These benefits are that a composite attitude score based on individually important attributes is better able to detect differences between attitude groups and provides more insight into the structure of their attitudes and the implications for attitude change strategies. Finally, we showed that our measure can also be used to assess attitude ambivalence. We now summarize our findings and discuss implications for research on attitudes and attitude change.

A. ATTRIBUTE IMPORTANCE CAN BE MEASURED

Research during the past several decades has resulted in a variety of ways of assessing attribute importance. These methods vary in the type of data they require (at categorical, ordinal, interval, or even ratio level), the complexity of the task presented to respondents, and the amount of time it takes to generate all the needed responses. Unfortunately, response format has a considerable impact on the elicited attribute weights, as indicated by research on attitudes and decision making (e.g., Borcherding, Schmeer, & Weber, 1995; Doyle, Green, & Bottomley, 1997; Jaccard & Sheng, 1984; Jaccard, Brinberg, & Ackerman, 1986). Both practical and theoretical reasons play a role in determining which method to use. It is therefore essential to find a solution that takes all these factors (complexity, time, and meta-cognitive abilities) into account. We decided against complex methods such as the swing-weight method and the allocation of points to all presented attributes. These tasks are difficult, time consuming, and are likely to exceed meta-cognitive abilities. Simpler methods are easier for respondents and also result in more reliable assessments of attribute weights. In a series of studies (Van der Pligt et al., 1999a) we compared the allocation of points to individually selected important attributes, direct rating of both selected and the whole set of attributes, rank-based approximate weights, and an equal-weights solution in which the subset of individually selected, important attributes received equal weights. Our results confirm previous findings that response format has a profound impact on elicited weights or scores of attribute importance. Moreover, most of the methods resulted in more differentiated weights than those obtained when regressing each $b \times e$ value of selected important attributes on the overall attitude score. These objective, statistically derived weights were more

in accordance with an equal weights solution for the selected subset of individually selected, important attributes. We therefore opted for the use of a method requiring respondents to select a subset of individually important attributes. Our method of assessing attribute importance has four basic characteristics. First, it is an idiographic as opposed to a nomothetic measure of attribute importance, i.e., it assesses attribute importance at the individual (as opposed to group) level; second, it relies on a simple categorical judgment, in that an attribute is important or not; third, from a practical point of view, the measure does not take much time; and fourth, the measure relies on introspection and is a meta-attitudinal measure of one of the components of attitude, i.e., attribute importance.

We assume that people are capable of introspecting which attributes out of a larger set are important for their own attitude. The implication is that we are more optimistic about the quality of introspection than Nisbett and Wilson (1977). It should be added that the kind of introspection that we rely on is of a relatively simple nature. We acknowledge that more detailed assessments of the relative weights of attributes might be beyond the capabilities of the average respondent. Nisbett and Wilson (1977) provide a series of demonstrations of the ignorance of the causal factors that influence (changes in one's) behavior, preference, and choice. For example, their participants were unaware that the learning of the word pair "ocean–moon" increased their probability of naming "Tide" when asked to name a detergent.

There are at least three reasons for adopting a less stringent attitude toward meta-attitudinal measures. First, the ignorance that is associated with cognition need not apply to higher level central processes. If asked why we chose the particular words in the previous sentence, we are unlikely to be able to give an accurate answer, given that we are unaware of the exact processes underlying the construction of the sentence. However, if asked why (or how) we decided to buy a particular computer, most of us would be able to refer to the attributes that determined our choice. Second, it may well be the case that we are unaware of the precise numerical weights that we allocate to the various attributes underlying our attitude or choice. It seems unlikely, however, that people are incapable of distinguishing between important and less important attributes that determined their choice or attitude (see also Dawes, 1979). A third reason for taking meta-attitudinal measures seriously is that whether or not people's beliefs about their cognitive processes are accurate, these beliefs still form the basis of their attitudes, decision making, and behavior. Our research confirms this view. A composite measure of attitude based on important attributes is more closely related to overall attitudes and behavior than a measure based on nonselected, less important attributes.

In our view people are consciously aware of at least some of the processes that determine their more important attitudes and choices. These entail more controlled information processing at a relatively high level and concern attitudes and behaviors that are relatively important and have clear consequences for the individual. We therefore argue for a more prominent role for meta-attitudinal measures of attitude structure; more specifically, we believe that our measure of attribute importance can serve a useful function in the study of attitude structure.

B. IMPORTANT ATTRIBUTES ARE MORE PREDICTIVE AND MORE ACCESSIBLE THAN LESS IMPORTANT ATTRIBUTES

In this chapter we summarized evidence from a number of studies showing that selected, subjectively important attributes are more predictive of attitudes than are nonselected attributes in the modal set. Moreover, our composite measure based on important attributes was often more closely related to behavioral intentions and behavior than a measure based on all presented attributes (including the individually selected, important attributes). The latter finding suggests that less important attributes can dilute the predictive validity of the composite attitudinal measure. A comparison of various attribute weighting methods led to the conclusion that a solution in which these selected attributes receive equal weights is as predictive of attitudes and behavior as a solution in which approximate weights are derived from the rank values of the selected attributes. More complicated methods such as the allocation of points to the selected attributes and rating selected attributes or even all attributes in terms of their importance also failed to improve the predictive power of a simple composite score based on our categorical measure of attribute importance. Moreover, the obtained objective weights based on regression analysis confirm our solution.

Important attributes were also more accessible and were judged faster than the remaining attributes. The latter finding further corroborates our method of assessing attribute importance. Our findings from the more elaborate judgment tasks reveal RT facilitation over and above that created by increased accessibility. After all attributes had been made accessible, respondents' judgments of subjectively important attributes were still faster than those of nonselected, less important attributes. Our findings also provide support for Fazio's (1990) notion that repeated expression of attitudes increases their accessibility: Repeated judgments of overall attitudes generally resulted in faster responses. We found similar effects of temporary sources of accessibility on judgments of the various attributes underlying the attitude. All in all, our evidence also confirms the additive nature of

chronic and temporary sources of attribute accessibility (Bargh et al., 1986). It is worth noting that the effects of temporary sources of accessibility of attributes (due to repeated judgments) were less pronounced than the effects due to chronic sources of attribute accessibility (due to their subjective importance).

Interestingly, the results of one of the experiments reported above show both RT facilitation and RT inhibition as a function of attribute importance: Findings reported by Van Harreveld, Van der Pligt, De Vries, and Andreas (1999) show faster responses in a lexical decision-making task for important attributes than for less important attributes and slower RTs for the latter category than for control words incorporated in the total stimulus set. This can be related to research on the facilitatory and inhibitory effects of stereotype activation on trait accessibility (Dijksterhuis & Van Knippenberg, 1996). Further research is needed to confirm these facilitatory and inhibitory effects and to assess the possible role of mediators, such as commitment to one's attitude, attitude extremity, and the threatening nature of dissonant and (often) less important attributes.

C. TOP-DOWN VERSUS BOTTOM-UP CONCEPTUALIZATIONS OF ATTITUDES

After a period in which researchers tended to focus on controlled information processing and to develop and test models that were relatively optimistic about human information-processing capabilities (Ajzen, 1985, 1991; Anderson, 1971, 1981; Fishbein & Ajzen, 1975), attitude research now tends to focus on automaticity and possible antecedents and consequences of the accessibility of the overall attitudinal response (Bargh, 1989; Bargh et al., 1992; Fazio, 1986, 1989, 1990). Fazio (1986) has described his MODE model as an alternative to the expectancy–value models of Fishbein and Ajzen. As argued by Eagly and Chaiken (1993), Fazio (1986) is incorrect in regarding these models as assuming that an individual "considers the attitude in a deliberate reasoning process to arrive at a behavioral decision" (p. 237). In Eagly and Chaiken's view Ajzen and Fishbein focused on the role of deliberate or controlled information processing in attitude formation and did not necessarily presume that people think about all these consequences at each opportunity, engaging in a complete subjective cost–benefit analysis to recompute their attitude. It should be added, however, that Fishbein and Ajzen have not always been clear about the extent to which information processing takes place before expressing existing attitudes. For instance, Ajzen (1996) summarized the theory of planned behavior as stipulating "that when confronted with the need to decide on a course

of action, people consider the likely consequences of available alterna-
tives . . .'' (p. 387). Moreover, the way in which attitudes are decomposed
and assessed in research based on expectancy-value models carries the
implication that attitudes are based on elaborate computations.

Regardless of what Fishbein and Ajzen intended, it seems highly likely
that a full-blown computational analysis of all available attitude-relevant
information only takes place when individuals are confronted with new
and/or important attitude objects or behavioral choices. Equally, it seems
very likely that the processing of attitude-relevant information is only com-
pletely automatic when the individual is confronted with very familiar,
unimportant, or even trivial attitude objects or behavioral choices. We
would like to argue for more theory and research between these two ex-
tremes, focusing on processes underlying the expression of existing (nontriv-
ial) attitudes. These processes are likely to be based on relatively simple
computational rules according to which information is integrated, and the
amount of information (i.e., number of attributes) is also likely to be modest.

Our results show that RTs associated with judging the various attributes
(irrespective of their subjective importance) are much shorter than RTs for
the overall attitudinal response. This difference was obtained irrespective of
whether the overall attitudinal response was given before or after judging
the various attributes. These findings suggest that some information integra-
tion takes place in order to derive one's overall attitudinal response. We
thus favor a ''computational'' approach to attitudes, in which attitudes are
based on the retrieval of relevant attributes, as opposed to direct retrieval of
the overall evaluative response. We emphasize that information-integration
processes underlying the overall attitude are simple and based on a limited
number of personally relevant attributes. In other words, our assumptions
concerning the information-processing capabilities of people are more mod-
est than those that prevailed at the start of the cognitive revolution.

D. ATTITUDE STRUCTURE, STABILITY, AND
   ATTITUDE CHANGE

Another conclusion we would like to draw can also been seen as an
attempt to restore some balance in social psychological research. Older
attitude research focused on the mechanisms people use to preserve their
existing attitudes. This research examined biased information search, biased
interpretations of new (counterattitudinal) information, and so on (Mc-
Guire, 1985). Applied research on attitude change is often confronted with
considerable resistance to attitude change, and similar observations have
been made in behavioral domains in which values and/or habits play an

important role, such as health behavior, traffic behavior, and political attitudes (e.g., Sears, 1983). Research on stereotypes also suggests that attitudes about groups or individuals are difficult to change (Rothbart, 1981; Rothbart & Park, 1986).

This is in sharp contrast with attitudinal processes that have been the focus of research over the past 15 years. Research on context effects in attitudinal judgment and research on the effects of introspecting about one's attitude toward an attitude object suggest that attitudes are relatively unstable. This research on context effects adopts a constructionist view of attitudes, in which the focus is on how an attitudinal response is influenced by providing a specific judgmental context (Schwarz & Strack, 1991; Tourangeau & Rasinski, 1988). Research by Wilson and colleagues (Wilson & Dunn, 1986; Wilson, Dunn, Bybee, Hyman, & Rotundo, 1984; Wilson, Dunn, Kraft, & Lyle, 1989) suggests that the simple request to consider the reasons why one holds an attitude immediately before one expresses the attitude activates different attributes and feelings than would be normally accessible. This biased set of attributes and feelings affects the attitudinal response and can also result in a poor attitude–behavior relationship.

These lines of research imply that expressed attitudes have low reliability and that they are only marginally related to behavior. We take a different view on this issue and argue that attitudes can be related to quite stable attribute structures. Although we agree with the emphasis placed on the computational aspects of attitudes, we believe that the attributes used in computations made to derive one's overall attitude are more stable than is assumed to be the case in the two lines of research just mentioned. One reason for this difference may be that in our research we tend to focus on attitudes to behaviors or issues that can have consequences for the individual (smoking, safe sex, educational preference, blood donation, and so on). Most research on context effects on expressed attitudes has tended to focus on issues that are less involving for respondent and/or on contexts in which respondents have to reply under time pressure. Low involvement and time pressure increase the likelihood of limited and superficial information processing and are therefore likely to enhance context effects. Tourangeau and Rasinski (1988) more or less acknowledge this point. Fazio (1986) also maintained that with weak and poorly articulated attitudes, behavior is often controlled by features of the attitude object that happen to be salient (see also Fazio, Powell, & Williams, 1989). Similarly, the work of Wilson and his colleagues tends to focus on nonconsequential attitudes or attitudes with trivial consequences for the individual, such as the selection of a soft drink in a cafeteria. Moreover, subsequent research by Wilson, Dunn, Kraft, and Lisle (1989) showed that the effects of analyzing reasons on attitude change and on attitude–behavior correspondence were largely confined to

participants who were not very knowledgeable about the attitude object. More recently, Zanna (1993) made a similar point and noted that research in the persuasion literature has tended to employ attitude topics for which participants had rather weak attitudes.

If attitude structures are relatively stable, one should be systematic and persistent in attempting to change (elements of) this structure in order to change attitudes and behavioral preferences. We argue that assessing attribute importance should help to tailor attitude change programs. Fishbein and Ajzen also argued that expectancy–value models of attitudes have clear implications for persuasion (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1981). Not surprisingly, their application of expectancy–value principles emphasizes the importance of message content in producing changes in beliefs and consequently attitudes, behavioral intentions, and behavior. This approach has been quite popular and generally confirms the expectation that changes in beliefs (especially the probability component) can lead to corresponding changes in attitudes (see, e.g., Fishbein, Ajzen, & McArdle, 1980; Olson & Zanna, 1987). As argued by Eagly and Chaiken (1993), there is far less evidence showing that changing attribute evaluations leads to changes in overall attitudes. One reason is that changing attribute evaluations is much more difficult than changing the perceived likelihood of positive or negative attributes associated with the attitude object. Attribute evaluations are often related to more central values and norms and are likely to be more stable than attribute–attitude links.

Our approach offers an additional strategy. For Fishbein and Ajzen (1981), arguments play a key role in determining persuasion, and these arguments need to be selected with care. In their view, these arguments should pertain to the primary attributes underlying the attitude the influencer wants to change. Our argument is that the influencer should be aware of the prime determinants of attitudes at the individual or group level. Thus, persuasion strategies that emphasize message content should not only address the probability and evaluation of attributes or possible consequences of behavioral action, but also the subjective importance of these attributes. Explicitly considering the subjective importance of attributes opens up alternative strategies to foster behavioral change. These could be based on questioning the perceived importance of attributes for a specific target group or on attempting to increase the importance of attributes that are presently not considered important. Such a strategy broadens the scope of opportunities for persuasion in research on applied issues such as health behavior. Given the fact that changes in the perceived likelihood of adverse health consequences have a limited impact on attitudes (Van der Pligt, 1998), and given the fact

that evaluations of the possible adverse consequences of behavioral practices often hardly vary between attitude groups, it may well be more efficient to focus on changing the perceived importance of certain attributes. Our research on smoking illustrates this point and reveals that smokers do not necessarily deny the likelihood of adverse health consequences or evaluate these consequences less negatively; they simply find them less important. Moreover, they focus on positive attributes of smoking that are totally ignored in most persuasion strategies.

E. ATTRIBUTE IMPORTANCE AND ATTITUDE AMBIVALENCE

Our measure of attribute importance can be used to assess a number of features that are studied under the general rubric ''attitude strength.'' First, if respondents were only to select attributes that are consonant with their overall attitude we would obviously be dealing with stronger (less ambivalent) attitudes. As we showed, these attributes are not only more closely related to overall attitudes and behavior, but are also more accessible. A one-sided selection of attributes thus gives a good indication of strength and consequently of attitude ambivalence. Our measure of attribute ambivalence is similar to the Griffin measure, but can be more easily assessed and is also more reliably related to other indices, such as the time needed to integrate evaluatively incongruent attributes into an overall attitudinal judgment.

Our results show slower RTs for the overall attitudinal response when the set of selected attributes consists of attributes that support both sides of the attitudinal continuum. The difference between RTs for the overall attitudinal response and RTs for the various attributes underlying the overall attitude was more pronounced for ambivalent attitude holders. This was mainly due to increased processing time for the overall attitudinal response. These findings are in accordance with results obtained in related fields, such as person perception and stereotyping, showing that integrating evaluatively inconsistent information takes more time than integrating consistent information (Belmore, 1987; Hemsley & Marmurek, 1982; Rojahn & Pettigrew, 1992). These findings therefore support our conception of attitudes as a bottom-up process in which attributes are combined to arrive at an overall attitudinal response.

Our measure of attribute importance can also be related to ambivalence due to affective–cognitive inconsistency. If the modal set of attributes contains beliefs and feelings associated with the attitude object, the relative frequency with which beliefs and feelings figure in the set of selected attributes, in combination with their respective valences, can give a simple

indication of affective–cognitive consistency. As argued above, our measure of attribute importance is not taxing for the respondent, and we expect that it will be possible to use the measure to make reliable assessments of the relative weight of affect versus cognition at the individual level.

F. CONCLUDING REMARKS

Our primary objective in this chapter has been to argue that the scope of attitudinal research should be broadened and that more attention should be paid to the cognitive processes underlying relatively important attitudes. In studying these cognitive processes the best solution seems to be to focus on relatively simple cognitive operations that rely on limited amounts of information. In our view, assessing attribute importance could help to decompose attitudes into a set of attributes that can easily be integrated into an overall attitudinal judgment. The information integration presumed by our approach is more in line with the known limitations of on-line human information processing. We emphasize the need for more research on attitudes between the two extremes of automatic attitudinal processes, in which attitudes are conceived as the result of no conscious thought at all, versus controlled information processing approaches, in which it is assumed that people make a complete cost–benefit analysis of each attitudinal or behavioral decision. In our view, broadening the scope of attitudinal research also implies adopting a view that is more open to the possible benefits of meta-attitudinal measures of attitudes. We do not share the general distrust of such measures and believe that meta-attitudinal measures of components such as attribute importance are useful and can help to improve our insight in attitude structure and attitude change processes. In sum, we believe that attitude research should also address more important attitudes, pay more attention to the (simple) controlled information processes underlying such attitudes, and study these attitudes using both process-related and meta-attitudinal measures.

Acknowledgments

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TOWARD A HISTOLOGY OF SOCIAL BEHAVIOR: JUDGMENTAL ACCURACY FROM THIN SLICES OF THE BEHAVIORAL STREAM

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> So it cometh often to pass that mean and small things discover great better than great can discover the small; and therefore Aristotle noteth well, that "the nature of every thing is best seen in his smallest portions."
>
> (Francis Bacon, p. 178)

I. Significance

Many day-to-day impressions and judgments of others occur rapidly, unwittingly, and intuitively. A fleeting glimpse or a mere glance can lead to an instantaneous evaluative judgment. Once made, such judgments provide the anchor from which subsequent judgments are realized. Even without reaching conscious awareness, initial evaluative impressions can influence whom we sit next to on the subway, whom we ultimately hire for a job, and, perhaps, even whom we marry. Thus, as employers, we might reject a candidate on the basis of an unkempt appearance even before the employment interview has commenced. As savvy undergraduates, we might know we are going to drop a particular course even before the instructor has finished passing out the course syllabus on the very first day. And, who among us has never heard it claimed, "I knew it from the very first time our eyes met. This was the person I was going to marry"? The importance of these initial impressions is undeniable. But what is the magnitude of their importance? To what extent are our cognitions, emotions, choices, and behaviors explicit functions of these instantaneous impressions? How accurate are judgments made so quickly? Upon what are they based?

201

Despite the volumes that have been written on social cognition, we know very little about how first impressions naturally develop, what influences or does not influence them, and how much they determine future behavior.

A. BACKGROUND

Pioneers in the area of social perception such as Gordon Allport were very interested in the issue of the accuracy of everyday impressions and judgments of others. At the field's zenith Taft's (1955) review of the area did not provide a hint of the crash to come. In the very same year that Taft summarized what was known about interpersonal judgment, Cronbach and Gage (Cronbach, 1955; Gage & Cronbach, 1955) revealed that much of what was being concluded was in error due to methodological flaws inherent in the existing experimental designs and data-analysis techniques. Although the problems were not insurmountable, they proved discouraging. Interest in accuracy waned so much that in 1957, a landmark conference on interpersonal perception was devoted to turning the tide of research on social perception from investigating the accuracy of interpersonal judgments toward investigating the process of interpersonal judgments (Tagiuri, 1958, p. xvi). The tide did turn and interest in accuracy declined, primarily because of methodological rather than theoretical reasons (for detailed discussion of these issues see Funder, 1995; Jussim, 1991; Kenny, 1994; Kenny, Albright, Malloy, & Kashy, 1994). A critical problem was inherent in the concept of accuracy itself. After all, to be accurate is to be correct or ''on the mark.'' In order to assess accuracy, one must know what actually is ''the mark,'' or the truth. The assessment of accuracy implies knowledge of the truth, which in psychology typically refers to the true status of someone's behavior, disposition, or internal state—a difficult criterion to assess. Realizing the difficulty in establishing accuracy criteria for psychological constructs and the problems associated with extant accuracy metrics, researchers shifted their focus to the judgment process (Jones, 1985; Schneider, Hastorf, & Ellsworth, 1979).

During the decades that followed, social psychologists turned their attention toward examining the fallibility of human judgments (Kahneman, Slovic & Tversky, 1982; Nisbett & Ross, 1980). Innovative and intriguing research indicated that such judgments are prone to a depressing assortment of errors and biases. For example, people tend to rely on several judgmental heuristics that can lead to uninformed and poor decisions (Kahneman et al., 1982; Nisbett & Ross, 1980).

Preceding and parallel to this pathbreaking work on judgment and decision making, however, another line of research suggested that people (and

even animals) were responsive to very subtle features in their social ecology. Research on expectancy effects clearly indicated that people and animals can sense and behave in accordance with the subtle, unstated expectations that other people have of them (Rosenthal, 1966, 1991; Rosenthal & Jacobson, 1992; Rosenthal & Rubin, 1978). Systematic studies showed that these expectations are communicated through subtle variations in nonverbal behavior. In light of the evidence demonstrating how people perceive and respond to the subtlest of variations in expressive behavior, it seems surprising and paradoxical that social psychologists at that time were lamenting the inaccuracies of our social perceptions. The difference between the two streams of work was perhaps due to the domains being examined. The judgment and decision research focused on judgments regarding abstract, conceptual, and statistical information, whereas the interpersonal expectation and nonverbal communication research focused on judgments regarding individuals' actual behavior.

In response to the developing zeitgeist focusing on error, a small group of researchers reawakened interest in the attempt to quantify the accuracy of social judgments (Funder, 1987; Funder & Harris, 1986; Kenny & Albright, 1987; McArthur & Baron, 1983; Swann, 1984). Researchers began to develop the tools and the confidence needed to address the methodological issues that curtailed earlier research (Bernieri, Zuckerman, Koestner, & Rosenthal, 1994; Funder, 1982; Ickes, 1997; Judd & Park, 1993; Kenny, 1994; Snodgrass, 1985). Along with the developing methodology, theory on accuracy made huge strides as well (Funder, 1995; Kruglanski, 1989; McArthur & Baron, 1983; Swann, 1984). This work on accuracy revealed that perceivers are not as error prone and biased as was once thought. Observers are able to make unexpectedly accurate judgments of others, especially on certain personality traits. Furthermore, these judgments can be accurate or predictive even in the absence of any personal interaction between the targets and raters—even when impressions are based on ''thin slices'' or observations less than 5 min long.

B. DEFINITION

A thin slice is defined here as a brief excerpt of expressive behavior sampled from the behavioral stream. By brief we mean any excerpt with dynamic information less than 5 min long. Thus, static, still frames (e.g., photographs) do not qualify as thin slices. Thin slices can be sampled from any available channel of communication, including the face, the body, speech, the voice, transcripts, or combinations of the above. Thin slices retain much, if not most, of the information encoded via dynamic, fluid

behavior while reducing or sometimes eliminating: (a) the information encoded within the ongoing verbal stream; (b) the past history of targets; and (c) the global, comprehensive context within which the behavior is taking place.

1. Importance

On-line, everyday, dynamic social cognition often begins with the identification of expressive behavior. People form immediate impressions and evaluations from ongoing behavior. Work on the judgment of thin slices elucidates the process by which impressions are extracted from the ongoing behavioral stream. These impressions and evaluations form the basis for subsequent expectations as well as for subsequent behavior toward targets (Jones, 1990). A wealth of research in social psychology has shown that social information processing is schema and expectancy driven and that inferences and subsequent judgments are strongly influenced by the initial immediate impressions of expressive behavior. Thus, because initial impressions are so influential in person perception, judgments, and resulting behavior, the reliability and accuracy of these initial impressions is paramount to the understanding of social cognition in general. In this chapter we evaluate the judgments of others from minimal information—from thin slices of the ongoing behavioral stream.

2. Behavioral Stream

Like the continuous black-and-brown ribbon of videotape that records it, the ongoing stream of individuals' behavior while navigating through their social environment is inherently unpunctuated and whole. With the possible exceptions of birth and death, the flow of behavior has no definitive points of initiation and termination. Life itself is not intrinsically segmented. Yet, when reflecting upon our own behavior and the behaviors of others, we partition it in to meaningful units so that it can be comprehended, processed, and remembered (Newtson, 1976). These slices we project on to the behavioral stream are not fixed in length. Rather, their size and nature likely reflect the various processing demands and perceiver goals operating at the given moment (Newtson, 1990).

As researchers who appreciate the concepts of representativeness and reliability, our intuition compels us to suspect that larger slices will be more representative and more useful to judge. Common sense would suggest that larger slices contain more information and therefore provide a more reliable sample of the behaviors chronically embedded within the complete behavioral stream. To know confidently the dispositional nature of something as complex as a human being, our scientific acumen demands first a vast

sampling of past history, self-reported internal states, and an understanding of the situational contexts within which they occurred. To see an individual's identity, disposition, and intention revealed within a few seconds of behavior would strike any clinician or personologist as being an incredibly fortunate outcome of an otherwise random and chaotic sampling process.

Nevertheless, social perceivers appear quite comfortable working with such thin slices. Gordon Allport (1937) observed that "a brief acquaintance often does result in amazingly rich impressions" based on cues that "are derived entirely from expressive movements—from appearance, gesture, and manner of speaking" (p. 500). Allport's observation that individuals can glean a substantial amount of information about others through brief exposure to their expressive behavior has received considerable empirical support.

3. Expressive Behavior

In their classic book, *Studies in Expressive Movement,* Allport and Vernon (1933) defined expressive movement as "individual differences in the manner of performing adaptive acts, considered as dependent less upon external and temporary conditions than upon enduring qualities of personality" (p. 23). Expressive behavior conveys important information about the cultural, social, interpersonal, and behavioral ecology—information regarding affect and emotions, personality and dispositions, internal goals and motives, and, finally, information about social relationships.

DePaulo (1992) argued that expressive nonverbal behaviors are both more difficult to suppress relative to verbal behavior and more accessible to observers than to actors. One implication of the lack of control and accessibility of expressive behavior is that such behavior provides observers with a relatively valid source of information regarding the true internal states and dispositions of another. Another implication is that attempts to intentionally manipulate expressive behaviors in the service of self-presentation are difficult and often unsuccessful. Expressive behavior may be more revealing of communicative intentions and internal states than what is being consciously and verbally communicated (Ekman & Friesen, 1969). By sampling expressive behavior, thin slices capture chronic, reliable, and stylistic psychological information not subject to conscious control and monitoring (DePaulo, 1992; Ekman & Friesen, 1969, 1974; Rime & Schiaratura, 1991).

C. SUMMARY

Thin slices are excerpts of expressive behavior drawn from the ongoing behavioral stream. The expressive behavior sampled is diagnostic of many

affective, personality, and interpersonal conditions. Examining judgments based on thin slices can inform us about the sensitivity people have to this information as well as the process by which immediate impressions are formed. This scrutiny will then lead to a better understanding of how subsequent expectations of, and behavior toward, others come about. In the next section we provide several examples to illustrate the efficiency of thin slices in providing information about social and interpersonal relations.

II. Predictive Utility of Thin Slices

A. RELEVANT DOMAINS

Thin slices contain information pertaining to a wide spectrum of psychological constructs and phenomena, including internal states, personality, interaction motives, and social relations.

1. Internal States

Thin slices of behavior reveal valid information about fleeting, temporary emotions and affect. This information is communicated through channels of communication such as the face, the voice, and the body. Thin slices also provide information about chronic, long-lasting affective states such as depression and anxiety (Waxer, 1976, 1977).

2. Personality

Fritz Heider's famous contention that "Behavior . . . has such salient properties that it tends to engulf the field" (1958; p. 54), is particularly true in the case of thin slice judgments. Dispositional and correspondent inferences are often based on glimpses or slices of behavior. So far, observable traits such as extroversion and sociability have been studied and judged from brief exposures more successfully than the more internal traits such as openness to experience or perseverance (Albright, Kenny, & Malloy, 1988; Funder, 1995; Kenny et al., 1994; Passini & Norman, 1966; Paunonen, 1991; Watson, 1989). It is possible, however, that the social context within which thin slices are sampled may strongly moderate the extent to which a given trait is manifested (Dabbs, Strong, Milun, Bernieri, & Campo, 1999).

3. Interaction Motives

Nearly all of the experimental research on deceptive communications and their detection has employed thin slices as the stimulus units of analysis

(DePaulo, Stone, & Lassiter, 1985; Zuckerman, DePaulo, & Rosenthal, 1981, 1986). Results from several meta-analyses have documented well the finding that observers, with no prior knowledge of targets, can detect deception at greater than chance levels.

Interpersonal roles and goals can also be revealed in thin slices. For example, interpersonal goals such as forming an impression of a partner, managing one's impression, or trying to get along with a partner in an interaction can be assessed from thin slices (Richeson & Ambady, 1999a).

4. Social Relations

Two published measures of interpersonal sensitivity that ask examiners to make judgments regarding social relations are composed of a series of thin slices. The Profile of Nonverbal Sensitivity (the PONS; Rosenthal, Hall, DiMatteo, Rogers, & Archer, 1979) is composed of 220 video clips, each lasting no more than 2 seconds. Each thin slice is extracted from a brief ''scene'' in which a woman portrays herself in a number of different social and interpersonal situations (e.g., admonishing a small child, asking for forgiveness, returning an item purchased at a store, etc.). Although the verbal content has been removed from each of these clips, the overall accuracy level is above chance demonstrating that even within a scant 2 s of behavior there is some information diagnostic of social relations (Rosenthal et al., 1979). The Interpersonal Perception Task (IPT: Costanzo & Archer, 1989) is composed of longer clips ranging from 30 to 60 s and, unlike the PONS, preserves all of the channels of communication intact. The observer of the IPT makes judgments regarding the identification of kinship, level of romantic involvement, status, winners and losers in sporting events, and deception.

In addition to the standardized measures of interpersonal sensitivity, thin slices have also been used successfully to study such interpersonal relations domains as rapport (Bernieri, Gillis, Davis & Grahe, 1996), status hierarchies, power (Ambady, Koo, Lee, & Rosenthal, 1996; Costanzo & Archer, 1989), dominance, acquaintanceship, kinship (Costanzo & Archer, 1989), and level of romantic involvement (Ambady, Conroy, Tobia & Mullins, 2000; Costanzo & Archer, 1989; Gada, Bernieri, Grahe, Zuroff, & Koestner, 1997).

B. THIN-SLICE JUDGMENTS AS PREDICTORS OF OUTCOMES

Thin slices have been shown to have predictive validity in a number of different contexts. In this section, we selectively describe some recent find-

ings regarding the validity of predictions based on thin slices regarding
performance in educational, organizational, and health care settings, aspects
of interpersonal relationships, and individual differences such as sexual
orientation and hormonal levels.

1. Individual Performance

a. Teaching. Judgments from thin slices reveal a great deal of informa-
tion about teaching. Such judgments have been used to assess (a) expec-
tations teachers have of their students' potential for academic success,
(b) teachers' susceptibility to these differing expectations, (c) teacher effec-
tiveness, and (d) student learning.

i. Exposing teacher expectancies. Thin-slice judgments have been found
to reveal teachers' expectations of students. In one study, teachers identified
students for whom they held either high or low academic expectations
and then were recorded teaching them brief lessons about the concept of
temperature (Babad, Bernieri, & Rosenthal, 1991). Teachers were also
recorded while talking *about* the same students to the experimenter. Video
segments approximately 10 s in length were judged by 15 observers on
items such as warm, dogmatic, hostile, condescending, dominant, clear, and
active. Both when teachers were talking about their students and when
interacting with them, the teachers' expectations were revealed in the
10-s clips. Teachers were judged to be more dogmatic and less warm overall
on the basis of the thin slices when they talked *about* low-expectancy targets.
Thin slices of teachers talking *to* their students revealed that the negative
expectancy effects found in the previous context were much larger in the
body channel of communication and nearly reversed in the face channel
(Babad, Bernieri, & Rosenthal, 1989a). Thus, teachers appeared to be self-
presenting successfully to their low-expectancy students via their facial
expressions but may have been ''leaking'' their true internal states through
their expressive body behavior. The pattern of results dramatically illus-
trates the potential complexity of how expressive behavior can encode
psychological phenomena.

ii. Revealing bias. Thin-slice judgments of teachers also reveal teachers'
biases. Bias, in this case, refers to the extent a teacher discriminates in her
evaluations of the products made by students from different ethnic/religious
backgrounds (Babad, 1979). Thin-slice judgments revealed that biased teach-
ers addressed their classes in a warmer and less dogmatic fashion verbally
but in a less warm and more dogmatic fashion nonverbally than did teachers
scoring low on bias (Babad et al., 1989b). In effect, high-bias teachers
''leaked'' negativity nonverbally relative to no-bias teachers. This research
highlights the importance of thin-slice judgments. Had the researchers based

their conclusions on a record of what teachers actually said to their students throughout the day, the results likely would have led to the conclusion that the more biased teachers were warmer and less dogmatic than less biased teachers. Although this conclusion might truly reflect the 30 or so hours of verbal behavior exhibited weekly, it would lie in stark contrast to the conclusion derived from a mere 20-s thin slice of nonverbal behavior.

iii. Predicting effectiveness.   Thin slices also provide valid information regarding teacher effectiveness. Using 4-min clips of 9 instructors of a course in accounting, Stallings and Spencer (1967) found that 10 judges agreed on their rankings of the instructor on a global measure of effectiveness. Moreover, the rankings were significantly related to the instructors' rankings on course evaluations (r = .70). Teacher effectiveness can be gauged from ratings of even thinner slices of behavior (Ambady & Rosenthal, 1993). Three 10-s silent video clips of each of 13 university teachers, teaching diverse courses, were rated by nine naïve raters on 15 variables: accepting, active, anxious, attentive, competent, confident, dominant, empathic, enthusiastic, honest, likeable, optimistic, professional, supportive, and warm. Because the variables were highly intercorrelated, one new composite variable was created by summing all the variables except anxious. Teacher effectiveness was assessed through student course evaluations collected at the end of the semester. Results were remarkably similar to those obtained by Stallings and Spencer (1967) indicating that teachers with higher student evaluations were judged more favorably on the composite variable, r (11) = .76, p = .001. A second study revealed similar results for a sample of schoolteachers, using the school principal's rating as the criterion variable. Additional analyses suggested that the correlations obtained were not due to the physical attractiveness of the teachers, suggesting that "teaching can proceed quite successfully no matter how unfavored the teacher is by nature" (Allport, 1953; p. 857). Thus, judgments based on thin slices seem to draw on behavioral rather than appearance-based information.

iv. Predicting learning.   In the previous study the criterion used to gauge teacher effectiveness was student evaluations, but the best possible criterion for effective teaching should be student achievement (adjusted for student ability). We conducted a laboratory experiment to examine whether ratings of thin slices predict student achievement (Ambady, 1999a). Participants were assigned to the role of teacher or student. Each teacher taught four different students a mathematical language (combinations of letters of the alphabet represented different numerical symbols; e.g., 10 = djz; 3 = vfg). Teachers were given time to prepare and plan the lesson. Sessions were videotaped. Student learning was evaluated by a quiz requiring basic addition and subtraction after the session. At the end of each session, students

rated how much they enjoyed the lesson, the effectiveness of the teacher, how much they had learned, and the extent to which they had mastered the task.

Naïve raters rated one 10-s clip of each session extracted from the middle of the session. Thus, four 10-s clips of each teacher (each clip with a different student) were rated on the same variables as the previous study. Results replicated the previous study. Thin-slice ratings significantly predicted student evaluations of the teachers. But, more importantly, thin-slice ratings also predicted student performance on the test.

b. Job Performance. Thin slices have been used to examine job performance. For instance, Hecht and LaFrance (1995) found that thin-slice ratings of enthusiasm, sympathy, confidence, professionalism, and friendliness in telephone operators' voices predicted the length of their calls, a key measure of operator job performance. In another study on organizational peformance (Ambady, Hogan, Spencer, & Rosenthal, 1993) three 20-s tone-of-voice clips from a sample of management consultants were rated on variables assessing task and interpersonal performance. Results indicated that judges' ratings of variables assessing interpersonal functioning accurately predicted individuals' evaluations by senior management. More specifically, consultants whose thin-slice vocal clips were rated more positively on variables such as warmth and perceptiveness were more likely to have been rated by superiors as exhibiting outstanding performance. A second study replicated this finding with a sample of sales managers, using a criterion variable combining sales performance and supervisor ratings.

c. Camp Counseling. Blanck and Rosenthal (1984) used thin slices of audiotaped behavior to predict camp counselor effectiveness. They recorded camp counselors talking about the campers under their supervision. The audio tapes were content filtered to remove all verbal content while preserving the tonal and paralinguistic qualities within the stream of speech. Division leaders were asked to evaluate the counselors recorded on various competency dimensions. Thin-slice judgments of content-filtered audio clips on warmth and hostility predicted the counselor's overall effectiveness as evaluated by the camp's four division leaders.

d. Employment Interviews. One important setting when considering the validity of first impressions is that of the employment interview. The interest and importance of this one arena is underscored by the number of consultants who make a career advising people on how to conduct themselves during such interviews. How well do judgments from thin slices correspond to evaluations made by informed interviewers after the interview process?

Preliminary findings suggest they can correspond amazingly well. A recently completed study brought 59 undergraduates in for a mock ''initial screening'' interview (Prickett, Gada-Jain, & Bernieri, 2000). Potential in-

terviewees who agreed to participate were told over the phone that this interview would simulate the kind of on-campus screening interviews large companies conduct throughout the academic year. Interviews were conducted by trained interviewers in pairs from a team of six interviewers available for this project. Interviews ranged from 8 to 30 min, after which interviewers completed an extensive evaluation form covering such areas as personality traits, interpersonal skills, professional competencies, and overall employability (for a detailed description of the procedures see Gada-Jain, 1999). Thin slices from each interview, that began with the interviewee knocking on the door and ended 10 s after the interviewee took his or her seat, were extracted and shown to a group of untrained observers. Presented with a thin slice showing the initial greeting and settling into chairs (i.e., no formal interview questions had been asked at this point), observers were asked to assess a number of qualities that the interviewers themselves had evaluated. These included employability, competence, intelligence, ambition, trustworthiness, confidence, nervousness, warmth, politeness, likability, and expressiveness. Results indicated that thin-slice judgments of the preinterview greeting correlated significantly with the final evaluation of the interviewers for 9 of the 11 variables listed. Only judgments of trustworthiness and ambition failed to correlate with interviewers' final evaluations (Prickett et al., 2000). In sum, a thin-slice judgment of an initial handshake and introduction predicted the outcome of a structured employment interview.

Besides the behavior of interviewees, aspects of the relationship between interviewers and interviewees also seems to be captured by thin slices. It has been long acknowledged that the rapport an interviewee establishes and maintains with an interviewer positively influences the interviewer's assessment of the interviewee (Cardy & Dobbins, 1986; Imada & Hakel, 1977). Previous work had established both empirical (Bernieri, 1988; Bernieri, Davis, Rosenthal, & Knee, 1994) and theoretical (Tickle-Degnen & Rosenthal, 1987, 1990) links between rapport and an aspect of expressive behavior known as interactional synchrony (Bernieri, Reznick, & Rosenthal, 1988). Interactional synchrony is the degree to which the movements of one individual are similar to, and coordinated with, the movements of another (Bernieri & Rosenthal, 1991). Gada-Jain (1999) examined whether the level of interactional synchrony between an interviewer and interviewee assessed within a 30-s slice of a job interview would predict the interviewer's evaluations of the interviewee. The level of synchrony assessed correlated significantly with interviewers' reports of (a) how similar they thought the interviewee was to them, (b) the rapport they experienced with the interviewee, and (c) the overall success of the interview including their overall recommendation to hire (Gada-Jain, 1999). Thus, even some-

thing as subtle as the coordination of movements accurately predicted the outcome of an interview.

e. Health Care. Thin slices have been used to predict doctor's effectiveness in their referrals of alcoholic patients (Milmoe, Rosenthal, Blane, Chafetz, & Wolf, 1967) and patient satisfaction with their doctors (Hall, Roter, & Rand, 1981).

Recent work has shown that thin-slice judgments predicted the malpractice history of general practitioners and surgeons. Utilizing very brief clips of doctors' voices extracted from physician–patient interactions during medical visits, Ambady, LaPlante, Nguyen, Chaumeton, Rosenthal, and Levinson (1999) examined the relationship between thin-slice judgments of physicians' voices during routine office visits and malpractice claims against the same physicians. Thin slices were rated in two different channels: full audio and tone-of-voice channels. Consistent with prior work, results revealed that a mere 20 s of audio and vocal tone from the behavioral stream reveals a wealth of information. Thin-slice ratings of dominance both in the full audio as well as in tone of voice channels were significantly related to surgeons' past history of malpractice claims. Surgeons who sounded more dominant were more likely to have been sued in the past. Similarly, ratings of lower anxiety (interpreted as concern) both in the full channel as well as in the tone of voice was significantly related to primary care physicians' past history of malpractice claims. Thus, primary care physicians who sounded less anxious or concerned were more likely to have been sued in the past than those who did not.

More evidence regarding the validity of thin-slice judgments in predicting health-related outcomes was gathered in a study examining the relationship between physical therapists' behavior and the health outcomes of geriatric patients. Thin-slice judgments of silent video clips of physical therapists' positive affect and infantalization of patients were associated with both short- and long-term improvement in patients' mobility and ability to perform the activities of daily living—from the time of admission to the time of discharge, as well as from the time of admission to 3 months following discharge (Ambady, Koo, Rosenthal, & Winograd, 1999).

Practitioner effectiveness can also be judged from thin slices (Rosenblum et al., 1994; Tickle-Degnen, 1998). For example, Rosenblum et al. (1994) found that ratings of six 15-s slices of medical students in a pediatric clerkship, videotaped interviewing adult patients, predicted the grades assigned by their clinical supervisors. In addition, 15-s thin-slice judgments of occupational therapy students predicted their clinical performance (Tickle-Degnen, 1998; Tickle-Degnen & Puccinelli, 1999). Moreover, these thin-slice judgments proved sensitive enough to distinguish between specific therapist attributes uniquely suited to specific clinical contexts. Specifically,

students who were judged as less nonverbally responsive and more dominant were more effective in a pediatric rehabilitation setting, whereas less friendly students were more effective in a physical rehabilitation context.

Finally, thin slices can reveal psychological pathologies as well. Condon (1982) has performed detailed microanalyses examining individuals' synchronization of body movements to their speech rhythms and has claimed that asynchrony, which can be observed within extremely thin slices, is associated with schizophrenia, autism, and dyslexia. Similarly, certain personality disorders can be predicted from judgments of thin slices (Oltmanns, Turkheimer, Wagner, & Haury, 1999).

2. Relationships

a. Type of Relationship. In addition to effectively judging characteristics of individuals, thin slices have also been found effectively to differentiate characteristics of dyadic relationships. Ambady, Conroy, Tobia, and Mullins (2000) investigated whether the nature of the relationship between two opposite-sex strangers could be discerned from judgments of thin slices of their behavior. In contrast to the previous thin-slice work that examined accuracy in making judgments of individuals, this study addressed the accuracy of judgments about dyads. In this study, 15-s clips of opposite-sex college students interacting were shown to participants who were asked to identify the relationship between the two targets, whether they were strangers, platonic friends, or lovers. Raters were able to identify accurately the type of relationship both from the silent nonverbal channel as well as from the full channel (audio and video). Further analyses revealed that raters used cues from body and seating position in making their judgments. Consistent with previous work, the study further supports the notion that perceptions and impressions of interpersonal relationships are formed accurately almost instantaneously.

b. Quality of Relationships. Promising evidence indicates that the quality of interpersonal relationships is revealed via thin slices. The degree of rapport between two individuals has been linked theoretically and empirically to the nonverbal behaviors they exhibit while interacting (Tickle-Degnen & Rosenthal, 1990). For example, Harrigan and Rosenthal (1986) demonstrated that the apparent rapport between a doctor and patient could be predicted by the nonverbal behaviors observed between them within a 4-min slice.

In a series of studies Bernieri and colleagues have analyzed 30-s slices of five 25-min-long interactions of unacquainted opposite sex partners while planning a trip together and then later while debating a controversial topic (Bernieri & Grahe, 1998; Bernieri et al., 1996; Gillis, Bernieri, & Wooten, 1995). Precise microcodings of such theoretically relevant behaviors as

proximity, interactional synchrony, and partner responsivity in the form of head-nods and "hmm-hmms" strongly predicted (multiple $R > .70$) the interactants' self-reports of rapport made after the conclusion of each interaction (Bernieri et al., 1996). In addition, naïve observer assessments of rapport based on the same thin slices also correlated significantly with the self-report criterion.

Perhaps the ultimate assessment of relationship quality involves the love two people have for one another. In light of this, Gada and colleagues had naïve observers judge the degree of love that existed between 48 opposite sex couples from three 20-s thin slices taken from the beginning, middle, and end of a 10-min-long conflict-resolution interaction (Gada et al., 1997). Naïve judgments were correlated with the couple's scores on two published love scales (Rubin, 1973; Sternberg, 1986). Results showed that observer judgments of love correlated significantly with female reports of love for their partner but less so with male reports of love. In addition, when the thin slices were coded for the same types of behaviors employed in the research on rapport, it was found that several cues, including proximity, interactional synchrony, and touching in a positive manner, were all significant predictors of both female and male love for their partner.

c. Interpersonal Expectations. Thin slices of behavior have been used frequently to assess interpersonal expectancies and biases in experimental as well as naturalistic situations (Harris & Rosenthal, 1985; Rosenthal, 1966, 1969; Rosenthal & Rubin, 1978). For example, a series of studies conducted by Bugental and her colleagues revealed that parental expectancies, identified from brief voice clips, are related to their children's behavior (Bugental, Caporael, & Shennum, 1980; Bugental, Henker, & Whalen, 1976; Bugental & Love, 1975; Bugental, Love, Kaswan, & April, 1971). Thus, ratings of the tone of voice of mothers of normal children and children with behavior problems in school differed significantly, with the latter mothers revealing a lack of confidence in their tone of voice in their ability to control their children (Bugental & Love 1975). As discussed previously, research in the classroom has shown that thin-slice judgments can distinguish biased from unbiased teachers and also can identify differential teacher expectancies and affect toward students (Babad, Bernieri, & Rosenthal, 1987, 1989a, 1989b). Research in the courtroom has shown that ratings of thin slices of judges' instructions to jurors in actual criminal trials reveal the judges' expectations for the trial outcome and the criminal history of the defendant (Blanck, Rosenthal, & Cordell, 1985; Blanck, Rosenthal, Hart, & Bernieri, 1990).

3. Individual Differences

a. Personality. Accumulating evidence indicates that certain personality and dispositional variables can be judged rapidly from brief observations

(Borkenau & Liebler, 1992; Kenny 1994; Funder & Sneed, 1993). For example, Gangestad, Simpson, DiGeronimo, and Biek (1992) found that judges' ratings from 1-min video clips agreed with targets' ratings of socio-sexuality and social potency.

Other personality traits are also revealed by thin slices. In a recent study, 148 participants were videotaped entering a room, walking over to a seated female experimenter who greeted them, and then taking their seat and beginning a brief interview (Dabbs & Bernieri, 1999). Only the first 30 s was extracted. Thus, the thin slice contained little more than the entry, meeting, greeting, and seating. Participants had all been previously assessed on the big five personality traits (Costa & McCrae, 1995). Naïve observers viewed and judged each of the 148 participants on each of the big five traits. Whereas observer judgments of neuroticism did not correlate with target neuroticism as assessed by the NEO-PI (Costa & McCrae, 1995), judgments of extraversion, agreeableness, openness, and conscientiousness did correlate significantly with targets' psychometrically assessed traits (Dabbs & Bernieri, 1999).

b. Gender. Thin slices also reveal gender-related features. A fascinating line of research has focused on the information that is revealed in the expressive manner in which an individual moves through space. This work began when Johansson (1973) created his dynamic motion displays where he affixed lights to various points on a human body and recorded a high-contrast image such that all an observer could see was a field of point lights. He found that still-frame pictures of these point lights could not be reliably identified as being of a human. As soon as movement was introduced, however, the human form became immediately apparent. Subsequent research using similar or related methodological procedures that screen out all visual information except for dynamic movement has found that the sex of the target is somehow manifest in this movement as well (Bernieri, Sharpe, & Knee, 1992; Cutting & Koslowski, 1977).

These findings led other researchers to look for the related personality attributes of masculinity and femininity within thin slices. Several studies have confirmed that the masculinity and femininity of targets can be predicted from naïve observer judgments of thin slices (Bernieri et al., 1992; Cutting & Koslowski, 1977; Frable, 1987; Lippa, 1978).

c. Sexual Orientation. The previous section reveals that gender-related variables are accurately diagnosed from thin slices. We now turn our attention to a more complex and controversial variable—sexual orientation. Ambady, Hallahan, and Conner (1999) conducted a series of studies to examine the accuracy of judgments of sexual orientation from brief dynamic (10- and 1-s silent video clips) as well as static cues (still pictures of the participant). Heterosexual and homosexual participants were videotaped for 1 min discussing how they handled the competing demands of academic

and extracurricular activities. To ensure that the targets behaved as naturally as possible and were making no explicit attempt either to hide or to express their sexual orientation, participants were informed about the purpose of the study only after being videotaped.

A 10-s clip was created for each of the 25 participating targets by extracting the 25th through the 35th second of their recorded discussions. 1-s clips were extracted from the middle of the 10-s clip. Eight stills were selected by freezing frames every 700 ms from the middle 2 s of the 10-s clip. None of the discussions on the 10-s clips made reference to targets' sexual orientation. Heterosexual and homosexual undergraduates then rated the extent to which they thought the person on each clip or each set of stills was homosexual in one of three conditions: 10-s silent video, 1-s silent video, and 8 still pictures. Accuracy was significantly greater than chance for judgments based on 10- and 1-s clips. Judgments based on still pictures, however, were less accurate than chance.

In an attempt to examine how minimal the information transmitted for accurate detection could be, we created an outline white figure of each individual against a black background using a special effects generator. Sixteen judges rated 5-s clips of these outline figures. Accuracy of detecting sexual orientation was significantly above that expected by chance. Thus, exclusively gestural information is associated with fairly accurate judgments of sexual orientation.

d. Testosterone Level. In a series of studies, three hundred fifty-eight male and female college students whose testosterone levels had been previously assessed (a) entered a room, stood, and spoke to a video camera; (b) stood and talked with an experimenter; (c) sat and talked with an experimenter; or (d) sat and talked with a peer (Dabbs et al., 1999). In each of these conditions, the first few seconds of the context were extracted for a thin-slice analysis of behavior. Microcodings of behaviors as well as naïve observer assessments of certain interpersonal dimensions (e.g., friendliness, hostility, etc.) were made. The effects of testosterone were visible in these thin slices such that high-testosterone subjects entered the room more quickly, focused more directly on their targets, and looked more confident and independent. Thus, even variations in male hormones are potentially revealed in the careful analysis of a thin slice of behavior less than a minute long.

These data clearly suggest that in a real sense our personality pervades every aspect of our behavior and movement. Even within the simple and highly scripted act of entering a room, meeting an interviewer, and taking a seat, our core dimensions of personality manifest themselves and are revealed in the expressivity and style of our movements.

C. SUMMARY

Thin slices are useful in predicting outcomes in diverse areas of social life. These findings have important practical applications. For example, the finding that slices of doctors' voices postdict malpractice suits has serious implications for the selection and training of medical personnel. Table I presents a meta-analytic summary of the studies reported in this section by domain [excluding those reported in the Ambady & Rosenthal (1992) meta-analysis], and Table II presents a summary of the individual studies.

III. Perception of Thin Slices

A. RELIABILITY AND CONSENSUS

In the previous section, accuracy was operationalized as the correlation between raters' judgments and an outcome of interest. Another measure of accuracy that can be employed under some circumstances involves consensual accuracy or the agreement among judges (Funder, 1995; Kenny, 1994; Kruglanski, 1989). It can be argued that some psychological constructs (e.g., hostility, warmth, pleasantness, politeness, likability, etc.) must be defined from the perspective of social perceivers and their culture. For example, regardless of how friendly individuals try to be, or consider themselves to be, friendliness rests in the eyes of the beholder. If the world proclaims that an individual is behaving in an unfriendly or hostile manner

TABLE I
SUMMARY OF PREDICTIBILITY OF THIN SLICES
BY OUTCOME

Domain of criterion	Mean r
Performance while teaching	.45
Performance in the workplace	.39
Interviewing	.27
Health care outcomes	.18
Relationships	.27
Personality	.20
Sexual orientation	.58
Testosterone level	.20
Unweighted mean r	.25
Weighted mean r	.20

TABLE II
SUMMARY OF PREDICTABILITY OF THIN-SLICE JUDGMENTS BY STUDY

Domain of criterion	Study	Variables rated	Channel(s)	r	N	Z	p	Criterion
Performance while Teaching	Ambady (1999)	Warmth/interpersonal composite	Silent video	.451	25	2.25	.012	Average of student evaluations and learning
Performance in the workplace	Ambady, Hogan, Spencer, & Rosenthal (1999, Study 1)	Ratings of molar variables	Tone of voice	.362	12	1.22	.113	Ratings by superiors
Performance in the workplace	Ambady, Hogan, Spencer, & Rosenthal (1999, Study 2)	Ratings of molar variables	Tone of voice	.233	12	.727	.233	Ratings by superiors and sales performance composite
Performance in the workplace	Hecht and LaFrance (1995)	Positive affect	Tone of voice	.560	18	2.37	.009	911 operator call duration
Interviewing	Gada-Jain (1999)	Synchrony	Silent video	.266	29	1.40	.081	Average of rapport, personality, and hire recommendation
Health Care	Ambady, LaPlante, Nguyen, Chaumeton, Rosenthal & Levinson (1999)	Ratings of molar variables	Audio and tone of voice	.070	57	.72	.235	Malpractice claims against surgeons
Health Care	Ambady, LaPlante, Nguyen, Chaumeton, Rosenthal & Levinson (1999)	Ratings of molar variables	Audio and tone of voice	.063	53	.68	.248	Malpractice claims against physicians
Health Care	Ambady, Koo, Rosenthal, & Winograd (1999)	Ratings of NV and verbal variables	Video	−.005	51	−.04	.483	Various improvement outcomes
Health Care	Liggon, Weston, Ambady, Colloton, Rosenthal, & Reite (1992)	Ratings of molar variables	Tone of voice	.344	26	1.86	.032	NOFTT mothers

Health Care	Tickle-Degnen & Puccinelli (1999a)	Ratings of molar variables	Silent video	.294	44	1.87		Supervisor ratings of therapy student effectiveness
Health Care	Tickle-Degnen & Puccinelli (1999b)	Ratings of molar variables	Silent video	.152	44	.99		Supervisor ratings of therapy student effectiveness
Health Care	Rosenblum, Wetzel, Platt, Daniels, Crawford, & Rosenthal (1994)	Ratings of molar variables	Silent video	.277	36	1.10		Medical students' clinical grades
Health Care	Tickle-Degnen (1998)	Ratings of molar variables	Silent video	.227	34.3	.91		Supervisor ratings of therapy student effectiveness
Relationships	Ambady, Conroy, Tobia, & Mullins (2000)	Type of relationship	Silent video	.458	30	2.41	.011	Nature of cross-sex dyadic relationship
Relationships	Bernieri & Grahe (1998)	Rapport	Full	.162	41	1.05	.147	Rapport
Relationships	Bernieri, Gillis, Davis, & Grahe (1996)	Synchrony behaviors	Full	.281	50	1.98	.024	Rapport
Relationships	Gada, Bernieri, Grahe, Zuroff, & Koestner (1997)	Degree of love	Full	.139	48	.94	.173	Scores on love scales
Personality	Dabbs & Bernieri (1999)	NEO personality	Silent video	.14	40	.847	.198	Target self reports on NEO
Personality	Dabbs, Strong, Milun, Bernieri, & Campo (1999)	NEO ratings	Full	.185	148	2.22	.013	Target self report on NEO
Personality	Oltmanns, Turkheimer, Wagner, & Haury (1999)	NEO personality	Full	.202	229	3.04	.001	Personality disorders
Personality	Gangestad, Simpson, DiGeronimo, & Biek (1992)	Personality ratings	Silent video	.263	158	3.27	.001	Target self-reports

TABLE II *continued*

Domain of criterion	Study	Variables rated	Channel(s)	r	N	Z	p	Criterion
Sexual orientation	Ambady, Hallahan, & Connor (1999)	Sexual orientation	Silent video, outline figures, stills	.577	25	2.29	.011	Self-reported sexual orientation
Testosterone level	Dabbs, Strong, Milun, Bernieri, & Campo (1999a, Study 1)	NEO ratings	Full	.030	148	.36	.358	Testosterone
Testosterone level	Dabbs, Strong, Milun, Bernieri, & Campo (1999b) Study 1	Micro codings of behaviors entering room	Full	.131	97	1.29	.099	Testosterone
Testosterone level	Dabbs, Strong, Milun, Bernieri, & Campo (1999b) Study 2	Molar nonverbals	Full	.074	76	.64	.260	Testosterone
Testosterone level	Dabbs, Strong, Milun, Bernieri, & Campo (1999b) Study 3	Entry behavior	Full	.290	138	3.41	.0003	Testosterone
Testosterone level	Dabbs, Strong, Milun, Bernieri, & Campo (1999b) Study 4	Independence	Full	.460	18	1.96	.025	High or low testosterone

and reacts accordingly, then, in one real sense that behavior is unfriendly and hostile, regardless of the individual's motivations and internal states. One might say that the individual is correct and the world is in error, but it seems more parsimonious to argue that it is the individual, not the world, who needs to be corrected. In this case, consensus could be equated with accuracy. On the other hand, if many perceivers agree that a person who wears glasses is more intelligent than one who does not, then clearly, the perceivers are in error. In this second case, consensus should not be equated with accuracy. The difference is that the former example is one of perceptual identification (e.g., the world agrees to call the color of the daytime sky "blue") where reality is defined by consensus (Funder, 1995). The latter example is one of consensual hypothesis (e.g., thunder is the sound of the gods bowling up in the heavens) that can be proved false.

Regardless of their relationship with accuracy, the factors that moderate consensus are important to understand. How much do people agree in their judgment of thin slices? What variables do they judge most reliably and under what conditions? A meta-analysis examined the reliability of thin-slice judgments across different channels and different variables (Richeson & Ambady, 1999b). Five important determinants of interjudge agreement have been identified (John & Robins, 1993): (a) the trait being assessed, (b) the observability of the trait-relevant behaviors, (c) the social desirability of the trait, (d) the level of acquaintance between the judge and the target, and (e) individual differences in the judgability of the target person. We focused on the first two factors as they are most relevant to thin-slice research already conducted. Research on personality judgments has found that interjudge agreement is higher for certain variables than for others (Block, 1978; Funder & Dobroth, 1987; Norman & Goldberg, 1966). Specifically, this work has found that variables associated with Extraversion (such as being outgoing or talkative) exhibit higher interjudge agreement than variables associated with Emotional Stability (such as being anxious or irritable). Further, traits associated with more observable behaviors tend to have higher interjudge agreement than traits with less observable behaviors (John & Robins, 1993). For instance, Funder and Dobroth (1987) found that items in a Q-sort that were more observable were associated with higher levels of agreement among judges compared to less observable items.

Research on the accuracy of personality judgments, however, has been based mostly on ratings of people who know the target very well or people who have been exposed to the target for more than brief periods of time. For example, it is typical in studies assessing personality for targets to rate themselves on a number of personality scales and, in addition, for friends, family members, or close associates to rate targets on the same personality

dimensions. Even in studies in which strangers are used as judges, contact with the target typically exceeds 5 min and therefore provides substantially more exposure to a target than is provided in thin-slice studies. Hence, it is not clear whether the type of variable being examined (for instance, extraversion or emotional stability), or whether the observability of the variable, or whether both type and observability are associated with increased reliability of judgments from thin slices. To address these issues, a meta-analysis was conducted to investigate the relationship between the type of variable, the observability of the variable, and the reliability of thin-slice judgments.

The meta-analysis also considered the channel of communication because, as is apparent from our review of the predictive utility of thin slices in the previous section, the channels of behavior examined in studies using thin-slice judgments vary substantially. For instance, in some studies judges rate content-filtered audio clips of speech. In other studies, judges rate silent video clips. It is possible that the reliability of judgments might vary depending on the channels of communication being judged. It is also possible that certain variables may be more reliably assessed from some communication channels than from others. Thus, the meta-analysis also examined differences in the reliability of judgments associated with different channels of communication.

The meta-analysis included 26 studies, primarily from our respective laboratories and the laboratories of our collaborators.[1] We only included studies that (a) assessed variables from brief segments of expressive behavior (less than 5 min long), (b) correlated those judgments with some criterion and were therefore able to evaluate the accuracy of the judgments, and (c) employed naïve observers (see Appendix 1 for a complete listing of the studies included in the meta-analysis). For instance, in some studies, judges rated clips of physicians on variables such as anxiety, dominance, tension, warmth, or enthusiasm. The interjudge reliability (the reliability of a single judge) for each of these variables was extracted. For studies that reported the reliability of several judges, the interjudge reliability was calculated using the Spearman–Brown formula (Rosenthal & Rosnow, 1991). From 26 studies, the interjudge reliability for 45 variables was identified.

The 45 variables extracted from the studies were coded by three graduate student experts on nonverbal communication on two dimensions: (1) how much the variable tapped into affect and (2) how judgable or observable the variable was. These expert ratings were sufficiently reliable ($R = .90$ for affective ratings and $R = .89$ for observability ratings) and, therefore,

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[1] Often the reliability of single variables is not reported in published work; it was necessary to draw from studies for which we could obtain such ''unpublished data.''

the mean of the experts' ratings was used as an index of the "affectivity" and the "observability" of each variable. Based on previous research we hypothesized that the observability of the variable should influence the reliability with which it is judged. We also hypothesized that variables that tap affect should be judged more reliably. As expected, there was a positive correlation between ratings of affectivity and ratings of observability ($r = .60$). Although quite related, these dimensions do seem to be somewhat nonoverlapping. In order to examine the relationship between variable affectivity, observability, and reliability, the mean of the judges' ratings for each variable was computed and then correlated with the mean reliability of each variable, averaged across channels. Results suggested that affectivity of the variables only modestly correlated with reliability ($r = .23$), but observability correlated quite substantially with reliability ($r = .42$).

In order to examine affectivity and observability in tandem, the expert ratings were dichotomized via a median split to construct four diagnostic categories by which to classify the 45 variables: (1) observable and affective, (2) observable but not affective, (3) not observable but affective, and (4) neither observable nor affective. The number of variables falling into each category and their mean reliability were computed and are shown in Table III. The values presented in Table III can be interpreted as the expected correlation between judgments made by any two thin-slice observers sampled at random. As expected, variables assessed by our expert raters as observable did indeed have higher reliability than variables not rated as observable.

Variables rated as observable but not affective (e.g., active, competent) were associated with the highest interjudge reliabilities (mean $r = .27$). However, variables that were neither observable nor affective (e.g., analytical, self-perceptive) had the lowest mean reliability ($r = .18$). These findings suggest that observability is a key determinant of the reliability of thin-

TABLE III
RELIABILITY OF THIN-SLICE JUDGMENTS: AFFECTIVITY AND OBSERVABILITY
OF VARIABLES

Variable type	Observable	Nonobservable	Mean
	$n = 15$	$n = 9$	$n = 24$
Affective	.247	.218	.232
	$n = 7$	$n = 14$	$n = 21$
Nonaffective	.274	.175	.224
	$n = 22$	$n = 23$	
Mean	.261	.197	.233

slice judgments. But even variables that are not observable can be judged reliably as long as they tap into affect (e.g., loving). Interestingly, observable and affective variables (e.g., nervous) seem to be less reliably evaluated than observable but nonaffective variables (e.g., active). This finding seems somewhat counterintuitive, but corroborates research on personality judgment indicating that variables associated with extraversion have greater interjudge agreement than variables associated with neuroticism (Block, 1978; John & Robins, 1993). Perhaps both the personality literature and the present work assess a counterintuitive, yet important, determinant of judgment consistency. Variables that are readily identifiable by their associated behaviors tend to be observable but not affective. For instance, the rate of movement in a silent video clip or the frequency of utterance in a content-filtered speech segment provide enough information to judge a target's level of activity. Although the target may be accurately judged to be active, the explanation for this behavior may differ considerably between judges. For example, is the target angry? Or, is the target enthusiastic? Anger and enthusiasm are relatively more complex, affective variables that draw on some of the same underlying, nonaffective behavioral traits (activity). Hence, the stage of mapping an emotion or affective state onto readily observable behavior might be accompanied by a reduction in reliability.

Does the reliability of thin-slice judgments differ according to the channel of communication on the basis of which judgments are made? Of the 45 variables, 22 had reliability estimates for more than one channel of nonverbal communication. The mean reliability of each variable for each channel is shown in Table IV. As can be seen in the bottom row of Table IV, reliability was greater on average for judgments of full-channel clips that included both video and sound than on silent video clips. Silent video clips were judged more reliably on average than audio clips, which, in turn, were judged more reliably than content-filtered speech. Previous research has already documented the dominance of the video channel in nonverbal research (Noller, 1985). The present results furthermore suggest that, on average, variables used in studies employing thin-slice judgment methodologies are more consistently judged in the video compared to the vocal channels. Inspection of the mean reliabilities by the channel of communication, however, suggests that for certain variables, the opposite is true. For instance, judgments of activity, anxiety, and dominance were more reliable when based on content-filtered speech rather than silent video clips. Thus, it appears that the reliability with which different variables are judged differs according to the channel from which those judgments are made. These findings, while provocative, are based on a small number of studies and suggest the need for systematic studies to further probe these trends.

TABLE IV
RELIABILITY OF DIFFERENT CHANNELS: ONE JUDGE

Variable	CF	Audio	Silent video	Full
Active	.447	—	.392	.366
Anxious	.149	.060	.094	—
Attentive	.183	.030	.249	.460
Cheerful	.337	.478	—	—
Competent	.126	.164	.208	—
Confident	.241	.262	.293	—
Depressed	.273	.320	—	—
Dogmatic	.178	.093	—	.378
Dominant	.230	.210	.170	—
Emotional	.210	.169	—	—
Empathic	.170	—	.287	—
Enthusiastic	.276	.320	.435	—
Happy	.303	.396	—	.324
Honest	.139	—	.177	—
Hostile	.111	.202	—	—
Likable	.171	.188	.345	—
Loving	.164	.158	—	—
Optimistic	.205	.333	.428	—
Professional	.217	—	.216	—
Relaxed	.153	.111	—	—
Supportive	.150	.133	.337	—
Unstable	.149	.142	—	—
Warm	.176	.234	.372	.460
Mean	.208	.214	.289	.399

B. MODERATORS OF ACCURACY

Consensus among judges cannot be universally substituted for judgment accuracy. Thus, in this section, we discuss variables that moderate judgmental accuracy. These include person moderators such as the characteristics of judges and targets, cultural moderators, and contextual moderators.

1. Person Moderators

a. The Target: Who Is Being Judged? What are the attributes of people who are more accurately judged, that is, people who are more "legible"? Not much work has directly examined the attributes of people who are more accurately judged based on thin slices. In general, people who are more extraverted and more expressive are better encoders and are better judged in minimal interaction, zero-acquaintance settings (Ambady,

Hallahan, & Rosenthal, 1995; DePaulo, 1992; Kenny, 1994). In judgments of love and rapport, observers have been more accurate in assessing the self-reports of females than males (Bernieri & Grahe, 1998; Bernieri, Gillis, & Curtis, 1999; Gada et al., 1997). In addition, the personality judgment literature suggests that people who are better adjusted are more accurately judged (Colvin, 1993).

Most of the research has focused on the variables or traits that are most accurately judged. Of course, it follows that people who possess these traits to a greater degree should also be more legible than other people. As with reliability and consensus discussed in the previous section, studies on the accuracy of personality judgments, using self-reports as a criterion and peer and stranger ratings as predictors, have generally found that observable traits and behaviors are more accurately judged than less observable ones (Albright et al., 1988; Funder & Colvin, 1988; Kenrick & Funder, 1988; Kenrick & Stringfield, 1980; Koretzky, Kohn, & Jeger, 1978; McCrae, 1982; Watson, 1989). Thus, traits such as extraversion can be judged reliably and accurately from minimal acquaintance and from very little information in contrast to traits such as openness (Borkenau & Liebler, 1992; Funder, 1995; Funder & Colvin, 1988; Kenny et al., 1994). The Richeson & Ambady (1999b) meta-analysis revealed that observable characteristics are more reliably judged from thin slices than less observable characteristics. Based on these findings, thin slices may be most appropriate in predicting variables characterized by observability.

b. The Judge: Who Is the Judge?   What characteristics distinguish better judges from worse judges on thin slice judgment tasks? In a meta-analysis on the accuracy of person perception, Davis and Kraus (1997) found that people who are more accurate judges of others tend to be more intelligent, more cognitively complex, less dogmatic, better adjusted, and more interpersonally oriented. Whereas these findings were based on studies using the PONS as well as on studies using self-reports and peer ratings, accurate judges of thin slices seem to possess similar attributes.

Characteristics of individuals who score higher on the PONS have been examined in some depth (Rosenthal et al., 1979). People who score higher tend to be less dogmatic and Machiavellian and more democratic, extraverted, and socially adjusted than people who scored lower. In addition, people who perform better on the PONS tend to be rated as more interpersonally sensitive and more popular than people who perform worse on the measure by others who know them well such as their clients, teachers, supervisors, and spouses (Funder & Harris, 1986; Rosenthal et al., 1979). Further, several studies have found that both adults and children who have more successful interpersonal relationships are better decoders of nonverbal behavior (Baum & Nowicki, 1998; Boyatzis & Satyaprasad, 1994;

Funder & Harris, 1986; Gottman & Porterfield, 1981; Noller, 1980; Noller & Feeney, 1994; Nowicki & Carton, 1997). Depressed adults tend to be poor decoders of nonverbal behavior (Carton, Kessler, & Pape, 1999). In a similar vein, shyness and social anxiety have been associated with poorer performance on the Interpersonal Perception Task (Schroeder, 1995a, 1995b). These results suggest that people who are rated by others as more interpersonally skilled and as better socially and interpersonally adjusted should be better judges of thin slices.

Are better judges of thin slices also more intelligent? The relationship between intelligence and the accuracy of thin slice judgments is less consistent. While cognitive ability has been positively related to empathic accuracy (Davis & Kraus, 1997), other work suggests that intelligence is not related to performance on the Profile of Nonverbal Sensitivity (Rosenthal, Hall, DiMatteo, Rogers, & Archer, 1979) or the judgment of interactant rapport from thin slices (Bernieri & Gillis, 1995a).

Recent work suggests that individual differences in accuracy may vary extensively across judgment tasks and judgment contexts. For instance, a recent study, using the PONS (Rosenthal et al., 1979) and the IPT (Costanzo & Archer, 1989) in addition to two "in-house" thin slice judgment tasks involving rapport assessment (Gesn, Bernieri, Gada-Jain, & Grahe, 1999), revealed low intercorrelations between the four tasks (median $r = -.01$). Another study found that occupational therapy students in a pediatric rehabilitation setting who were judged to be better performers by clinical fieldwork supervisors scored higher on the PONS than their peers, whereas those judged to be better performers in a psychiatric rehabilitation setting scored higher on the accuracy of facial but not body cues on the PONS than their peers (Tickle-Degnen, 1998). Thus, people in different roles and contexts perform differently on different subscales (e.g. full body vs face only), suggesting that different elements of sensitivity may be context dependent. In general, individual difference moderators of accuracy should be discussed with respect to specific thin-slice judgment tasks.

2. Cultural Moderators: Where Are the Judges and Targets From?

Cross-cultural studies on the accuracy of judgments of others have, for the most part, examined the accuracy of judging emotions from still photographs which represent a static channel of communication (Ekman, 1994; Russell, 1994, 1995). Studies that have investigated judgments based on dynamic behavior suggest that culture can be an important moderator of accuracy of thin-slice judgments. For example, the PONS test was administered to over 2000 individuals from 20 nations. Americans were the most accurate judges, suggesting that people are most accurate at judging targets

from their own culture. Further, people from cultures more similar to the United States were more accurate than people from less similar cultures. Thus, cultures whose languages most closely resembled English performed better than cultures whose language was not quite so similar (Rosenthal et al., 1979). A recent study of rapport judgments, however, found cross-cultural consistency in judgments and also found that competency in English did not affect the accuracy of judgments (Bernieri & Gillis, 1995a; Bernieri et al., 1999b).

3. Context Moderators: Under What Conditions Is the Assessment Being Made?

Contextual factors play an important role in the accuracy of thin-slice judgments. Consider the trait of extraversion. Although extraversion can be judged fairly accurately from limited exposure to a target, the accuracy of judgment of extraversion increases when targets are observed in group rather than dyadic interactions (Kenny et al., 1994).

We would argue that thin-slice judgments are most accurate when the context is appropriate, ecologically valid, and diagnostic. For example, Dabbs et al. (1999) found that, of the Big Five traits, openness was the most accurately assessed from a 2-min slice taken from a diagnostic context: when targets were asked to talk about themselves in front of a camera. Earlier, we reported that openness was not easily judged from observing individuals in a face-to-face interaction. When people are talking about themselves in front of a camera, however, the situation pulls more for self-disclosure and openness. So within this diagnostic context, openness becomes more easily judged and thin-slice judgments of this trait are more accurate.

The diagnosticity of both the situation as well as the behavior in relation to the criterion is extremely important (Nisbett & Ross, 1980). Our intuition suggests that thin-slice judgments are constrained. Thin slices probably provide "circumscribed" rather than "global" accuracy (Swann, 1984) and thus are accurate only in relation to a particular context. When individuals are judged in similar situations, thin slices should provide reliable and valid information. At this point, we do not know how well such judgments generalize to other contexts. Thus, for example, will a person judged "warm" in a teaching situation also be judged "warm" when interviewing for a new job? Perhaps the likelihood of being judged "warm" in both situations depends on the extent to which warmth is a dispositional quality.

Subtle differences in the context have been shown to have profound differences in accuracy. In one study (Gesn et al., 1999), judges rated the

rapport within thin slices of 37 dyads involved in debates. Then, a week later they rated the rapport within the very same 37 dyads having a cooperative discussion that involved them planning a fantasy trip around the world together. Accuracy of judging rapport within one context correlated negatively with judgmental accuracy in the other context. One possible explanation for this result is that judges may have had stable differences in how they judged rapport. For some judges, their implicit judgment policy worked better within the debate context, whereas for others, their judgment policy worked better within the cooperative contexts.

In much of our social life, it seems reasonable to conjecture that actions and behavior do convey information about dispositions, skills, motivation, affect, and personality. Indeed, as some have suggested, the fundamental attribution error and the tendency to make correspondent inferences may often produce accurate attributions and judgments in certain contexts (Funder, 1987, 1995; Jussim, 1993). Of course, thin-slice judgments are prone to errors arising from impression management tactics and blatant deception, but these very same tactics might also be extremely diagnostic in certain circumstances. Consider the case of the car salesman overly concerned with impression management. Although thin-slice judgments might not accurately predict how good a friend he is going to be, such judgments should be able to predict his sales ability because impression management is an important attribute in being able to sell cars. Thus, appropriate contexts seem to be extremely important for the validity of the judgments from thin slices.

If predictions are being made across domains and contexts, then behavior should be sampled and judged in all the relevant contexts. Traits and behaviors to be judged should be carefully selected because certain traits are only revealed in and are relevant only to certain situations (Allport, 1966; Bem & Funder, 1978; Epstein, 1979; Funder & Dobroth, 1987; Kenrick & Funder, 1988; Kenrick, McCreath, Govern, King, & Bordin, 1990). For example, the low validity of unstructured interviews in predicting job performance, college success, and professional success (Hunter & Hunter, 1984) could, perhaps, be attributed to the inadequate sampling of truly relevant behaviors (Ross & Nisbett, 1991). Therefore, both the relevance and ecological validity of the behavior as well as the outcome measures are important for accurate prediction. To the degree that situations overlap and individuals are consistent in their style of behavior across different situations, these predictions probably can be generalized across situations (Allport, 1937; Epstein, 1979; Kenrick & Stringfield, 1980). Clearly, the cross-situational generalizability of thin-slice judgments needs to be further examined.

C. SUMMARY

Expressive people are more reliably and accurately judged from thin slices. More accurate judges of thin slices tend to be better socially adjusted than less accurate judges. But the skills and abilities associated with accurate judgments tend to vary depending on the judgment task. Cultural factors can affect both accuracy and accessibility of constructs associated with thin-slice judgments. Finally, thin-slice judgments are context dependent and possess circumscribed accuracy. At this point, we do not know whether these judgments can be generalized across different situations with different criteria. Having reviewed the role of important moderators on the accuracy of thin-slice judgments, in the next section we discuss the cognitive and affective mechanisms that influence the processing of information from thin slices of the behavioral stream.

IV. Processes and Mechanisms Underlying Thin-Slice Judgments

A. AUTOMATIC VERSUS CONTROLLED COGNITIVE PROCESSES

Several dual-process models of social cognition suggest that person perception consists of two stages. The first is a relatively automatic, evaluative stage, involving minimal cognitive processing, whereas the second is a more controlled, deliberative stage involving more elaborate cognitive processing and effort (Anderson et al., 1996; Chaiken, Liberman, & Eagly, 1989; Eagly & Chaiken, 1993; Fazio, Sanbonmatsu, Powell, & Kardes, 1986; Fiske & Neuberg, 1990; Gilbert & Krull, 1988; Gilbert, Pelham, & Krull, 1988; Trope, 1986). The initial evaluative stage is likely to be more prominent in thin-slice judgments because of a combination of the brevity of the stimuli being perceived and the nature of the information being conveyed.

Recent work in the area of social cognition suggests that initial perceptual appraisals, particularly those involving an evaluative component, are automatic processes requiring few cognitive resources (Anderson, Krull, & Weiner; 1996; Devine, 1989; Fiske & Neuberg, 1990; Neuberg, 1988; Srull & Wyer, 1979; Tesser & Martin, 1996). Such automatic processes include classifying behaviors rapidly in terms of traits and accessible constructs (Carlston & Skowronski, 1994; Higgins & Bargh, 1987; Smith & Lerner, 1986; Uleman, Newman, & Moskowitz, 1996), stereotyping (Greenwald & Banaji, 1995), and making dispositional inferences (Gilbert & Krull, 1988; Gilbert, Pelham, & Krull, 1988). In particular, processes that involve affec-

tive perception and evaluation occur rapidly (Bargh, 1996; Murphy & Zajonc, 1993; Pratto, 1994). As Zajonc (1980) argued in his classic paper, "preferences need no inferences," affective evaluations occur rapidly without conscious processing. Similarly, social categorization according to visible and marked categories, such as gender, race, and age, occurs automatically, within milliseconds of encountering a target (Banaji & Hardin, 1996; Blair & Banaji, 1996; Devine, 1989; Fazio, Jackson, Dunton, & Williams, 1995; Fiske, 1998; Wittenbrink, Judd, & Park, 1997; Zarate & Smith, 1990).

Social psychological processes that are considered to be automatic generally possess one important characteristic: they are efficient, meaning that they require minimal resources and can be processed in parallel with other tasks (Bargh, 1994, 1996; Devine, 1989; Neuberg, 1988; Srull & Wyer, 1979). Thus, such processes are not vulnerable to informational load, time pressure, and distracters (Bargh & Pietromonaco, 1982; Shiffrin & Schneider, 1977; Treisman & Souther, 1985). Controlled cognitive processes, on the other hand, are mental acts that (a) are intentional and conscious, (b) can be controlled, and (c) require effort (Bargh & Chartrand, 1999). Thus, there are several ways in which one can investigate the automaticity of thin-slice judgments.

1. Awareness

Are individuals aware of the process by which they assess the ongoing behavioral stream? Can people report the factors that contributed to their final judgment? Anyone who has ever debriefed a participant in an interpersonal perception study can tell you that people have little trouble reporting the factors that led to their judgment. The problematic issue, however, lies in the validity of these reports. The research bearing directly on this matter is sparse but does indicate that our awareness of our own thin-slice judgment process is minimal.

In a study of rapport judgment (Bernieri et al., 1994) participants were asked to report how important each of several behavioral cues were in making their judgments. Perceivers were not able to report accurately how features of the behavioral stream contributed to their judgments. Their reports of their judgment process (indications of how much they relied on a given cue) did not agree with their actual judgment process (how much their judgments covaried with the expression of the cues). In another study, Grahe and Bernieri (1998) reported that judges' awareness of the cues driving their judgment decreased as the cues became more concrete and specific. For example, judges were more accurate in stating that their judgments of rapport depended on a target's level of friendliness than in stating that their judgments were determined by the amount of smiling.

Thin-slice judgments may not be exclusively unconscious. People can be aware of their use of nonverbal cues (Smith, Archer, & Costanzo, 1991). The relationship between their confidence and their accuracy of judgments, however, is generally quite low (DePaulo, Charlton, Cooper, Lindsay, & Muhlenbruck, 1997). And, furthermore, although people may be aware of using behavioral cues in their intuitive judgments, they are often unable to articulate or control their processing (Smith, et al., 1991).

2. Control

Can individuals deliberately control and alter their judgment process according to specific instructions? Some studies have failed to demonstrate that accuracy from thin slice displays could be improved through judgment process instruction (Costanzo, 1992; Hoffman, 1964; Rosenthal et al., 1979). More recently, Gillis, Bernieri, and Wooten (1995) attempted to instruct judges precisely how to assess rapport accurately within the thin slices they observed. Half of the participants made judgments from thin slices. The others were given quantified, graphically displayed values for each of five features within each clip previously identified as either valid but underutilized cues, such as mutual silence and proximity, or as invalid but overutilized cues, such as smiling and expressivity, in judging rapport (Bernieri et al., 1996). Participants were asked to judge the self-reported rapport on the basis of this abstracted, quantified, and graphically displayed information. Table V displays the results. Those participants who considered the quantified and graphed information, but not those who just viewed the video clips, were able to alter their judgment polices according to instructions. Thus, it seems that people can be taught to use valid cues and ignore invalid ones when making thin-slice judgments.

3. Distraction and Deliberation

Are thin-slice judgments subject to capacity limitations? An automatic process is immune to conditions that normally tax cognitive and attentional processing. For example, placing participants under an attentional or cognitive overload is thought to prevent conscious and controlled processing by limiting cognitive capacity (Gilbert 1991, 1993; Wegner, 1992, 1994). Using a cognitive load manipulation, Ambady (1999b) found that load did not disrupt the accuracy of judging teacher effectiveness or the accuracy of judging the relationship between opposite-sex dyads.

An informative pattern of relevant findings was reported by Patterson and Stockbridge (1998), who asked half of their perceivers to make intuitive

TABLE V
CORRECT CHANGES IN JUDGMENT POLICY OF RAPPORT AFTER INSTRUCTION AS A FUNCTION OF
INFORMATION PRESENTATION: THIN-SLICE VIDEO DISPLAYS VERSUS ABSTRACT GRAPHICAL/
VERBAL PROTOCOLS

		Correct change in cue dependency after instruction	
	Actual relationship of cue to criterion	Graphical display	Thin-slice video display
Invalid cues			
Expressivity	.17	+.39*	+.12
Smiling	−.03	+.50*	+.07
Valid cues			
Silence	−.36*	+.08	.00
Female gestures	.44*	+.52*	+.13
Proximity	.28*	+.09	−.11
Mean cue use correction		+.32	+.04

* $p < .05$

initial impressions and the other half to pay attention to specific details and cues within the thin slices observed. Here, cognitive load increased accuracy for those asked to make the intuitive judgments but decreased accuracy for those making judgments analytically (i.e., attending to and processing specific cues).

Interestingly, increased attention and capacity devoted to an automatic process is thought to reduce the effectiveness of the process. That is to say, the application of cognitive resources to otherwise-effective automatic judgments can reduce accuracy (Dunning & Stern, 1994; Gilbert & Krull, 1988; Greenwald & Banaji, 1995; Schooler & Engstler-Schooler, 1990; Vallacher & Wegner, 1987; Wilson, Hodges, & LaFleur, 1995; Wilson & Schooler, 1991). For example, the verbalization of the mental content of tasks that call for nonverbal processing, such as facial processing, has been found to disrupt processing and performance (Schooler & Engstler-Schooler, 1990). Using this line of reasoning, participants were asked to judge teachers under a reasons-analysis condition, in which they were asked to generate reasons to support their judgments (Ambady, 1999b). These participants performed significantly worse than controls or participants under cognitive load. Similar results were found for participants asked to judge the relationship between members of a dyad who were friends, strangers, or lovers.

Perhaps under deliberative conditions, people attend to the wrong or irrelevant information. Murphy and Balzer (1986) found evidence suggesting that this might be the case. College students made judgments of teachers on a number of dimensions such as organization and clarity from videotapes either immediately after viewing them or on the next day. When their judgments were compared with those of "expert" rater graduate students, participants who made judgments after the delay were more accurate than those who made judgments immediately after viewing the clips. Judgments made on the next day were less hampered by irrelevant or misleading detail and were likely driven by larger global gestalt impressions. Indeed, further analysis indicated that with the delay, ratings converged with the criterion on relatively important dimensions but not on unimportant dimensions. The results are reminiscent in some respects to the findings by Meehl (1954), who suggested that people have a tendency to "over fit the model" in their clinical assessments of others in their zeal for accuracy. We can easily imagine, too, that thin-slice observers who are eager to hit the nail on the head might chronically fall in to the trap of overestimating the importance of an idiosyncratic and vivid cue (e.g., a cough, a scratch, a certain gesture or utterance, etc.).

Thus, tasks that tax cognitive resources, such as rehearsing a series of numbers, do not seem to impede the accuracy of thin-slice judgments. In contrast, thin-slice judgments suffer when information is processed more deliberately, such as under conditions when people have to come up with reasons and justifications for their judgments.

4. Effort

Are thin-slice judgments made effortlessly? Automatic processes, being more or less effortless, should not succumb to the effects of fatigue. At least one study has examined whether accuracy declined with fatigue (Bernieri & Gillis, 1994). This was done after several participants in previous experiments spontaneously complained that the judgment tasks ran too long. A separate thin-slice judgment accuracy coefficient was calculated for every 10 slices judged, which represented one-fifth of the total judgment task. It was predicted that, at some point, subsequent accuracy coefficients would begin to decline as fatigue and boredom set in. Contrary to expectations, however, no interpretable pattern of accuracy over time was observed. In addition to accuracy, interjudge agreement shows little evidence of varying due to practice or fatigue (see also Bernieri, 1988).

A follow-up study created a 37-item version of the original 50-item stimulus tape. The properties of the shortened stimulus tape in terms of criterion variance and the ecological validities of the micro and macro cues

were equated with the original tape. The 20% reduction in length was intended to reduce fatigue and was expected to increase accuracy of judgments. No such increases were observed despite the fact that participants reported fewer complaints about the length and/or boredom of the task during debriefing (Bernieri et al., 1999a; study 1).

Additional evidence suggests that the accuracy of thin-slice judgments is not susceptible to monetary incentives. Monetary incentives used to increase accuracy by increasing motivation have shown little impact on accuracy. In one study, participants were informed that of the 100 or so participants who would judge rapport, the 10 most accurate judges would receive $5 and a chance to win $100 that would be given randomly to one of these 10 (Bernieri & Gillis, 1994). Although this offer generated a good deal of enthusiasm and effort on the part of participants, no increase in accuracy was observed for this sample. The same general procedure failed to increase scores on the PONS (Bernieri, 1988) and the IPT (Gada, Bernieri, & Grahe, 1996). Similar results were found by Ambady (2000) in a study examining the effects of a monetary incentive on the accuracy of judging teaching effectiveness and the relationship between opposite-sex dyads from thin slices. In sum, there is little evidence that effort affects thin-slice judgment data despite the fact that observers, or, more accurately, experimenters observing the observers, may suspect their presence.

5. Summary

In the studies reported above, thin-slice judgments were not normally affected by motivation, effort, or cognitive load. The process by which judgments are generated may not be directly accessible to judges. Furthermore, this process may be difficult to alter and control. Overall, the research points to thin-slice judgments as being typically, though not necessarily exclusively, an automatic rather than controlled process. An important theme in future research will be to understand more fully how this automatic versus controlled distinction impacts the judgments of thin slices both in terms of normal day-to-day social perceiving and in the initial development of an individual's implicit social perception policies.

B. AFFECTIVE MECHANISMS

1. State-Related Affect

Induced mood has received considerable empirical attention, particularly over the past decade. Performance has been assessed on a wide range of

activities, from physics problems (Isen, Means, Patrick, & Nowicki, 1982), to analytic tasks (Melton, 1995), to resource dilemmas (Knapp & Clark, 1991), to interpersonal problem-solving tasks (Mitchell & Madigan, 1984), and to creative tasks (Isen, Daubman, & Nowicki, 1987).

Some authors propose that moods may induce different processing styles and thus the influence of mood may depend, in part, on the type of task involved (Hirt, Melton, McDonald, & Harackewicz, 1996; Sinclair, 1988; Forgas, 1992). For instance, Hirt et al. (1996) suggest that positive mood may enhance performance on creativity tasks, yet impair performance on tasks requiring more detailed, systematic processing. Further, they argue that negative mood states are conducive to more systematic processing. In a similar vein, Sinclair (1988) argues that negative (or depressed) mood states may lead to processing strategies that result in less error. Work by Forgas (1992) suggests that different moods induce different processing styles; happy moods were associated with less systematic attention to stimulus details and poorer recall, whereas negative moods were associated with better recall and more systematic processing of stimulus information.

Although there is less evidence regarding how mood influences interpersonal perception, there is some indication that induced mood influences the nature of impression formation judgments. For example, induced mood can increase the extremity of positive and negative judgments made by children (Forgas, Burnham, & Trimboli, 1988). The idea of mood congruency in social judgments has also received some empirical support. For example, Forgas and Bower (1987) report that happy subjects formed more favorable impressions and made more positive judgments than did sad subjects. Mood also appears to influence what information is attended to and how it is evaluated (Bower, 1991; Clore & Parrott, 1991; Fiedler, 1991; Forgas, 1992; Forgas & Bower, 1987; Forgas, Bower, & Krantz, 1984; Isen, 1984; Schwarz & Bless, 1991).

How might induced mood influence accuracy in interpersonal perception based on minimal information? At this point, evidence supporting a particular association, although sparse, is intriguing. Work associating positive moods with less systematic processing (Forgas, 1992; Sinclair, 1988) suggests that positive moods should be associated with improved accuracy in interpersonal perception. Ambady (2000) examined the differential effects of mood on thin-slice judgments of teacher effectiveness and dyadic relationships. Positive and negative moods were induced by having subjects watch a 5-min film clip (Gross & Levenson, 1995). Interestingly, the positive mood condition was associated with improved accuracy in judging both teacher effectiveness and the type of dyadic relationships, compared to a control group. Negative mood was associated with decreased accuracy compared to a control group with no mood induction. Thus, it seems that positive

affective states facilitate and negative affective states impede the accurate processing of thin slices.

2. Trait-Related Affect

Whereas temporary, experimentally manipulated positive moods increase the accuracy of thin-slice judgments, a mixed pattern of results emerges for stable, chronic affective traits. Shyness and social anxiety were negatively correlated with performance on the Interpersonal Perception Task (Schroeder, 1995a, 1995b). This might lead one to expect that negative mood related traits would lower judgment accuracy. Work on depressive realism suggests, however, that depressed people should be more accurate in their judgments of others (Alloy & Abramson, 1979, 1982). Chronic negative states, such as depression, have been associated with increased accuracy of judgment, particularly for negative stimuli (Bargh & Tota, 1988; Ruehlman, West, & Pasahow, 1985). For judgments of rapport, Bernieri and Gillis (Bernieri & Gillis, 1993; Gillis & Bernieri, 1993) found that moderately or mildly depressed participants were slightly more accurate than normal participants. Furthermore, depressed observers were more likely to track the negative partner in the dyad, suggesting schematicity for negative information. While some studies have found a similar decoding advantage associated with depression (Giannini, Folts, & Fiedler, 1989; Pietromonaco, Rook, & Lewis, 1992), others have reported a decoding disadvantage (Giannini et al., 1995; Aube & Whiffen, 1996; Russell, Stokes, Jones, Czogalik, & Rholeder, 1993; Zuroff & Colussy, 1985), and still others have reported no differences between depressives and normals (Prkachin, et al., 1977).

Perhaps the severity of depression is relevant here. It is possible that severe depression might be associated with poor thin-slice judgments, whereas mild or moderate degrees of depression might be associated with increased accuracy. Another possibility is that the exact effect of depression interacts with the particular construct being assessed.

C. PERCEPTUAL MODELS

Having reviewed potential cognitive and affective mechanisms underlying thin-slice judgments, below we review two different perceptual models that provide insights into the processes underlying thin-slice judgments.

1. Brunswik's Lens Model: A Framework for Description

Egon Brunswik (1956, 1966) argued that perceivers are often trying to apprehend a "distal" environmental variable, one that is not directly

observable (i.e., an intrinsic property of some stimulus target). The perceiver has only imperfect indicators of that variable. The identification of an indicator gives the perceiver only probabilistic information regarding the presence or future presence of the variable. But although no indicator or cue is a perfectly reliable predictor of the distal variable, typically there are several cues available for determining its status. The perceiver's task is to combine information from these uncertain sources to reach the best estimate of the criterion.

Heider (1958) proposed Brunswik's scheme as a basic model of interpersonal perception in that it took account of the perceptual arc linking two end points: the object or person to be perceived and the percept itself, the way the object appeared to the perceiver. Klaus Scherer (1977, 1978) observed that the model was especially appropriate for the study of nonverbal behavior because it involved the expression, information transmission, and impression aspects of the communication process. He applied the model to the ecology of vocal tones, examining the extent to which such tones served as cues to emotional states. The application of the lens model in thin-slice research has provided intriguing demonstrations of the wealth of psychological information that has yet to be mined (Gillis & Bernieri, in press).

In particular, the lens model approach to the perception of rapport based on thin slices has led to precise microcodings of such theoretically relevant dimensions such as proximity, interactional synchrony, and posture that strongly predict rapport (Bernieri et al., 1996). While perceiver judgments have shown little sensitivity to changing cue validities (Bernieri et al., 1996) and remain influenced by a small set of stereotypical cues (Gillis et al., 1995), the lens model is sensitive to diagnostic cues that vary slightly across situations in response to changing interaction goals and physical constraints (Bernieri et al., 1996). Thus, Brunswik's lens model, by integrating the perceiver, the target, and the mediating cues, provides a theoretical framework and methodological structure that allows an investigator to examine thin slices with a degree of precision and perspective that reveals the wealth of information contained within a few brief seconds of expressive behavior.

2. Gibson's Event Action Approach: A Framework for Explanation

In contrast to the largely descriptive lens model above, the ecological approach to interpersonal perception is most relevant for understanding accuracy or responsivity to thin-slice stimuli. Fairly recently, James Gibson's (1979) ideas on ecological perception have been extended to social psychological phenomena (Baron & Boudreau, 1987; Baron & Misovich, 1993; McArthur & Baron, 1983).

The central idea from this perspective involves the notion of *affordances,* which are, in simple terms, the experience opportunities a perceiver has with any given stimulus or target. For example, a glass of water has an affordance of ''drinkability,'' a chair offers an affordance of ''can be sat upon,'' and a nurse in uniform might provide an affordance of nurturance. Whereas affordances are assumed to be genuine properties inherent within objects and organisms, they are, by no means, perceptible to all living things or individuals. An organism must have an *attunement* to a specific affordance in order to perceive it. The attunement to any given affordance is believed to be a function of the importance that affordance has to the organisms' survival and well-being. Thus, small pointed pieces of sea shells on a beach are perceived as hazards to be avoided by the barefoot human walking among them because they are affording the experience of pain, if not lacerations and punctures. To the hermit crab, however, these very same human hazards may be perceived to afford enormous protective potential as prized building materials for its home. Attunements vary within species as well, and are a function of development and prior experience. Adults, therefore, perceive their car keys as a necessary means to start their car, whereas 6-month-old infants may simply see them as offering an opportunity to mouth and gum.

The notion of affordances and attunements has been employed often in the discussion of thin-slice findings as a way to understand why we can perceive the things that we do (Zebrowitz, 1990). It is argued that humans are attuned to various social affordances relevant to survival and ultimately reproductive success (Baron & Boudreau, 1987). Thus, humans are astute at perceiving the human form in thin-slice point-light dynamic displays of motion (Johansson, 1973). We can perceive attributes such as gender (Bernieri et al., 1992; Cutting & Koslowski, 1977; Frable, 1987), sexual orientation (Ambady, Hallahan, & Conner, 1999), acquaintanceship (Cutting & Koslowski, 1977), power (Montepare & Zebrowitz-McArthur, 1988), and the intention to act (Runeson & Frykholm, 1983) because the perceptions of these affordances have survival value.

Certain attunements appear consistent across cultures. In a cross-cultural study on personality judgments, Chinese and American participants showed high levels of consensus in their judgments of the extraversion of Chinese and American targets, suggesting that extraversion is afforded through facial appearance (Albright, Malloy, Dong, Kenny, & Fang, 1997). Members of diverse cultures might be attuned to such information, perhaps because extraversion signifies social orientation, an adaptive function. The perception of rapport also seems to be similar across cultures (Bernieri & Gillis, 1995b; Bernieri et al., 1999b). Other attunements, however, appear to be culture specific. In a study on the judgment of status cues, Koreans were

more accurate than Americans. Koreans might be more attuned to status because of their hierarchically structured culture (Ambady & Hecht, 2000).

These ideas can be extended and used to understand the individual differences observed in thin-slice research. The general principle is that the needs of an organism will help to influence the nature and sensitivity of the various attunements that develop over time, and can even affect the attunements operating within a given situational context. For example, individuals who are powerless to the will of stronger others may exhibit attunements to various precursors of threat and harm, such as anger, irritability, aggressiveness, and other forms of negative affect as well as the precursors to impending altruistic or nurturing behaviors. If individuals cannot impose their will onto others directly and forcefully, then the next best thing is to possess the means to do so indirectly. A powerful and controlling individual would have less need to be attuned to emotional affordances because their perception would be less relevant to their achieving interpersonal goals, which could be gained through sheer force (Baron & Boudreau, 1987; Hall & Halberstadt, 1994).

The ecological approach to person perception, then, provides the theoretical background to generate a vast array of experimentally testable hypotheses concerning the perception and judgment of thin-slice stimuli. In general, individuals who have prior experience interacting with a given attribute in their social environment and who either (a) have a chronic need to be able to assess this attribute or (b) have a transient need to assess this attribute given the present context should be more attuned to variations in the relevant affordance and its associated behavioral manifestations. It follows, then, that their thin-slice judgment accuracy will be greater than those of other individuals who have less experience with, and less of a need to assess, the attribute.

D. SUMMARY

We have discussed the thin-slice judgment process from different perspectives, all of which are well known in the social cognition literature. In fact, it is important to note that the thin-slice judgment process is not a unique process at all. The processes involved should be the same as those already posited to occur generally with respect to the perception and judgment of others, the only difference being the relatively constrained nature of the stimuli to be judged. The next two sections discuss in more depth the theoretical and methodological boundaries of thin-slice judgments.

V. Boundaries and Limitations of Thin-Slice Judgments

Thin slices of the behavioral stream contain information relevant to, and predictive of, a potentially large number of personality and social psychological constructs. But such judgments are bounded. For example, thin-slice judgments are predictive and accurate only to the extent that relevant variables are observable from the thin slice sampled. As an illustration, consider the variables that distinguished superior from average consultants and marketing managers in the study discussed earlier (Ambady, Hogan, Spencer, & Rosenthal, 1993). Thin-slice judgments of observable variables such as warmth and perceptiveness that tap interpersonal functioning predicted performance effectiveness, in contrast to thin-slice judgments of noninterpersonal, task-related variables such as perseverance or being analytical. The information diagnostic to constructs such as perseverance and analytical ability is more likely revealed through completed actions and behavioral events that unfold over a relatively long period of time than information that is revealed within 30 s of expressive behavior. Below we discuss some additional boundaries and limitations of thin-slice judgments.

A. ABSTRACTION LEVEL OF THE CONSTRUCT BEING JUDGED

The constructs accessible from thin slices vary in the extent to which they refer to unambiguously defined objective referents. For example, a clip of two people interacting could be assessed in terms of (a) the average physical distance separating them measured at 10-s intervals; (b) the specific behaviors such as their posture configuration, smiles, and gaze; (c) the general impression of each target's apparent ''friendliness'' or the overall friendliness impression of the dyad; or (d) a judgment as to the quality and nature of the relationship that exists between them (i.e., friend, stranger, colleague, etc.). In general, judgments of impressionistic, fuzzy, molar variables related to affect and interpersonal functioning have yielded more accurate judgments than have quantitative assessments of microlevel behavior such as smiles and nods. This is because the same specific behavior might signal very different types of affect. As Brunswik (1956) argued long ago, our ecologies contain cues that are correlated imperfectly with the distal environmental variable a perceiver is attempting to apprehend. Heider (1958) referred to this phenomenon as ''ambiguous mediation'' (see also, Tolman & Brunswik, 1935). Consider the smile. A smile, depending

on the context and accompanying behavior, may signal warmth, anxiety, or, hostility (Ambady & Rosenthal, 1993).

The results of one lens model analysis suggested that perceivers may not be as sensitive to microcoded cues (e.g., head nodding) as they are to the more abstract macrocoded cues (e.g., partner responsivity) that are inferred from the microcoded cues in judging rapport from thin slices (Grahe & Bernieri, 1998). Thus, although individual cues can contradict each other within a given social context, observers can still glean meta-messages from overall behavior. The more abstract molar judgments, by directly assessing such latent constructs as warmth, anxiety, or hostility, capture the overall gestalt impression conveyed in the slice.

B. NONVERBAL VERSUS VERBAL CONTENT

Does the validity and accuracy of thin-slice judgments vary depending on whether purely nonverbal information or both verbal and nonverbal information are available to judges? Earlier meta-analytic work suggested that the inclusion of verbal information did not increase the accuracy of judgments (Ambady & Rosenthal, 1992). More recently, Grahe and Bernieri (1999) have shown that thin-slice judgments based purely on non-verbal information (silent video clips) are more accurate in predicting rapport between members of dyads than are judgments based on both nonverbal and verbal information. But counterexamples can also be found. For example, one study indicated that key words in dyadic conversation (e.g., emotion words, the use of present tense, self-referents, etc.) communicated more important information about the competency, dominance, and warmth of the target than did nonverbal information (Berry, Pennebaker, Mueler, & Hiller, 1997).

At least two factors contribute to the relevancy of nonverbal versus verbal information in thin-slice research. First, the relevance of the nonverbal and verbal channels is necessarily related to the psychological construct being assessed and the nature of the key diagnostic indicators and communication mediators associated with the construct. For example, dyad rapport may be a construct that is chronically revealed throughout the behavioral stream. Studies have established a robust association between perceived rapport and such features as interpersonal proximity, synchrony, and forward lean (Tickle-Degnen & Rosenthal, 1990), all of which can be reasonably sampled within thin slices. Other constructs, such as openness to experience, may be less likely to be manifested in expressive behavior. As suggested by the meta-analytic results presented earlier in this chapter, some constructs are more observable than other constructs.

Second, a thin slice normally does not contain enough verbal information to adequately assess the content of a target's cognitions and schemas. The utility of content analysis of verbal behavior as a tool to assess mental structures is undeniable. But it is precisely here where thin slices are most limited. For instance, thin slices might not provide a large enough sampling of verbal behavior to adequately estimate inner motivations and desires of a single target, let alone those of a dyad or of a small group. But, again, exceptions exist. Thus, one study found that judgments of written transcripts of thin slices (30–50 words) of patients' speech in psychotherapy sessions on variables such as helplessness, anxiety, and hostility, predicted the onset of psychological and somatic symptoms such as migraine headaches, momentary forgetting, depression, and phobic behavior. Interestingly, ratings of 300- to 400-word transcripts yielded less significant results (Luborsky, 1996).

It is important to note that we are not arguing a position of universal exclusion of verbal variables within thin-slice research. Clearly, verbal content is critical for the expression and communication of a vast array of psychological constructs and relationships (e.g., Archer & Akert, 1977; Berry et al., 1997). Instead, we are arguing that psychological constructs differ across contexts in the channels through which they are revealed, mediated, and communicated to others and, often, the context under investigation might not be conducive to a thin-slice analysis of verbal behavior. So far, research findings suggest that nonverbal behavior may be relatively more important than verbal behavior: (a) in the expression and communication of spontaneous affect (e.g., Argyle, Salter, Nicholson, Williams, & Burgess, 1970), (b) in the assessment of self-presentation and communication motives (e.g., DePaulo, 1992), (c) in the expression and communication of rapport and the related trait of extraversion (e.g., Funder & Colvin, 1988; Levesque & Kenny, 1993), and (d) when perceptions are based on thin slices of behavior (Ambady & Rosenthal, 1992). More work needs to be done, however, before we can begin confidently to map out the behavioral ecology of thin-slice judgments.

C. EXPERTISE OF THE THIN-SLICE JUDGE

Are experience, competency, and familiarity with a domain necessary for valid judgments? Again, the psychological domain will be a likely factor. In examining the accuracy of judgments of sexual orientation, Ambady, Hallahan, and Conner (1999) speculated, based on the popular literature on sexual orientation (e.g., Di Lallo & Krumholtz, 1994), that homosexual judges, in comparison to heterosexual judges, might show greater accuracy

in their judgments of sexual orientation because of greater domain familiarity and accessibility. Indeed, this was found to be true for extremely thin-slice judgments of 1 s and less, but the advantage disappeared at the longer clip length of 10 s (Ambady et al., 1999). In another study examining the accuracy of judging sexual orientation, judgments were made by observers from a different culture. Silent videoclips were rated by a sample of South Asian Indian women who had grown up in a conservative environment with little exposure to homosexual exemplars. Their accuracy of judgment was below chance levels (Ambady, Dudkin, & Hallahan, 1999). The studies suggest that an observer's direct experience with the psychological construct being assessed can moderate judgment validity.

A third study underscores the role of accessibility and familiarity in thin-slice judgments. A great deal of theory and research suggests that people from Western cultures tend to be more individualistic and independent in their orientation and values, whereas individuals from Eastern cultures tend to be more collectivistic and interdependent (Fiske, Kitayama, Markus, & Nisbett, 1998). It was hypothesized that these orientations would be related to greater accuracy of judgments related to culturally determined accessible constructs. In order to test this hypothesis, Korean and American students were presented with a computer task in which they were shown brief clips of Koreans and Americans talking to another target (a superior, subordinate, or a peer). Participants were asked to indicate the status of the person whom they thought the target was addressing. We hypothesized that Koreans should be more accurate as well as respond faster on this task because of the hierarchical orientation of their culture (Ambady, Koo, Lee, & Rosenthal, 1996; Hwang, 1990; Matsumoto, 1989). Both latency as well as accuracy measures supported the hypotheses (Ambady & Hecht, 2000). Thus, thin-slice judgments can be affected by judges' familiarity with the psychological domain being assessed as well as their expertise and competency with the given social context and culture.

D. SUMMARY

A few theoretical and pragmatic issues moderate the accuracy of thin-slice judgments. Such judgments are most predictive of psychological constructs that are likely to be accessible within brief segments of time. Moreover, thin slices are more likely to be useful in assessing constructs emphasizing nonverbal over verbal variables. And, finally, the experience and competency of the judges employed can moderate the validity of the assessments made.

VI. Methodological Issues

Thin-slice methodology is characterized by a number of flexible alternatives that result in a methodology that is both ecologically valid and informative. Variations in target content, information quantity, display format, variables assessed, and conditions under which observer assessments are made can be incorporated systematically into thin-slice research.

A. CONTENT

The first decision a thin-slice researcher makes before carrying out a study concerns the phenomenon or theory under investigation. Thin-slice methodology will be useful only to the extent that relevant and valid information can be extracted from the behavioral stream. Although this chapter implies that the domain to which thin-slice methodology applies is quite large, it is far from being universal. Psychological phenomena that involve or are affected by controlled and prolonged cognitive processing (such as gauging long-term goals or investigating rational decision making) will not likely benefit from thin-slice methodology.

In addition to the theoretical content, one must also be concerned with integrity of the behavioral content. By this we are referring to the spontaneity of the behavioral stream. In other words, to what extent are the targets acting for the camera? We are not referring to general self-consciousness processes (Carver & Scheier, 1981; Duval & Wicklund, 1972) or basic self-presentation strategies (Jones & Pittman, 1982) because these processes are involved in every face-to-face interaction regardless of whether a camera is present. Rather, we mean deliberate attempts by an individual to control specific behaviors (e.g., smiles, gestures, gaze behavior) and general expressivity (e.g., tone of voice, posture movements, speed, etc.). At this point in time we simply do not know how well the ecology of a consciously controlled behavior stream compares to that of a spontaneous behavior. The few studies we report below may foreshadow the complexity of what future research will yield.

For instance, one study examined whether individuals could control the expression of their sexual orientation. Twenty-two homosexual (11 female, 11 male) participants were videotaped (a) behaving naturally, (b) trying to pass as heterosexual, and (c) exaggerating their sexual orientation (the last two conditions were counterbalanced across participants). Male participants were less likely to be judged homosexual when trying to pass as straight, suggesting successful volitional control of their behavior. Female partici-

pants, however, showed less variability in their behavior across the conditions (Ambady, Dudkin, & Hallahan, 1999).

In general, research has found that some people are better at controlling their behavior than are others (DePaulo, 1992). Individual differences seem to play a large role in the ability to control self-presentation and behavior (DePaulo, 1992). Thus, dispositionally expressive people seem to be more successful at hiding deceptive communication than less expressive people (DePaulo, Blanck, Swaim, & Hairfield, 1992). Similarly, people high on traits such as self-monitoring are more able to modify and regulate their behavior according to the demands of the situation than are people low on such traits (Riggio, 1986; Snyder, 1987).

Undoubtedly, however, there are limits to what can be controlled. There may exist a domain of automatic expressive behaviors that resist monitoring and control (e.g., Bargh & Chartrand, 1999; Bernieri & Rosenthal, 1991; Ekman & Friesen, 1969). For example, Gada-Jain (1999) attempted to have interviewees intentionally synchronize (i.e., mimic the posture of, and coordinate their movements with, a target) with an interviewer in a job interview situation. Mimicry and synchrony had been observed earlier to correlate with interactant rapport (Bernieri et al., 1992) and interviewer evaluations of job applicants (Dabbs, 1969). Normally interviewer evaluations are more favorable when applicants spontaneously synchronized to the interviewer (Gada-Jain, 1999). When instructed to do so, however, applicants could not intentionally increase the subtle coordination of movements involved in the synchrony phenomenon. Although they could grossly mimic the interviewer intentionally, this controlled mimicry did not influence the interviewer evaluation and contrasted sharply with the positive effects found for spontaneously occurring mimicry (cf. Bernieri, 1988; Chartrand & Bargh, 1999).

Researchers examining thin slices need to be mindful of how the psychological constructs under investigation might be manifest within the behavioral stream they are sampling. Variations in the spontaneity of the behavior being analyzed, in particular, may have a profound impact on outcomes and should be treated as a potential moderator variable throughout thin-slice research.

B. CHANNEL OF COMMUNICATION

Meta-analytic findings indicate that thin slices from both nonverbal and verbal channels of communication accurately predict criterion variables (Ambady & Rosenthal, 1992). In an effort to reduce the amount and complexity of information contained in just a few seconds of expressive

behavior, researchers sometimes focus their attention on specific features within the entire behavioral stream to the exclusion of all else. In our laboratories, thin slices have been extracted from diverse channels of communication, including silent videotapes, audiotapes, content-filtered audiotapes, and standard videotapes. This flexibility in the type of channel allows researchers to assess the predictive value of various channels of communication. In addition, this flexibility also permits secondary analyses of existing data sets. Such further analyses yield unique insights not revealed by the original analyses (Ambady et al., 1999; Grahe & Bernieri, 1999).

C. SAMPLING OF SLICES

Perhaps one of the most important and seemingly most idiosyncratic decisions that thin-slice researchers make involves behavior sampling. How many slices are needed? And precisely where will they come from? The assumption underlying the entire paradigm is that a thin slice is somewhat representative, or predictive, of the entire behavioral sequence in terms of the critical information to be extracted from it. Some information (e.g., physical features, general vocal tone) is spread chronically and uniformly throughout the behavioral stream and is accessible no matter what the temporal resolution (i.e., thickness of the slice). Other information might appear at such a low base-rate that one might have to analyze an entire interaction sequence in order assess it with any reliability (e.g., kissing, use of profanity). Generally, the sampling of slices has been governed by the experience and intuition of each experimenter. Despite a lack of a formal prescription for exactly how slices should be sampled, several tendencies can be observed throughout the literature.

When an interaction sequence has a definite beginning and end, as is very nearly always the case for behavior recorded in the laboratory, a therapy session, or a teaching interaction, thin-slice researchers tend to extract three samples covering the beginning, middle, and end of that interaction (e.g., Ambady & Rosenthal, 1993; Babad et al., 1987, 1989b; Blanck, Rosenthal, Vannicelli, & Lee, 1986; Rosenthal, Blanck, & Vannicelli, 1984). One advantage of this strategy might be that it approximates and parsimoniously samples social reality. Almost any interaction scene is more or less culturally scripted (Goffman, 1959), especially its initiation and ending. Therefore, whereas the center piece from an interaction scene might highlight individual differences in spontaneous behavior and affect due to the relative lack of structure, the end pieces might highlight individual differences in knowledge of, experience with, and the skills involved in, negotiating through that particular context. A second advantage

of the three-slice sampling technique is that it allows for the assessment of linear trends throughout an interaction sequence. Statistically, linear trend effects are carved out of main effects (Rosenthal & Rosnow, 1985; 1991) and are involved in any situation in which there might be practice effects, fatigue and satiation effects, or other developmental effects.

For example, Bernieri, Zuroff, and Koestner (1999d) reported that linear decreases in interactional synchrony between loving partners, in contrast to average levels of synchrony between them, predicted decreased involvement and satisfaction with conflict-resolution outcomes. The context of the interaction observed was such that the variance in mean levels of synchrony was influenced by many factors but a linear decrease could only be understood in terms of disengagement and withdrawal during the conflict. When such trends are neither theoretically relevant nor predicted, however, differences between clips sampled at different time periods, especially beginning and end, are not found (e.g., Bernieri et al., 1996).

Another tendency is to employ an arbitrary time-sampling technique using rigid chronologically based criteria (e.g., the slice begins on the 31st second after the subject sits down and continues for 30 s). This common technique eliminates duration variance across targets and maximizes behavior quantity variance (e.g., amount of talking, gesturing, etc.). Another alternative employs thin slices that are meaningful action units. One example might be to define a slice as, "the point from which the target enters the room (i.e., foot crosses threshold) to the point at which the target finishes uttering their first sentence." Notice that this sampling procedure standardizes the behavioral event(s) and lets duration vary from target to target. The important point is that the choice of one technique over the other will necessarily constrain the nature of the information accessible to an observer.

D. LENGTH OF SLICES

The trade-off of clip length for convenience should concern most researchers familiar with the notions of reliability and validity. Intuition and dogma would suggest that more is better. Surprisingly, a meta-analysis investigating the accuracy of thin-slice judgments found that observer judgments made with slices under 30 s in length were as accurate as judgments based on slices nearly 5 min in length (Ambady & Rosenthal, 1992). Thus, longer lengths of the behavioral stream do not lead to more accurate assessments of their content.

Furthermore, the predictive validity of thin-slice studies rivals the level found in several classic studies that employed entire behavioral streams

(i.e., interviews, etc.) and test data. For example, the results of the meta-analysis were compared to the classic work of Holt and Luborsky (1958), who studied over 200 psychiatric residents at the Menninger School of Psychiatry, using several different methods to predict psychiatric competence. The major criterion variables were supervisors' evaluations and peer ratings of competence. Four judges' ratings of about 65 residents, using different methods of evaluation (such as analyses of application materials, interviews, Thematic Apperception Test, and Rorschach protocols), were correlated with peer and supervisor ratings of residents' competence. Judges' ratings were correlated with supervisor and peer ratings of the residents on psychotherapy competence, diagnostic competence, management competence, and overall competence. The effect sizes from these ''thick chunks'' did not significantly differ from the effect sizes of the meta-analysis on thin slices (Ambady & Rosenthal, 1992). Thus, ratings from thin slices of behavior apparently predict certain criteria as well as do those based on observations over much longer periods of time.

Two studies have tested directly the validity-length hypothesis by systematically decreasing the length of a clip to which observers were exposed (Ambady & Rosenthal, 1993; Bernieri & Grahe, 1998). Ambady and Rosenthal (1993) created a series of 10-, 5-, and 2-s clips for an investigation of teaching effectiveness by randomly selecting portions from the longer clips. There were no significant or appreciable differences in the accuracy of judgments with respect to clip length. Another study on rapport perception examined judgments of thin slices ranging from 5 s to judgments based on the entire interaction (ranging from 15 to 50 min) and arrived at the same conclusion (Bernieri & Grahe, 1998). Targets were observed in two interaction contexts, one cooperative and the other more adversarial (i.e., a debate). The correlation between the rapport assessment made by a typical observer-of-the-whole interaction and the criterion variable (rapport reported by members of the dyad) was significant, $r = .29$. Judgments of thin-slice clips of the adverserial interaction, ranging from 5 to 50 s in length, showed very slight declines in accuracy as a function of slice length. To put this into perspective, however, this drop was not nearly as large in magnitude as suggested by the corresponding drop in exposure; 40 min per target to 50 s per target (a 98% reduction in the behavioral stream sampled). Furthermore, no declines in observer accuracy across slice length were found in judgments of these same targets in a more cooperative, rather than an adverserial, discussion (Bernieri & Grahe, 1998).

Two possibilities can explain the minimal impact of clip length. One is that the information influencing observer judgments of the psychological constructs in question is chronically embedded throughout the entire behavioral stream. Such would be the case if the information was not contained

in actions, behaviors, or events but rather contained in the style or manner in which these behaviors are executed. The other possibility is that observers form an almost immediate impression and then remain anchored to this impression regardless of the amount of information to which they are ultimately exposed. Such a process would be consistent with current stage theories of interpersonal perception (Gilbert & Malone, 1995; Trope, 1986). Although more systematic research is needed to explore each of these hypotheses, at present we are comfortable in concluding that, for many constructs, slice length does not seem to affect the accuracy of thin-slice judgments.

Having stated this, we must remind the reader that the validity and utility of a thin slice ultimately depends on the construct being assessed. A thin slice may provide valid information regarding an individual's affective state, for example, but may provide completely invalid information regarding that same individual's specific motivations or future intentions. At this point the literature is not extensive enough to demarcate precisely which constructs are validly examined with thin slices and which are not.

Finally, it is worth mentioning here that even very brief dynamic information increases judgmental accuracy compared to static photographs. In the study examining sexual orientation (Ambady, Hallahan, & Conner, 1999); sexual orientation was judged from still frames in addition to the 2- and 10-s-long stimuli. Accuracy was significantly lower in the static still-photo condition than in the thin-slice conditions, supporting previous work which indicated that dynamic cues generally yield more accurate perceptual judgments than static cues (Barclay, Cutting, & Kozlowski, 1978; Valenti & Costall, 1997).

E. CONSENSUAL JUDGMENTS VERSUS AVERAGE JUDGMENTS

There are two common methods used to assess judgmental accuracy. Researchers can combine the judgments of all perceivers first to model the group mean judgment (e.g., Gifford, 1994; Gifford & Hine, 1994), or they can model the judgments of each perceiver individually and then summarize the results across the observed sample (Bernieri & Gillis, 1995b). The first approach generalizes to those situations where a single assessment or outcome evaluation is generated from some small group or committee, such as a personnel committee. It would also be an appropriate way to maximize the validity of a thin-slice assessment by increasing the reliability through the use of multiple items (i.e., judges). The second approach generalizes and applies to the "typical" social perceiver.

As a rule, group mean judgments will be more reliable and potentially more predictive than judgments from any single individual (Rosenthal, 1987). Therefore, pooled judgments bring more power to bear on the study of targets. Pooled judgments, however, overestimate the level of predictability or accuracy that can be achieved for a typical individual perceiver. Also, it is not a mathematical necessity for the mean of a group of perceivers to represent or reflect the modal pattern of responses over a series of trials. In other words, when researchers model the group mean consensus judgment, there might not be a single individual within that group for whom that consensus model applies. Therefore, consensus judgments should not be employed when the results are intended to apply or generalize to social observers (Bernieri & Gillis, 1995). In sum, the decision to pool the judgments from observers or analyze them separately should depend entirely on whether the goal of the research is to describe (a) a target, (b) a group judgment, or (c) the judgment of a typical social perceiver.

Some recent reviews of the error-accuracy debate have suggested that reports of accuracy based on thin slices may be due to methodological artifacts (Kunda, 1999). Specifically, the robust accuracy coefficients found in thin-slice studies are attributed to use of multiple judges, and the averaging or pooling of their judgments. Consequently, the accuracy reported in the Ambady and Rosenthal (1992) meta-analysis is thought to be inflated (Kunda, 1999). While the logic that aggregation bolsters correlation is true, the following points need to be considered.

First, these reviews confuse validity with reliability. The validity coefficient in the Ambady and Rosenthal meta-analysis was $r = 0.39$. Kunda used a version of the Spearman–Brown equation used to compute reliability estimates (Nunnally, 1978, p. 243) and inferred that the average accuracy of a single judge was $r = .02$. This would be an appropriate equation to use if the reliability of a single judge were being computed based on aggregated reliability estimates. The meta-analysis, however, reported aggregated validity estimates. The appropriate equation for estimating the validity or accuracy of a single judge would be the equation 14.37 described in Guilford (1954, p. 407). As discussed earlier in this chapter, Table IV indicates that depending on the channel being judged, the average judge to judge reliability in thin slice studies varies from $r = .21$ to $r = .40$. Applying Guilford's equation (14.37) to the overall validity coefficent of $r = .39$ reported in the Ambady and Rosenthal (1992) meta-analysis, we can estimate that if the average judge to judge reliability is $r = .50$, the validity of a single judge of thin slices is $r = .28$. If the average judge to judge reliability is $r = .30$, the validity of a single judge is $r = .22$. Even if the average judge to judge reliability is lower than that of the vast majority of thin-slice studies—as low as $r = .10$—the validity of a single judge is $r = .14$.

Second, several studies assessing the accuracy of judgments based on thin slices of nonverbal behavior do not aggregate judges' ratings. Instead, these studies correlate each individual judgment with the criterion and then average the individual validities (i.e., level of agreement with criterion). Thus, such accuracy estimates are already at the level of the individual judge, and are, therefore, not boosted by aggregation. Dividing these accuracy coefficients by the median number of judges is, therefore, not a true reflection of the accuracy of judgments.

F. IMPROVING/TRAINING OBSERVERS

Several studies indicate that training increases the accuracy of decoding facial expressions and sensitivity to nonverbal cues (for a review, see Rosenthal et al., 1979). Research using the Profile of Nonverbal Sensitivity indicates that the accuracy of thin-slice video judgments of affect improves considerably with practice and improves slightly with training. Benefits due to practice and training are particularly striking for judgments of the body. The judgment of channels involving audio cues also seems to show smaller benefits from practice and training (Rosenthal et al., 1979).

The benefits of practice have also been noted in performance on the IPT. Costanzo (1992) found that individuals who received practice and feedback in attending to and in correctly interpreting critical cues on the IPT improved their performance compared to individuals who received training regarding potentially useful cues, but no practice, on a posttest 9 days after the practice or training session.

An interesting distinction exists between training that provides individuals with immediate performance feedback and training instructing them how to make the most accurate judgment. In the former case, a researcher simply gives the observer the actual criterion value after each trial so that they can immediately determine how accurate their judgment was on that trial. A simplification of this is simply telling an observer whether their judgment was ''correct.'' This feedback says nothing about the judgment process or how to go about improving it. Nevertheless, providing observers with performance feedback alone with no instruction appears to improve their judgment accuracy (Gillis et al., 1995). Performance feedback seems to be the most explicit and direct means to attempt to manipulate and improve the judgment process. Unfortunately, the instruction method, when employed alone without practice and performance feedback, shows little evidence of being able to improve judgment on thin-slice displays (Gillis et al., 1995; Costanzo, 1992). These findings are consistent with what would

be expected if the cognitive processes primarily responsible for thin-slice judgment were automatic (Bargh, 1994, 1996).

G. SUMMARY

The preceding section attempted to make explicit a number of methodological issues impacting the outcome and interpretation of thin-slice research. Until now, these issues have primarily been dealt with in an intuitive manner by experimenters, according to their own laboratory experience and expertise. As a result, reviews of the literature and empirical meta-analyses are made more difficult. Our intention is to encourage authors to address more of these issues explicitly in future reports so that secondary analyses and reviews of the literature might have access to the very important moderator variables presented above.

VII. Conclusions

Thin slices provide insight into basic social perceptual processes. Judgments based on thin slices reflect fundamental, almost reflexive, evaluative processes of social perception and social judgments. Work on thin-slice judgment has implications for two important areas of social cognition: the process of stereotyping and the development of correspondent inferences.

A. THIN-SLICE JUDGMENTS AND STEREOTYPING

Thin-slice judgments draw on the real-world, rich, social knowledge that people have acquired. The accuracy of thin-slice judgments reflects knowledge of the social ecology, including knowledge of exemplars, prototypes, and stereotypes. But such judgments are probably most accurate when the behavioral evidence upon which these judgments are based is valid, meaningful, veridical, and relevant to the category being judged (Heider, 1958; McArthur & Baron, 1983; Moskowitz & Roman, 1992). Thus, stereotypes and categories irrelevant to the situation and wrongfully applied should be associated with inaccurate judgments. Appropriate implicit knowledge that is correctly applied, however, will be associated with accurate judgments. Consider, for example, the judgment of an individual's potential to be a good teacher. The observer's use of tacit knowledge about the behaviors and skills associated with good teaching (''she is enthusiastic

and clear'') should be associated with more accurate judgments of teaching potential rather than the use of implicit race or gender stereotypes (''she is Asian and likely to be shy'').

We believe that thin-slice judgments are accurate because they rely on implicit knowledge of mental representations of exemplars pertaining to the category being judged (Smith & Zarate, 1992). Although such judgments might rely on stereotypes, there is considerable evidence that when stereotypes and expectancies are pitted against behavioral information, individuals use the behavioral information more than either stereotypes or expectancies in making their judgments (Jussim, 1991, 1993).

B. THIN-SLICE JUDGMENTS AND CORRESPONDENT INFERENCES

A prevailing assumption in the literature on social cognition is that traits and intentions are not directly observable (Fiske & Taylor, 1991). Undoubtedly this is sometimes true. It is also true, however, that people do not or cannot hide all (or most) of their dispositions and motives all (or most) of the time (DePaulo, 1992; Jussim, 1991; Kenny, 1991). We are often seen for who we are in many psychological domains.

In our complex social interactions, when we are both actors as well as perceivers, both encoders and decoders of social information, several perceptual and cognitive processes occur simultaneously. In order to navigate this complex social world effectively, perception, cognition, and behavior occur routinely, unintentionally, and rapidly (Abelson, 1981; Bargh & Chartrand, 1999; Langer, 1988; Langer & Abelson, 1974; Uleman et al., 1996; Zajonc, 1984). To paraphrase William James, ''effortless attention is the rule'' (James, 1890/1983, p. 427). Thus, many evaluations, judgments, and inferences regarding traits, attitudes, and personalities of others are often made spontaneously, nonconsciously, on-line, and from limited behavioral information (Uleman et al., 1996; Weiner 1985). For the most part, this process appears to be adaptive and efficient, and initial impressions and judgments remain uncorrected.

These initial evaluations may be adjusted later in the second stage of information processing (Gilbert & Krull, 1988; Gilbert & Malone, 1995; Trope, 1986). This stage involving corrections, attributions, and explanations generally occurs only when a log jam occurs in the nonconscious, evaluative stage of processing (James, 1890/1983), and when we need to expend effort: when we are motivated to obtain diagnostic information or when we are confronted with unexpected, novel, or inconsistent events or behaviors (Clary & Tessar, 1983; Fiske & Neuberg, 1990; Hastie, 1984;

Kanazawa, 1992; Weiner 1985). Nevertheless, the present work highlights the efficiency of our spontaneous on-line judgments based largely on non-verbal behavior and suggests that, to the extent that much of the relevant and diagnostic information is present when initial judgments are made, these judgments can be quite accurate.

C. CONCLUDING REMARK

The material reviewed in this chapter suggests that (a) thin slices of the behavioral stream contain important diagnostic and predictive social psychological information; (b) because thin-slice perception and judgment is as good as it is, our interpersonal perceptions can occur immediately, automatically, and to some extent validly before much can be communicated verbally or through actions and events; and (c) given the limited conditions under which social inference and correction occur, these initial judgments may determine the lion's share of our ultimate perceptions, evaluations, and theories about those with whom we interact face to face.

We agree with Renato Tagiuri who summarized the landmark 1957 conference on interpersonal perception by stating, "evaluation of other persons, important as it is to our existence, is largely automatic, one of the things we do without knowing very much about the 'principles' in terms of which we operate. Regardless of the degree of skill which an adult may have in appraising others, he engages in the process most of the time without paying much attention to how he does it" (Tagiuri, 1958, p. ix).

We end with two recent newspaper accounts that poignantly illustrate the importance of the accurate communication and perception of thin slices. The first concerns the capture of U.S. soldiers in April, 1999 in Macedonia. A report in the *Boston Globe* stated that "Staff Sergeant Chris Stone's voice was so flat, so unemotional, that when he radioed for help his superior officer, Sergeant First Class Jim LaShelle, didn't think he was serious." While Stone was identifying his location, his skeptical superior officer cut him off to make sure he wasn't kidding, at which point the radio went dead. Because he was cut off, Sergeant Stone had provided only half the information needed to identify his location and was captured along with two fellow soldiers by the Serbs. The misperception of this thin slice of communication may have contributed directly to their capture ("We're Trapped," 1999). Fortunately, the soldiers were released a few months later.

The second account concerns the recent Kennedy–Bessette airplane crash off the coast of Martha's Vinyard. As we write this chapter, there are reports that the Federal Aviation did not respond as promptly as it should have to early information that the plane was missing. On Friday,

July 16, an employee of the Martha's Vineyard Airport alerted the FAA only 25 min after Kennedy's plane was lost on the radar, 4 h before the Kennedy family friend called and the search for the plane began. A FAA spokesman, defending the organization's initial lack of response to the employee's call, responded by implicating the importance of vocal cues in such a communication asserting that, ''there was no tone of concern in the voice or anything out of the ordinary. There needed to be some expression that this airplane is overdue.'' Thus, a misinterpretation and miscommunication of a thin slice of affective information contributed to a substantial delay in action regarding the search for the plane (''Early Alert,'' 1999).

Incidents such as these, together with the research reported in this chapter, provide compelling illustrations of the importance of thin slices and their perception. It may be wise and even necessary for social psychologists to learn more about the perception and judgment of thin slices of the behavioral stream in order to understand more fully how individuals come to know and to negotiate their social environment. The present chapter is intended to be a step toward this goal.

Acknowledgments

Appendix A

STUDIES INCLUDED IN META-ANALYSIS

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ATTRACTIVENESS, ATTRACTION, AND SEXUAL SELECTION: EVOLUTIONARY PERSPECTIVES ON THE FORM AND FUNCTION OF PHYSICAL ATTRACTIVENESS

Diane S. Berry

I. Introduction

Social psychology as a discipline has more than once been accused of burying its collective head(s) when it doesn't like what it sees. This point was eloquently made by Gardner Lindzey in 1965, in his often-cited presidential address to Division 8 of the American Psychological Association. In particular, Lindzey critiqued the field for refusing to attend to the potential social psychological consequences of variables that have a genetic basis, including physical appearance and morphology. He attributed much of the field's distaste for these variables to its underlying environmentalist worldview and suggested the result was a rather unscientific reluctance to consider whether some important psychological phenomena might, at least in part, be biologically or genetically based (Lindzey, 1965).

Given this atmosphere, it is perhaps remarkable that by the mid-1970s a small but significant group of pioneering studies of physical attractiveness finally made their way into mainstream social psychological journals (e.g., Berscheid, Dion, Walster, & Walster; 1971; Dion, 1972; Dion, Berscheid, & Walster, 1972; Murnstein, 1972; Sigall & Aronson, 1969; Sigall & Landry, 1973; Walster, Aronson, Abrahams, & Rottman, 1966). However, it was the publication of Berscheid and Walster's seminal review of that literature in the 1974 volume of *Advances in Experimental Social Psychology* that finally legitimized attractiveness as a topic worthy of scientific study. In the 25 years that have passed since it appeared, the impact of Berscheid and Walster's chapter on the field has been substantial. In addition to being one of the most frequently cited papers in social psychology, it launched numerous programs of research; literally hundreds of studies of physical attractiveness appeared in the ensuing years.

As prolific as the attractiveness literature is, it is also largely atheoretical. The majority of research published on this topic during the 1970s and 1980s

essentially replicated the original "beautiful is good" effect: The finding that more positive evaluations are elicited by attractive than unattractive individuals. Attempts at a theoretical analysis of the origin and function of attractiveness effects were rare. Some researchers provided insightful articulations of how mechanisms such as behavioral confirmation could amplify and perpetuate attractiveness preferences (e.g., Langlois, 1981; Snyder, Tanke, & Berscheid, 1977). However, these models did not address the critical question of the *origin* of attractiveness effects (Berry & Finch Wero, 1993). In fact, in their review of the literature, Bull and Rumsey (1988) commented that although they originally "intended to include a 'theoretical' chapter in this book . . . no one theoretical perspective deserved pride of place. Furthermore, the vast majority of the publications cited in this book made little or no mention of theoretical perspectives. Certainly there was no theory that could in any way provide a comprehensive explanation of the research findings" (p. 287).

Most social psychologists continue to take a "sociocultural" view of attractiveness effects (Jackson, 1992). This term does not refer to a particular theoretical model, but instead to a general view of attractiveness preferences as culturally determined. Beliefs about what is and is not attractive and the values placed on physical attractiveness in a given culture are attributed to socialization, and consensus observed in people's perceptions of or responses to attractiveness is assumed to reflect exposure to similar cultural values. As Jackson (1992) notes, fundamental to the sociocultural perspective is the idea that the determinants of attractiveness are essentially arbitrary; "physical attractiveness itself has no inherent value. The *culture* imparts value to it" (p. 36).

Until quite recently, assumptions that provide the foundation for sociocultural views of attractiveness preferences received limited empirical scrutiny. Beliefs about the arbitrary nature of the form of attractiveness and the role of socialization in the development of attractiveness preferences were often presented as statements of fact rather than untested hypotheses. This led Symons, an evolutionary biologist, to suggest that "variability and arbitrariness have been overemphasized for the same historical and ideological reasons that physical attractiveness itself has been ignored in the social sciences: physical characteristics are close to the genes and are distributed undemocratically. If standards of attractiveness can be shown to vary arbitrarily, attractiveness itself is made to seem trivial" (Symons, 1979, p. 186).

In recent years, however, two bodies of work emerged that promise to advance our understanding of why we respond positively to attractive people. The first is empirical. In particular, recent studies suggest that attractiveness standards are not arbitrary and that attractiveness cannot be adequately explained by socialization or the communication of cultural norms.

The second body of work is theoretical and describes evolutionary models of human social behavior that yield theoretically based predictions regarding the function of attractiveness preferences. These two lines of work evolved simultaneously, but relatively independently, and have yet to be formally integrated. However, each has something important to offer the other. Recent empirical developments in the attractiveness literature—in particular, demonstrations of near-universal standards of attractiveness, infant sensitivity to variations in attractiveness, and the identification of reliable determinants of attractiveness (e.g., Cunningham, 1986; Cunningham, Barber, & Pike, 1990; Langlois, Roggman, Casey, Reiser-Danner, & Jenkins 1987, Langlois & Roggman, 1990; Langlois, Kalakanis, Rubenstein, Larson, Hallam, & Snoot, in press; McArthur & Berry, 1987)—provide support for some of the more controversial (to mainstream social psychologists) premises of evolutionary theories of social behavior. Recent evolutionary theories provide those trying to understand the form and function of attractiveness effects with formal theoretical models within which to frame their data (e.g., Buss, 1989; Buss & Barnes, 1986; Buss & Schmitt, 1993; Gangestad & Simpson, 1990; in press).

This chapter does not review the vast literature on the well-established attractiveness halo effect; excellent comprehensive summaries of those studies are available elsewhere (cf. Alley & Hildebrant, 1988; Bull & Rumsey, 1988; Eagly, Ashmore, Makhijani, & Longo, 1991; Hatfield & Sprecher, 1986; Jackson, 1992). Instead, the intent is to integrate recent empirical developments in the attractiveness literature with evolutionary perspectives on human social behavior and provide a coherent theoretical conceptualization of the form and function of attractiveness. First, recent empirical advances that shed light on the origin of attractiveness preferences are reviewed. Second, several evolutionary models of human social behavior and their predictions regarding the function of attractiveness are discussed. The ability of these models to account for recent findings in the attractiveness literature is evaluated, and a number of questions raised by and implications of the application of an evolutionary perspective to this topic examined. Finally, potential criticisms of an evolutionary theory of physical attractiveness are addressed.

II. Empirical Developments: The Form of Attractiveness

A. CONSENSUS IN PERCEPTIONS OF ATTRACTIVENESS

Although many social scientists at the time accepted the popular adage that attractiveness is ''in the eye of the beholder,'' Berscheid and Walster

(1974) reviewed the available data and instead concluded that people agree about who is attractive. More recent examinations of consensus in attractiveness judgments concur with their conclusion. "Consensus," which refers to the extent to which ratings of an individual's attractiveness provided by different judges converge, is typically assessed by examining whether different people rank order the attractiveness of a particular set of targets similarly. Considerable data has accumulated regarding three types of consensus (Langlois et al., in press). First, within-culture/within-ethnic consensus refers to studies of agreement among people of the same ethnic origin living in the same culture (e.g., to what extent do Caucasian Americans agree with one another in their judgments of attractiveness?). Second, within-culture/cross-ethnic consensus refers to agreement among judges who live in the same culture, but are from different ethnic or racial groups (e.g., to what extent do African Americans and Asian Americans agree with one another in their ratings of attractiveness?). Finally, cross-cultural/cross-ethnic agreement refers to the degree of similarity in attractiveness judgments provided by people who are simultaneously members of different cultures and different ethnic groups (e.g., to what extent do the attractiveness judgments made by native Koreans agree with those provided by Caucasian Americans?).

As noted, based on the data available in 1974, Berscheid and Walster concluded that there was high agreement in the judgments of people from the same culture and ethnic background. Although considerably more data are now available, the conclusion remains the same. Langlois and her associates recently conducted a comprehensive meta-analysis that examined within-culture/within-ethnic consensus in ratings of adult targets (Langlois et al., in press). They also examined possible moderators of the magnitude of agreement observed among judges [i.e., sex and age of judge, type of stimulus (i.e., photograph, videotape, etc.), year of publication, and sample size]. Very high levels of agreement were revealed, $r = .90$, and few moderator effects were observed.

Although relatively few empirical studies of cross-cultural agreement in attractiveness were available in 1974, a number of more recent studies compare attractiveness ratings provided by judges from different cultures and ethnic backgrounds (e.g., Cunningham, Roberts, Barbee, Druen, & Wu, 1995; McArthur & Berry, 1987; Zebrowitz, Montepare, & Lee, 1993). Langlois et al.'s meta-analysis revealed high average reliabilities for both cross-ethnic and cross-cultural attractiveness judgments, r's $= .88$ and $.94$, respectively. Again, few moderator effects were observed. These effect sizes are more than double the magnitude of what is typically considered "large," leading Langlois and colleagues to concluded that this impressive

agreement ''suggests a possibly universal standard by which attractiveness is judged'' (Langlois et al., in press, p. 24).

B. INFANT SENSITIVITY TO VARIATIONS IN ATTRACTIVENESS

At the time that Berscheid and Walster compiled their review, only a handful of studies examined the developmental course of attractiveness effects. Most of these considered whether children's attractiveness (as assessed by adults) predicted their social behaviors and experiences (e.g., popularity with peers, Dion & Berscheid, 1974). Fewer studies of young children's *perceptions* of attractiveness were then available (e.g., Cavior & Lombardi, 1973). However, Berscheid and Walster speculated that it would not be surprising if children's ratings of their peers' attractiveness paralleled those of adults, as ''it is possible that preschoolers have already learned the physical attractiveness stereotype, and differentially attend to and/ or interpret behaviors exhibited by peers who differ in attractiveness'' (Berscheid & Walster, 1974, p. 190).

Subsequent research provides clear evidence that children's attractiveness judgments mirror adults' ratings (e.g., Cross & Cross, 1971). Some of the most dramatic evidence of the early emergence of sensitivity to attractiveness is provided by Langlois and her colleagues (e.g., Langlois et al., 1987; Langlois, Ritter, Roggman, & Vaughn, 1991; Rubinstein, Kalakanis, & Langlois, 1999). In their studies, infants ranging in age from 3 to 6 months typically view pairs of faces, one of which adults consider attractive and one of which adults consider unattractive. This work repeatedly documents that infants show a visual preference for attractive faces. Moreover, these effects replicate across faces drawn from various ages and ethnic backgrounds (Langlois et al., 1991). Studies from other labs provide consistent data (e.g., Kramer et al., 1995; Samuels, Butterworth, Roberts, Graupner, & Hole, 1994; Samuels & Ewy, 1985), and a more recent study documents that even week-old newborns display visual preferences for attractive faces (Slater, Schulenburg, Brown, Badenoch, Butterworth, Parsons, & Samuels, 1998).

An inherent difficulty of studying such young participants is that there is no way to directly assess their perceptions, forcing researchers to draw inferences about what behaviors such as visual preference mean. One plausible interpretation of preferential looking is that infants actually ''prefer''—in some meaningful sense—attractive people. A more conservative interpretation is that infants can simply discriminate attractive from unattractive faces. A clever study of 12-month-olds lends credence to the former

interpretation. Langlois, Roggman, and Reiser-Danner (1990) watched infants interact with a woman. In some conditions, the woman wore a professionally constructed life-like facial mask with very attractive features. In other conditions, she wore a mask with unattractive features. Infants in the attractive-mask condition displayed more positive affect and play involvement during their interactions than did infants in the unattractive-mask condition. In a second study, 12-month-olds were videotaped after being placed near two dolls, one of which had attractive facial features, and the other of which had unattractive features. The infants initiated the most physical contact with the attractive doll. These data augment the interpretation that attractiveness, at least facial attractiveness, is both discriminated and preferred at a very young age. The early emergence of these preferences makes it difficult to argue that they result from socialization and the internalization of cultural values regarding what attractiveness is and how one should respond to it.

C. DETERMINANTS OF ATTRACTIVENESS

Although Berscheid and Walster (1974) noted that people agree in their judgments of attractiveness, they suggested "there exists no compendium of physical characteristics or configurations of characteristics which people find attractive in others, even in a single society. It appears, however, that the culture transmits effectively and fairly uniformly, criteria for labeling others as physically attractive" (p. 186). Some interesting recent lines of work challenge this assumption, however, and identify several stimulus qualities that reliably influence perceptions of attractiveness. Moreover, the available data indicate that these qualities exert a similar impact on attractiveness judgments provided by people from a variety of cultures. Data from five relevant lines of research are briefly reviewed: Studies of age-related physical characteristics, waist-to-hip ratio, facial averageness, symmetry, and exaggerated facial features.

1. Age-Related Physical Characteristics

Physical qualities correlated with age predict attractiveness (Alley, 1988; Alley & Hildebrant, 1988; Jackson, 1992).[1] In particular, increases in age lead to decreases in the judged physical attractiveness of both men and women (e.g., Cross & Cross, 1971; Deutch, Zalenski, & Clark, 1986). In the

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[1] A review of the relations between age and specific physical characteristics is beyond the scope of this chapter (see Berry, 1994; Berry & McArthur, 1986, and Montepare & Zebrowitz, 1998 for in depth reviews of that literature.)

most comprehensive study of attractiveness across the lifespan, Zebrowitz, Olsen, and Hoffman (1993) obtained ratings of the facial attractiveness of over 200 men and women. Multiple photographs of each target taken from childhood through late adulthood were rated. Increasing age yielded reliable decreases in the judged attractiveness of adult targets. Other studies reveal that this negative correlation between age and attractiveness replicates across various cultures (e.g., Jones & Hill, 1993).

Although summaries of these studies often note that the relation between age and attractiveness is stronger for women than men (e.g., Buss, 1994), a careful review reveals that the data pertaining to sex differences in the magnitude of these effects are unclear. Some evidence that the relation between age and attractiveness is stronger for women than men is indeed available, but the relevant studies are plagued by methodological limitations. For example, data reported by Henss (1991) are often cited as evidence of sex differences in the relations of age and attractiveness. However, he described relations between targets' *perceived* age and attractiveness; correlations between chronological age and attractiveness (or, age and perceived age) were not reported. Other problems arise from the fact that these studies often use cross-sectional designs, confounding age with target sample (e.g., Henss, 1991). Moreover, in the few studies that longitudinally assess relations between age and attractiveness, sample size is typically problematic. For example, Deutch et al. (1986) obtained ratings of people photographed during their twenties, forties, and sixties. Ratings of women's attractiveness did decline more than men's as a function of age. However, the authors obtained ratings of only six male and six female targets, making any pattern of results difficult to interpret. As noted, Zebrowitz et al. (1993) describe the one large-scale, longitudinal study of age and attractiveness. In this data set, the interaction of target sex and age on perceived attractiveness was not significant; according to the authors, an examination of the means provided ''no hint of a tendency for attractiveness to decline more with age for women than for men'' (p. 463). In sum, although there is clear evidence that physical attractiveness declines with age for both men and women, the data regarding sex differences in these effects are mixed.

2. Waist-to-Hip Ratio

Research on body appearance reveals that women's waist-to-hip ratio (WHR) influences judgments of their attractiveness. WHR is defined as the circumference of the body at the waist, divided by the circumference of the body at the hips; i.e., the smaller the waist as compared to the hips, the lower the WHR. Before puberty, boys and girls have similar WHRs. Due to differences in how sex hormones regulate the distribution of fat in

males and females, however, adult men and women differ substantially along this dimension. Healthy women have WHRs in the range of .67 to .80, whereas men's WHRs range from .85 to .95 (Singh, 1993a, 1993b). Women with relatively low WHRs (i.e., around .7) are judged to be more attractive than those with higher WHRs (Singh, 1993a, 1993b), an effect that replicates across male and female perceivers of various ages (Singh & Young, 1995). Moreover, there is cross-ethnic and cross-cultural agreement in the effects of WHR on attractiveness; Singh and Luis (1995) reported that samples of Caucasian-American men, African-American men, and native Indonesian men all judged female figures with low WHRs to be more attractive than those with higher WHRs.

Although these data suggest that WHR is a reliable predictor of women's physical attractiveness, criticisms of this work have been raised. For example, the vast majority of studies of WHR manipulate waist and hip circumference in simplistic ''stick figure'' drawings, raising concerns about ecological validity. Moreover, some argue that the figures used in these studies confound WHR with other variables (e.g., waist size, cf. Tassinary & Hansen, 1998). Singh (1993) does provide some WHR data based on actual body measurements. In particular, an analysis of the physical measurements of *Playboy* centerfolds and competitors in the Miss America pageant across several decades revealed an average WHR of approximately .7. Moreover, despite a trend for more recent samples to have lower body weights than earlier samples, this ratio remained constant. Although these data do not fully address the concerns raised above, they are consistent with the hypothesis that a relatively low WHR is perceived as attractive. An even more convincing case for the role of WHR in attractiveness could be made by work that assesses the attractiveness and body measurements of real people and establishes that the relation between WHR and attractiveness is independent of other variables.

3. Facial Averageness

Galton (1878) provided the first hint that ''average'' faces might be particularly attractive. In an attempt to create a composite face that represented a specific facial type (e.g., a ''criminal'' face) he superimposed photographic images of the faces of people who fit a particular category. Galton parenthetically noted that the superimposed images were somewhat more attractive than the individual faces that comprised them. More recently, a more sophisticated demonstration of this effect was carried out by Langlois and her associates (e.g., Langlois & Roggman, 1990). They created composite faces by digitally averaging neutral expression frontal facial photographs of young adults (cf. Langlois and Roggman for methodological details).

Two-, four-, eight-, sixteen-, and thirty-two-face composites were created separately for men and women. The attractiveness of the two-, four-, and eight-face composites did not differ significantly from that of the individual faces. However, judges rated the sixteen- and thirty-two-face composites as significantly more attractive than the original faces.

Although this work was initially criticized on several methodological grounds (e.g., that averageness was confounded with symmetry, blending artifacts, or perceived age; cf. Bensen & Perrett, 1992; Alley & Cunningham, 1991; Pittenger, 1991), subsequent empirical replications and extensions convincingly refute these critiques (Langlosi, Roggman, Musselman, & Acton, 1991; Langlois, Roggman & Musselman, 1994; Rhodes, Sumich, & Byatt, 1998; Rhodes & Tremewan, 1996; Samuels et al., 1994). Moreover, recent work demonstrates that young infants prefer averaged faces (Rubinstein, Kalakanis, & Langlois, 1999) and that preferences for composites over individual faces are observed cross-culturally (cf. Jones & Hill, 1993; Pollard, 1995). Thus, it appears that people find attractive those faces that are near the mathematical average of the population.

4. Symmetry

Gangestad and Thornhill (1997a) report that members of numerous species, including humans, who are low in "fluctuating asymmetry" (FA) are attractive. Fluctuating asymmetry is defined as the "asymmetry of bilateral characteristics (e.g., wings, fins) for which the population mean of asymmetry (size of right side minus size of left side) is zero and variability is near-normally distributed" (Gangestad, Thornhill, & Yeo, 1994, p. 75). In species ranging from swallows to scorpionflies, low FA is correlated with sexual attractiveness, with "attractiveness" being operationally defined as mating success (e.g., Ridley, 1992). In humans, FA is operationalized by the measurement of symmetry at eight locations on the body (feet, ankles, ears, wrists, etc.; cf. Simpson, Gangestad, Christensen, & Leck, 1999). Data from human studies suggest that FA is negatively correlated with facial attractiveness, especially in men (Gangestad et al, 1994). Moreover, women prefer men low in FA as sexual partners, especially short-term partners (Gangestad & Thornhill, 1997b; Thornhill, Gangestad, & Comer, 1995).

Measurements of the face are not included as part of the standard operational definition of human FA. However, other research reveals that facial symmetry does predict attractiveness. This was first documented by Grammar and Thornhill (1994), who measured symmetry by marking several left and right facial landmarks (e.g., innermost eye corner) and calculating the extent to which midpoints of the lines connecting the left and right markers fell on the same vertical plane. Those faces in which the midpoints

corresponded perfectly to one vertical line were the most symmetrical, and increasing deviations from this theoretical dividing line indicated less facial symmetry. Symmetry was positively correlated with judgments of the faces' attractiveness. More recently, Mealey, Bridgestock, and Townsend (1999) compared the symmetry and attractiveness of pairs of monozygotic twins' faces. They first created left–left side and right–right side mirror image composites of each individual's face. Raters simultaneously viewed the mirror images of both sides of an individual twin's face and judged how similar the images were. The perceived similarity of the left–left and right–right images was used as an index of symmetry. Judges then rated the attractiveness of unmanipulated photographs of the targets. The twin most often identified as the most attractive of each pair was typically the most facially symmetrical. These and other studies using a variety of methods of measuring symmetry consistently reveal that symmetrical faces are more attractive than asymmetrical ones (e.g., Rhodes, Proffitt, Grady, & Sumich, 1998; Rhodes, Sumich, & Byatt, 1999; Zebrowitz, Voinescu, & Collins, 1996).

Note that facial averageness and facial symmetry are not isomorphic; a face could be perfectly symmetrical and still display features that are far from the population mean. Empirical support for the independent contributions of symmetry and averageness to facial attractiveness was recently provided by Rhodes, Sumich, and Byatt (1999), who simultaneously manipulated both variables in composite faces. Analyses revealed that neither variable could account for the impact of the other on attractiveness judgments. Thus, both variables can contribute to the attractiveness of a particular face.

5. Exaggerated Features

Certain exaggerated features also influence facial attractiveness. In particular, prominent facial features that reveal sexual maturity influence judged attractiveness, especially male attractiveness. For example, Keating (1985) manipulated schematic faces to create ''mature'' and ''immature'' versions. The mature faces were characterized by large, prominent jaws, whereas the less mature faces featured smaller, rounder jaws. Prominent chins and jaws increased the attractiveness of male faces and decreased the attractiveness of female faces. Other studies featuring both schematic and photographed faces report similar findings (e.g., Berry & McArthur, 1986; Cunningham, 1986; Cunningham et al, 1990; Johnson & Franklin, 1993). Another extreme or exaggerated facial feature that predicts both male and female facial attractiveness is a set of high or prominent cheekbones (e.g., Cunningham et al., 1990); both men and women with high cheekbones are

perceived as more attractive than are people with less prominent cheekbones. These effects of jaw, chin, and cheekbone height and prominence on attractiveness have further been replicated cross-culturally (e.g., Cunningham et al., 1995; McArthur & Berry, 1987). Thus, although facial attractiveness increases as a function of symmetry and averageness, the data also reveal that certain large or exaggerated features are reliable predictors of attractiveness (Thornhill & Gangestad, 1993).

D. SUMMARY

In sum, judgments of attractiveness converge across cultures and age groups, and several reliable predictors of attractiveness have been identified. Are these recent empirical developments compatible with the sociocultural perspective? A sociocultural view can readily accommodate evidence of within-culture consensus, which would be expected if members of a given culture were exposed to similar beliefs about what is and what is not attractive. However, other aspects of the data just reviewed are inconsistent with the position that attractiveness preferences represent socialized, cultural beliefs. Specifically, a sociocultural perspective is unable (a) to explain why there are near-universal standards by which attractiveness is judged; (b) to provide reasons for why certain physical characteristics reliably predict attractiveness judgments, whereas others do not; (c) to explain why certain physical characteristics exert similar effects on the attractiveness judgments of people from diverse cultures; and (d) to explain how infants could internalize culturally and socially transmitted ideas about what is attractive and how one should respond to it within weeks or months of birth.

The point is not that social and cultural processes don't contribute to the impact of attractiveness on social perception and behavior. A number of elegant experiments demonstrate that they do and in very important ways (e.g., Snyder, Tanke, & Berscheid, 1977). However, in addition to being unable to accommodate the data reviewed previously, these perspectives fail to account for the *origins* of attractiveness preferences (Berry & Finch Wero, 1993): Where does the ubiquitous concept of attractiveness come from in the first place?

During the past decade, a growing number of psychologists developed evolutionary models that expand on Darwin's concepts of natural and sexual selection to explain various aspects of social perception, interaction, and behavior. Some of these theoretical models have much to say about the origin of preferences for physical attractiveness, the reasons for the links between attractiveness and attraction, and the mechanisms that underlie the effects of attractiveness on human behavior. Moreover, not only do these

theories readily accommodate evidence of early sensitivity to attractiveness and universal standards of attractiveness, they specifically predict such effects. Can these evolutionary perspectives provide a compelling theoretical account of the form and function of attractiveness preferences?

III. Theoretical Developments: The Function of Attractiveness

A. DARWIN'S THEORY OF SEXUAL SELECTION

Evolutionary perspectives on attractiveness preferences are ultimately grounded in Darwin's (1859, 1871) concept of sexual selection. Recall that the doctrine of natural selection argues that individuals who possess traits that give them a survival "edge" over individuals who lack those traits will be better represented in the future gene pool. Thus, heritable traits that increase the likelihood of survival will be "selected" and become characteristics of the species. For example, individuals who were inclined to seek nourishment from dirt and pebbles rather than fruit and meat did not survive long enough to reproduce. Consequently, such dietary preferences were not carried forth into future generations. Surviving to maturity, however, does not guarantee contributions to the gene pool; the genes of individuals who live to a ripe old age but never produce offspring are not represented in future generations, whereas those of individuals who both survive and produce offspring are. Sexual selection emphasizes differential *reproduction* as opposed to differential *survival* and favors the perpetuation of morphological, psychological, or behavioral qualities that increase an individual's reproductive success.[2]

How might particular traits translate into differential reproductive success? Some characteristics are selected because they provide the individual with an advantage over other members of his or her sex when competing for access to potential mates (intrasexual selection). For example, in species in which males engage in physical competition for mates, physical size and strength could be selected if bigger, stronger males were most likely to gain sexual access to females. Traits may also be selected because individuals exhibiting them are more often chosen as mates by members of the opposite sex (intersexual selection). For example, if peahens prefer peacocks with brilliant tails over those with less impressive tails, males displaying brighter

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[2] The term "reproductive success" is used to refer to "success" in the very narrow sense of the extent to which an individual contributes to the gene pool, either through the number of offspring produced or the ability of offspring to ultimately contribute to the gene pool.

plumage will have greater reproductive success and, consequently, greater numbers of descendants.

In many cases, the qualities favored by sexual selection advertise some form of reproductive advantage, and selection for these qualities can be roughly divided into two types: ''good parent'' or ''good provider'' selection and ''good genes'' selection (e.g., Cronin, 1991; Gangestad & Thornhill, 1997a; Trivers, 1972).[3] The ''good provider'' model of sexual selection emphasizes (genetically) nonheritable benefits that increase the likelihood that more offspring will be produced and that those offspring will survive and reproduce successfully themselves. For example, potential mates can vary in health status in ways that are not heritable (e.g., the absence of contagious diseases). Disease-free, healthy mates are more likely to produce viable offspring and help provide for them than are sickly mates. Nonheritable benefits are not limited to the absence of disease, but also may include qualities such as the ability or willingness to provide resources to offspring. Individuals who preferred mates who provided such benefits theoretically enjoyed greater reproductive success and ultimately had more descendants than did others. As a result, these preferences presumably became more common in the population.

Selection for ''good genes,'' on the other hand, results from preferences for traits that reveal heritable fitness or viability. For example, if a visible male trait advertises some aspect of good health that is to some extent heritable, the offspring of females who select as mates males who display that trait will enjoy those genetic benefits. If females who prefer a particular trait produce greater numbers of or more viable offspring due to their mate's superior fitness, and pass these benefits on to their descendants, both the female preference and the male trait will become more prevalent in the population.

To the extent that physical attractiveness veridically reveals heritable or nonheritable beneficial qualities, preferences for attractive mates are expected to evolve. Darwin (1871) recognized our propensity to prefer physically attractive members of the opposite sex, as evidenced by his well-known observation that ''man is largely . . . influenced in the choice of his wife by external appearance'' (p. 881). Darwin further observed that women favored men who were attractive and noted that if women's preferences

[3] Some propose that selection can also occur for traits that serve no functional purposes. If females arbitrarily prefer a trait that provides no genetic benefits (e.g., a trait that simply makes certain males more noticeable or salient than other males), their male offspring may be especially preferred as mates by other females due to their possession of that trait (i.e., the ''sexy son'' hypothesis; cf. Weatherhead & Robinson, 1979). Thus, this model proposes that selection can occasionally perpetuate characteristics and preferences for characteristics that—in of themselves—do not promote reproductive success (cf. Cronin, 1991; Fisher, 1958).

entirely dictated mate selection "a very ugly man would perhaps altogether fail in getting a wife" (p. 898). Surprisingly, however, he never developed the notion that reproductive advantages might accrue to those who preferred attractive mates and instead viewed such preferential selection as arbitrary in nature. Although Darwin did not specifically posit a functional role of attractiveness in mate selection, several recent evolutionary models do. Some of these build on the concept of the good genes model of selection, whereas others elaborate on the good provider model, an idea further developed by Trivers (1972).

B. TRIVERS' THEORY OF PARENTAL INVESTMENT

Like Darwin, Trivers did not posit a functional role of attractiveness in sexual selection. However, as theoretical perspectives that built on his notion of relative parental investment do, his contributions are briefly reviewed. Darwin noted that in many species males show evidence of sexual selection due to female preferences; i.e., females typically are "choosier" about mates, and males evolve exaggerated, showy characteristics in response to such selection pressures. Trivers (1972) argued that these sex differences result from differences in parental investment. In many species, one sex invests more heavily than the other in producing offspring. In humans, for example, females are initially the more heavily investing sex. Whereas one act of intercourse could be sufficient for a man to produce offspring, a woman must invest a minimum of nine months of time and effort to achieve an equivalent level of reproductive success. Thus, attracting greater numbers of partners during a given time period was less likely to increase women's than men's reproductive success.[4] Rather, the greatest number of offspring a women could have during a year would be one regardless of the number of her sexual partners. One consequence of this limited variability is that differential reproductive success in women is determined less by differences in the quantity of their offspring than by differences in the "quality" or viability of those offspring. Consequently, the offspring of women who historically chose "better" fathers for their relatively limited number of children ("better" being defined as fathers who contributed more to their survival and ultimate reproductive success) should have been favored by evolution over the offspring of women who made poorer choices.

[4] More accurately, attracting multiple partners does not yield reproductive benefits for women *via increases in number of offspring*. Recent evolutionary perspectives emphasize, however, that other benefits (e.g., genetic diversity, increased genetic fitness of offspring, material resources) can accrue to women as a result of multiple mating, a point returned to later.

Based on these observations, Trivers made two primary predictions. First, females should be more selective than males when evaluating potential mates. His second prediction was a logical parallel to the first: In species where females are the more reproductively valuable and ''choosier'' sex, males will compete to gain their favor. These behavioral differences are not posited to result from sex per se, but instead from the fact that parental investment covaries with sex. For example, in the few species in which the male invests most heavily, males also tend to be more exacting in their preferences for mates, and females compete intensely for their favor (Trivers, 1985). Level of parental investment, however, is not an ''all or nothing'' variable. Although in many species females do invest more heavily than males, the extent to which males invest varies widely among species. Recall that the greater the level of investment, the more ''choosy'' one can be. Consequently, the extent to which male preferences play a role in mate selection varies between species. In some cases (e.g., humans), males invest relatively heavily and consequently exert greater levels of choice than they do in species in which males make relatively little parental investment (e.g., chimpanzees). Thus, although evolutionary biologists tend to focus on the importance of female choice, among humans, male choice is also deemed important.

Trivers noted that one quality human males seemed to prefer in mates is attractiveness: ''There is good evidence that American women tend to marry up the socioeconomic scale, and physical attractiveness during adolescence facilitates such movement. Until recently such a bias in female choice presumably correlated with increased reproductive success, but the value, if any, of female beauty for male reproductive success is obscure'' (Trivers, 1972, p. 172). It is somewhat puzzling that evolutionary biologists were slow to appreciate the possibility that the correlation between physical attractiveness and human sexual attraction has a functional basis. Although the idea of ''arbitrary selection'', or nonfunctional preferences, had been discussed by Darwin and others (e.g., Fisher, 1958), most preferences for ''attractive'' morphological characteristics in nonhuman species increase reproductive success. For example, peahens seem to prefer peacocks who sport brilliant tails because such displays advertise good health (e.g., Hamilton & Zuk, 1982).

Researchers may have failed to consider the functional basis of these preferences in part because of the prevailing view of attractiveness as arbitrary in nature and culturally bound. A second contributing factor may have been that, as Trivers noted, attractiveness was seen as being primarily a male preference and the idea of male selectivity was not a common theme in evolutionary biology (Jones, 1995). However, human males invest heavily in their children, as compared to many species, rendering male choice

relatively important. Recent articulations of human mate selection note that although men may, on average, be somewhat less discriminating than women in their choice of partners, under some conditions men may be quite selective, especially in systems that tend toward monogamy as opposed to polygamy (e.g., Buss & Barnes, 1986). These theoretical models further emphasize the importance of attractiveness in men's preferences.

C. ATTRACTIVENESS AS AN INDICATOR OF REPRODUCTIVE VALUE AND FERTILITY

Many researchers note the importance of physical attractiveness in romantic and sexual attraction. One of the most clearly articulated theoretical statements of why attractiveness influences human mate preferences is provided by Buss and his associates (Buss, 1989, 1998; Buss & Barnes, 1986; Buss & Schmitt, 1993; see also Kenrick & Keefe, 1992, for a related discussion and line of work). Buss' sexual strategies theory (SST) argues that differences between men and women are especially prevalent in the domain of sexual attraction and behavior because historically men and women were presented with different sets of challenges, or ''adaptive problems'' related to mating and reproductive success. Moreover, men and women theoretically evolved different ''strategies''—preferences or behavioral propensities—to deal with these divergent challenges. To the extent that a particular preference led to the successful resolution of a given problem and consequently increased reproductive success, it is posited that people who possessed the useful preference out-reproduced those who did not. Consequently, the prevalence of the preference in the population increased.

For example, recall that one consequence of differential parental investment is that women's reproductive success tends to be tied to the ''quality'' of their children, i.e., their children's viability, healthy development, and, ultimately, reproductive success. Thus, one adaptive problem women historically encountered involved securing sufficient resources to ensure such success. A woman who selected mates who possessed resources and were willing to invest those resources in her and her offspring had greater reproductive success than women who chose other mates. Thus, this model posits that women evolved preferences for men who are likely to provide resources. Requiring that men provide evidence of resources and a willingness to invest them before granting sexual access is a strategy that women may have evolved because it solves a particular adaptive problem.

On the other hand, another consequence of sex differences in parental investment is that men's differential reproductive success is directly tied

to the quantity of offspring they produce. Because of the low level of minimal male investment required to produce offspring (i.e., intercourse), engaging in sex with many partners may be an effective method of increasing reproductive success for men; the costs are relatively low and the potential payoff, reproductively speaking, is high.[5] Thus, men who wanted to engage in sex with numerous partners under conditions of relatively low commitment out-reproduced men who had no such desire. Consequently, men may have evolved a number of preferences that women did not, including a desire for sexual variety and an interest in casual sexual relations.

Although SST focuses on sex differences in the nature of men's and women's mating preferences, Buss and his associates acknowledge that men and women evolved multiple mating strategies, and the likelihood of following any particular strategy depends on both the context and environmental conditions. For example, increased reproductive success theoretically accrued to men as a function of the number of short-term, low-investment relationships in which they engaged (i.e., a "short-term sexual strategy"); however, obtaining numerous partners would be difficult if women were selective and insisted on high levels of resource investment. Moreover, men's reproductive success also improves as a function of the viability of those offspring they do produce, and this may increase with their level of investment. Consequently, a man who engages in relatively few long-term, high-investment relationships (i.e., a "long-term sexual strategy") may be more likely to obtain a mate and may also increase the reproductive success of his offspring.[6] This suggests that men evolved propensities to pursue, perhaps simultaneously, both long- and short-term strategies. SST has less to say about why women evolved short- as well as long-term mating strategies. However, Buss (1999) points out that women do indeed favor short-term liaisons under some circumstances and notes the need for more attention to the benefits that may accrue to women who employ short-term strategies.

How does attractiveness fit into the SST model? To the extent that choosing physically attractive mates solved important adaptive problems and increased reproductive success, preferences for attractiveness would be expected to evolve. Buss is most clear in his discussions of the theoretical basis of men's fondness for attractive women. In particular, attractiveness preferences are thought to constitute a solution to men's adaptive problem

[5] Of course, such a relation does not currently hold, given the availability in many cultures of effective contraception and legalized abortion.

[6] The selection of the term "sexual strategy" is perhaps unfortunate, as it may lead to misunderstandings on two fronts. First, it is not meant to imply strategic planning regarding gene propagation. Second, this term should also not be misinterpreted as suggesting that the process of evolution is a "forward thinking" purposeful process.

of identifying which potential mates were fertile and which were not "because the important class of cues that are linked with fertility and reproductive value are physical . . . men will place great importance on physical attractiveness in both short-term and long-term contexts" (Buss & Schmitt, 1993, p. 213). The reasoning is as follows: men's reproductive success will be severely limited if they tend to prefer partners who can't have children. Although a woman's reproductive status[7] is not readily apparent, it is reliably correlated with age and health. Direct knowledge about a woman's age and health is also not available (perhaps even to the woman herself, in ancestral times), but qualities associated with age and health are, and they tend to correlate with physical attractiveness. For example, as mentioned previously, waist-to-hip ratio predicts women's attractiveness. Moreover, WHR is correlated with women's fertility and health (e.g., Singh, 1993a). Consequently, men who selected attractive women as mates (i.e., women with low WHRs) may have had greater reproductive success then men who preferred unattractive women (i.e., women with high WHRs). Moreover, such preferences would tend to "pay off," reproductively speaking, in both long-term and short-term contexts.

The predictions advanced by SST regarding women's responses to male attractiveness are less well articulated. While acknowledging that attractiveness-related cues to health could be important for both sexes, the primary specific prediction advanced by Buss and Schmitt (1993) regarding women's preferences is that because a man's reproductive capacity is somewhat less directly tied to his age, "physical appearance should be less central to a women's mate preferences . . . men more than women should value physical attractiveness in potential mates" (p. 209).

A fair amount of available data are consistent with the hypothesis that men value attractiveness more than women do in long-term mates. For example, in a massive cross-cultural study, people in 37 countries rated how important attractiveness was in a partner (Buss, 1989). In 34 of the cultures examined, men gave significantly higher ratings to attractiveness than did women. A meta-analysis of the effects of attractiveness on romantic attraction (Feingold, 1990) further confirmed that attractiveness exerted a

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[7] Actually, Buss differentiates between the concepts of fertility and reproductive value (Buss, 1994, 1999). Specifically, "reproductive value" refers to the number of children a woman of a particular age could be expected to have in the future. "Fertility" refers to the likelihood of viable offspring being produced at a particular point in time. Thus, women's reproductive value peaks at a somewhat younger age (late teens) than does fertility (mid-20s). Consequently, it has been suggested that reproductive value should be more important in long-term than in short-term contexts. Although this distinction may be important for considering the relation of age to preferences, it seems to have somewhat less direct relation to discussions of attractiveness preferences. Thus clear distinctions will not be drawn here between these variables, and the more general term "reproductive status" is used.

greater effect on men's preferences than on women's. Although these data are consistent with the prediction that women place less value on a partner's attractiveness than do men, note that the magnitude of these sex differences is not large. For example, when a sample of college students rank ordered the importance of characteristics of a potential mate, men and women gave attractiveness an average ranking of 4.04 and 6.26, respectively (Buss & Barnes, 1986). When asked to indicate the minimum level of attractiveness that would be acceptable in an opposite-sex partner, undergraduate men held higher standards than women about potential marriage partners. However, both men and women required similar and high levels of attractiveness in someone whom they would date, date exclusively, or have sex with (Kenrick, Sadalla, Groth, & Trost, 1990). Women further seem to place particular importance on the attractiveness of a short-term partner (e.g., Buss & Schmitt, 1993; Kenrick et al., 1990; Regan, 1998a, 1998b), a finding not readily derived from extensions of the parental investment model. Noting this, Buss and Schmitt (1993) acknowledge that the ''evolutionary psychology of physical attractiveness is even more complex than this discussion points out'' (p. 209) and suggest that a more complete understanding of women's attractiveness preferences may be provided by recent theories that focus on heritable fitness, sometimes dubbed ''good genes theories.''

D. ATTRACTIVENESS AS AN INDICATOR OF HERITABLE FITNESS

Evolutionary models such as SST emphasize the importance of women's attractiveness to men because of its links to reproductive status and fertility. Although women are also posited to be selective about the characteristics of the men they choose as mates, these models tend to emphasize women's concerns with cues to resource investment. Considerable data support these predictions, but a number of observations are not readily explained by parental investment models. For example, in species in which males exhibit low levels of investment, females continue to find certain males more ''attractive'' than others. Moreover, as noted, when the likelihood of resource investment is low (i.e., short-term relationships), women are especially choosy about men's physical attractiveness. What reproductive benefits associated with male attractiveness could lead to these preferences?

Darwin did not foresee heritable advantages that might accrue to women who chose physically attractive partners. For example, he noted that if women selected handsome men as husbands, unattractive men might not find wives, but ''the handsomer men although more successful in obtaining wives would not as far as we can see leave more offspring to inherit their

beauty than the less handsome husbands of the same women'' (1871, p. 898). However, good genes (or ''viability indicator'') models posit that women evolved preferences for physically attractive males because attractiveness advertises superior heritable fitness or viability. To the extent that women who produced offspring with men high in genetic fitness (i.e., physically attractive men) passed increased fitness to their descendants, women's preferences for attractiveness in potential mates should evolve.

Good genes accounts of such preferences are controversial, largely due to disagreements about whether viability is heritable. Genetic variation in a particular trait is necessary for preferences for that trait to evolve. An underlying assumption of selection, however, is that it reduces heritable variation in the population to near zero. This creates a paradox. If, for example, women's attractiveness preferences are driven by cues to heritable fitness, and there is no variability in fitness, all men should be equally preferred. Clearly, they are not. Recent developments in evolutionary biology, however, provide insight into how variation in genetic fitness could be maintained even if sexual selection is in operation. The first is that the rate of mutations in humans—which introduce variations in heritable fitness into the population—is higher than originally thought (e.g., Charlesworth, 1990; Charlesworth & Hughes, 1998). A second source of genetic variation in human fitness stems from the phenomenon of host–parasite coevolution. Evolutionary biologists make the argument that changing selection pressures are placed on humans by parasites or pathogens—disease-causing microorganisms that inhabit their bodies. Although pathogens and their hosts place constant selection pressures on one another, the nature of these continual pressures repeatedly shift. As human hosts evolve resistant defenses to parasites, parasites evolve to invade successfully the defenses of their hosts, and humans, in turn, evolve new defenses. Thus, the genotype that yields heritable viability, or pathogen resistance, constantly shifts. In essence, because the nature of what constitutes heritable fitness changes, selection can not ''catch up'' and eliminate variability in fitness in the population. Consequently, although constant selection pressures reduce genetic variation in a trait, this shifting selection maintains it (Hamilton, 1982; Hamilton & Zuk, 1982; Tooby, 1982).

What are the implications of parasite/host coevolution for attractiveness preferences? To the extent that individuals high in pathogen resistance exhibit different physical traits than individuals low in resistance, potential mates who favored or found more attractive those physical qualities would have greater reproductive success due to the increased heritable fitness passed to their descendants. Thus, preferences for ''attractive'' features would evolve. For example, if physical attractiveness correlates with men's genetic fitness, women who historically preferred physically attractive men increased their reproductive success by gaining increased fitness (i.e., ''bet-

ter genes'') for their descendants. To the extent that this preference increases reproductive success, it should become prevalent in future generations. Moreover, as parasite–host coevolution maintains variability in heritable fitness, individual differences in the ''attractive'' indicators of this trait are also maintained. Consistent with this prediction, several lines of work suggest that physically attractive human physical features may be markers of heritable fitness. For example, the links between symmetry and attractiveness reviewed previously are posited to result from the links between symmetry and fitness (e.g., Gangestad & Thornhill, 1997a; Gangestad & Simpson, in press).

Good genes models of attractiveness preferences tend to emphasize females' interest in male attractiveness. Why is selection for good genes considered more relevant to women's than men's attractiveness preferences? A couple of points are germane. First, in many species the correlates of heritable fitness that females find attractive (e.g., peacocks' tails) are features that honestly advertise genetic fitness and health; they do so by diverting the body's resources away from basic functions in order to develop the physiologically expensive characteristic. Because females expend much physiological effort on gestation and lactation, less effort is available to be siphoned off and used to develop ''showy'' traits (Gangestad & Thornhill, 1997a). This suggests that at least in some species, such costly, attractive correlates of fitness are less likely to develop in females than in males. Second, recall that due to differences in parental investment, there is much less variability in the number of offspring women can produce than in the number men can produce (Trivers, 1985). Thus, increasing the quantity of offspring is not an especially effective method of increasing women's reproductive success. Consequently, increased viability or ''quality'' of offspring has historically been the primary avenue by which women's reproductive success increased, and those women who met with greater reproductive success were likely also those especially attuned to indicators of heritable fitness in men.

E. A DUAL-MODEL EVOLUTIONARY THEORY OF ATTRACTIVENESS PREFERENCES

In sum, whereas models such as SST emphasize men's preferences for attractive women, good genes models tend to focus on women's preferences for attractive men.[8] These two approaches may initially sound incompatible,

[8] The focus on sexual strategies theory and good genes accounts of attraction is not meant to imply that these are the only evolutionary accounts of human mating. Other perspectives, however (e.g., attachment-based models; cf. Zeifman & Hazan, 1997; so-called ''female-centered'' theories; cf. Gowaty, 1992; Hrdy, 1997), do not incorporate such explicit predictions regarding the role of physical attractiveness in attraction.

but they are not. Instead, each emphasizes different sets of attractive features for which preferences evolved. The former focuses on cues that reveal fertility and reproductive status, whereas the latter focuses on cues linked to heritable fitness. Moreover, preferences for these two sets of features evolved via different mechanisms, and sex-linked differences in how these mechanisms work lead to some differences in the opposite-sex features for which men's and women's attractiveness preferences evolved. Men's preferences may be especially attuned to attractiveness-related features revealing age, as the likelihood of a sexual encounter producing offspring is more directly tied to a women's age than a man's. On the other hand, because increasing quality of offspring is their most effective method of increasing reproductive success, women should be especially attuned to attractiveness-related cues that reveal men's heritable fitness. Finally, both models observe that good health—apart from heritable fitness—is a desirable quality in mates of either sex. Consequently, both models predict that men and women will find visible indicators of disease unattractive and prefer opposite-sex members who appear healthy.

A comprehensive evolutionary theory of attractiveness needs to incorporate predictions from both approaches to explain men and women's attractiveness preferences. Although a dual model predicts that attractiveness will be important to both men and women, it emphasizes that the mechanisms that led to the evolution of these preferences differ. As a result, the specific features that men and women may find most physically attractive, and the constraints under which attractiveness is most important to men and women, will likely differ, a point revisited later.

IV. Are Recent Empirical Developments Consistent with Evolutionary Perspectives on Attractiveness?

Thus, evolutionary models argue for the importance of attractiveness in human interaction, especially in the domain of sexual attraction. However, can these models account for recent empirical findings in the attractiveness literature? Are recent data regarding consensus, early sensitivity to variations in attractiveness, and reliable predictors of attractiveness consistent with these perspectives?

A. CONSENSUS

Recent work documents substantial within-culture and between-culture agreement in perceptions of attractiveness. As noted, it is difficult for

sociocultural views to account for cross-cultural consensus. On the other hand, both within-culture and cross-cultural agreement are predicted by evolutionary models. These perspectives consider attractiveness preferences to be an adaptation (e.g., Symons, 1995), defined as an ''inherited and reliably developing characteristic that came into existence through natural selection because it helped to solve a problem of survival or reproduction during the period of its evolution'' (Buss, 1999, p. 36). Adaptations can be morphological, physiological, or psychological in nature, and, as Tooby and Cosmides (1990a) point out, although the ''expression [of adaptations] may be limited by sex, life history stage, or circumstance . . . at the genetic or design level, the adaptation will almost always be species universal'' (p. 393). As implied, such universality does not preclude the existence of some individual differences, an issue discussed later in detail. However, both within- and cross-cultural consensus is clearly predicted by evolutionary models.

B. INFANT SENSITIVITY

As noted, young infants prefer faces that adults judge to be attractive over faces that adults judge to be unattractive (e.g., Langlois et al., 1987). Not only are these data consistent with evolutionary perspectives, they provide much needed support for critical points in evolutionary arguments. Recall that evolutionary models point to sexual selection as the mechanism that ultimately drives attractiveness preferences. For example, Buss and Schmitt (1993) argue that men who preferred attractive women—who were purportedly more fertile and had greater reproductive value than unattractive women—experienced greater reproductive success than men drawn to less attractive women. Because men who favored attractiveness outreproduced those who did not harbor such preferences, attractiveness preferences became increasingly prevalent. Similarly, those working within a good genes approach note that women find markers of heritable fitness attractive in men (e.g., Gangestad & Thornhill, 1997a). To the extent that passing on good genes to one's offspring increased the offspring's reproductive success, women who preferred men who exhibited these markers eventually had more descendants than those who did not, again increasing the prevalence of preferences for attractive markers of heritable fitness in the population.

Implicit in both lines of logic is the assumption that appearance preferences are genetically transmitted. As noted, preferences for attractiveness are posited to be an adaptation, and adaptations are assumed to be heritable (e.g., Buss, 1999). If attractiveness preferences are not heritable, evolution-

ary models argue that sexual selection could not result in a species typical
(or sex typical) preference for attractive members of the opposite sex. The
inherited nature of such preferences is an idea that evolutionary theorists
have been quick to assert, but somewhat lax in testing, a point revisited
later. However, the demonstration of early sensitivity and responsiveness to
attractiveness renders social learning accounts of attractiveness preferences
unlikely and provides empirical support for this critical assumption of evolu-
tionary models.

C. DETERMINANTS OF ATTRACTIVENESS: WHAT DOES ATTRACTIVENESS VERIDICALLY ADVERTISE?

As noted, the demonstration of consensus in perceptions of attractiveness
is entirely compatible with an evolutionary perspective. The identification of
specific physical qualities that reliably influence these perceptions provides
even greater support for an evolutionary interpretation of attractiveness
preferences, especially if those characteristics influence the judgments made
by people from diverse cultures. However, evolutionary models further
posit that the physical features that correlate with attractiveness are (or
were during ancestral times) veridical ''advertisements'' of qualities that
influence reproductive success. Evolutionary theorists are fairly explicit
about what these qualities are: fertility and reproductive status, general
health, and heritable fitness. Is there any evidence that the specific charac-
teristics previously identified as reliable predictors of attractiveness—age-
related cues, WHR, facial averageness, symmetry, or exaggerated fea-
tures—reveal these qualities?

1. Fertility and Reproductive Status

Evolutionary models such as sexual strategies theory emphasize men's
sensitivity to women's attractiveness and suggest this preference evolved, in
part, because appearance provided reliable cues to fertility and reproductive
value (e.g., Buss & Schmitt, 1993). If this is correct, variables correlated
with fertility and reproductive function should influence perceived attrac-
tiveness.

a. Age-Related Characteristics.   As women's fertility and reproductive
value peak at a relatively young age, a youthful appearance is posited to
be an important determinant of women's attractiveness (e.g., Symons, 1979,
1995). Because age is less directly related to men's reproductive capacity,
men's attractiveness is not predicted to be strongly tied to their age. More-
over, because other benefits may accrue to men as they age (e.g., social

power, resources), women are expected to find older men more attractive than younger men (Buss & Schmitt, 1993). It has been convincingly established, for example, that men tend to marry women who are somewhat younger than themselves and that women typically marry men who are somewhat older than they are (cf. Kenrick & Keefe, 1992).[9] However, as noted previously, the parallel expectation of sex differences in the effects of age on *physical attractiveness*—although often asserted—has received lukewarm empirical support. This is puzzling; age *is* a more reliable marker of the reproductive status of women than men. Why haven't clearer sex differences emerged?

One possibility is that evolutionary models underestimate the deleterious influence of age on men's physical attractiveness. Although the point has been made that *Playboy* has never needed to publish a special issue for older men featuring older women, it is also the case that *Playgirl* has never been inundated with requests from women of any age to publish special issues featuring older men; the literature clearly documents that neither sex benefits—in terms of physical attractiveness—from the aging process. The pairing of younger, physically appealing women with older, successful men is often cited as evidence of age being attractive in men. However, it seems more likely that the ''trophy wife phenomenon'' (e.g., Kenrick, Trost, & Sheets, 1996) reflects women's interest in much older men's resources and power rather than their perception of older men as more physically appealing than younger men.

A second possibility is that evolutionary models overestimate the deleterious influence of age on women's physical attractiveness. This may stem from differences between conditions in the current environment and the historical conditions under which men's attractiveness preferences evolved. The level of physical attractiveness exhibited by ancestral women at the age of their greatest reproductive value (e.g., late adolescence) likely decreased rapidly as a result of the harsh conditions they endured. This point is made well by Symons, when describing women of the present day Yanomamo tribe of South Venezuela: ''Among natural-fertility pre-literate peoples, such as the Yanomamo, a 25-year-old woman typically will have borne and nursed two to four children and been exposed to the elements of nature every day of her life, and the effects of gestation, lactation, and a rigorous physical existence will be manifested clearly in almost every feature of her body'' (Symons, 1995, p. 106). This suggests that conditions in industrialized societies may result in women maintaining a youthful appearance for much

[9] Although postadolescent men tend to prefer women who are somewhat younger than themselves as mates, this is not posited to reflect a desire for *younger* partners per se, but instead a general preference for women of high reproductive value. Thus, adolescent males actually prefer women who are older than themselves (Kenrick & Keefe, 1992).

longer periods of time than was true in ancestral environments. Thus, clearer sex differences in the relations of age and attractiveness may have indeed existed in ancestral than in current industrialized societies, due a more rapid age-related decline in the attractiveness of women in ancestral environments.

b. Waist-to-Hip Ratio.   Some studies suggest that WHR is a reliable predictor of attractiveness judgments, a finding that extends across cultures. What functional purpose might be served by preferences for women with relatively low WHRs? A fair amount of data suggest that WHR may be a veridical indicator of fertility and reproductive potential. First, pre-menopausal women have lower WHRs than do postmenopausal women (Kirschner & Samojilik, 1991). Moreover, WHR predicts fertility among premenopausal women. For example, in a sample of married women diffi-culty in conceiving was positively related with WHR, and women with low WHRs had their first child at an earlier age than did women with higher WHRs (Kaye, Folsom, Prineas, Potter, & Gapstur, 1990). In addition, WHR is a valid indicator of a variety of health problems that lower fertility (cf. Singh, 1993a, 1993b). The mechanism linking reproductive success to WHR appears to be hormonal; high levels of estrogen lower WHR, whereas high levels of testosterone increase it. These links between WHR and actual reproductive status provide a plausible functional basis for the evolution of the perception of low waist-to-hip ratios as desirable and attractive.

2. Health and Heritable Fitness

As noted, characteristics found ''attractive'' in many animal species are those that reveal low pathogen or parasite load, good health, and heritable resistance to disease (e.g., Hamilton & Zuk, 1982; Johnson, Thornhill, Ligon, & Zuk, 1993; Moller, 1990, 1992). This seems true in humans as well. Ford and Beach (1951), for example, noted that people from many cultures find markers of disease (e.g., sores, unclear skin) extremely unat-tractive. Moreover, it seems likely that reproductive success would be greater for those people (especially women) who historically preferred mates with physical characteristics that revealed superior immune systems, particularly if that superiority would be passed on to their offspring. How might the attractive stimulus qualities described earlier accurately reveal health or heritable fitness?

a. Facial Averageness.   As mentioned, averaged faces are more attractive than individual faces (e.g., Langlois & Roggman, 1990). No available data address the relations between health or heritable fitness and the extent to which features approximate the population mean, and research on this question is warranted. However, there are sound theoretical reasons to

expect such qualities to predict health and genetic fitness. First, as Symons (1995) points out, the population average for morphological features typically reflects natural selection's ''opinion'' regarding the optimal design for that feature. For example, noses evolved to be the size and shape they are, on average, because that was the most efficient design to support breathing. Thus, selection is posited to favor, in general, preferences for morphological features that approximate the population average. Moreover, Langlois and Roggman note that preferences for ''average'' features (or, more accurately, aversions to deviations from average) serve an additional function. In particular, such anomalies or deviations often signal the presence of genetic mutations and congenital abnormalities (cf. Munro, 1984).

b. Symmetry.   In humans, overall body and facial symmetry predict physical attractiveness and sexual attraction (e.g., Gangestad & Thornhill, 1997b; Gangestad, Thornhill, & Yeo, 1994; Rhodes, Proffitt, Grady, & Sumich, 1998). Why would people find symmetry attractive in members of the opposite sex? The aesthetic appeal of symmetry has been noted for years, both in inanimate objects and in living beings (Zebrowitz, 1997). However, only recently have evolutionary biologists posited a functional connection between physical attractiveness and symmetry. Specifically, deviations from perfect symmetry in bilateral organisms reflect deviations from the optimum expression of the organism's intended symmetrical design. Because the left and right sides of the of the body are under the control of the same set of genes, these fluctuations represent ''things gone wrong'' in the expression of the genotype. Such fluctuations can result from a variety of sources, including parasites (Moller, 1992), mutations, and exposure to toxins (Parsons, 1990). Thus, fluctuating asymmetry is considered a marker of genetic quality and, as FA is heritable (Moller & Thornhill, 1997), heritable fitness. A number of studies reveal that FA is related to the length of life, reproductive success, and health of members of various animal species (e.g., Parsons, 1990).

This suggests that FA should be a marker of and predict health and fitness in humans as well. Consequently, preferences for people who exhibit bilateral symmetry may have evolved due to its links with health and fitness. Very little data directly address this hypothesis. In one ambitious study, Shackleford and Larsen (1997) examined the relations between facial asymmetry and numerous (over 60) measures of personality, physical appearance, social activity, and physical and psychological health in two samples of college students. The authors concluded that ''it is evident that facial asymmetry signals poor psychological, emotional, and physical health'' (Shackleford & Larsen, 1997, p. 465). This summary overstates the case a bit. Although some negative relations between facial asymmetry and measures of health were indeed revealed, many predicted relations were not

significant, and some significant correlations were in the opposite direction
of what would be expected. Moreover, although the use of different mea-
sures of health in two samples makes direct comparisons difficult, relatively
few relations replicated across both samples. For example, men's asymmetry
was positively correlated with their scores on the Beck Depression Inven-
tory in one sample, but unrelated to MMPI depression scores in the second.
Although Shackelford and Larsen provide a valuable data set, their results
do not establish convincing links between asymmetry and emotional or
physical health. One possibility is that measures of facial asymmetry are
not an especially good measure of overall FA (J. A. Simpson, personal
communication), which has typically been assessed at multiple points on
the body. Additional research on this important issue is warranted.

  c. Exaggerated Features.   Although the work on facial averageness
points to the functional utility of favoring features close to the population
mean, it is also proposed that preferences for certain exaggerated features
evolved because those features signal superior immune functioning and,
consequently, low parasite load. A familiar example of selection for an
exaggerated feature is the extravagant plumage of the peacock. The
development of this plumage is costly because the associated diversion
of physiological and hormonal effort places stress on the immune system.
This can only be tolerated and maintained by organisms that are in
good health, have low parasite loads, and likely superior heritable fitness
(cf. Folstad & Karter, 1992). Thus, those who found these particular
exaggerated qualities (called ''handicaps'') attractive in potential mates
likely benefited by avoiding diseased partners and by increasing the
heritable fitness of their offspring.

  Several exaggerated features in humans (particularly men) may influ-
ence physical attractiveness for similar reasons. As mentioned, prominent
jaws, chins, and cheekbones increase the perceived attractiveness of male
faces (e.g., Keating, 1985). These facial features are secondary sex
characteristics and develop due to the influence of testosterone (Thorn-
hill & Gangestad, 1993). Interestingly, testosterone is also an immunosu-
pressent and decreases the effectiveness of the immune system. Such
features thus constitute ''honest advertisements'' of a superior immune
system, as individuals with less competent immune systems could not
tolerate the stress created by their development. Consequently, women
who preferred these particular exaggerated features in mates may have
secured greater fitness benefits than did those who preferred mates with
less developed features.

  Large chins and jaws are not perceived to be attractive in women's faces,
and this makes functional sense. Exaggerated versions of these features in
women are not under the control of testosterone production. Consequently,

they provide no information about immunocompetence. However, women's cheekbones do become more prominent in response to testosterone production during puberty (Thornhill & Gangestad, 1993), and, interestingly, high cheekbones are also perceived to be especially attractive in women's faces (e.g., Cunningham et al, 1990). This illustrates that the perception of prominent or exaggerated features as attractive is specific to those particular features that advertise immunocompetence. It does *not* reflect a general abstract preference for big features. Big noses or large ears for example, are not reliable predictors of physical attractiveness, and faces in which all features are exaggerated are not considered attractive (Rhodes & Tremewan, 1996).[10]

d. Overall Facial Attractiveness. Finally, an ambitious study reported recently by Kalick, Zebrowitz, Langlois, and Johnson (1998) examined the relations between evaluations of overall facial attractiveness and health, and its provocative findings warrant discussion. The authors obtained photographs and health data from participants in the Intergenerational Studies archive at the University of California at Berkeley. This sample consisted of over 200 Berkeley residents born between the years 1920 and 1929 who were tracked over several decades. Health measures were obtained yearly from project physicians, based on exams and histories. These consisted of a summary evaluation on a 5-point scale ranging from ''no illness'' to ''serious illness.'' Kalick et al. averaged these yearly evaluations to compute adolescent, middle adulthood, and older adulthood indices of health. Attractiveness ratings were obtained from facial photographs of the participants taken in late adolescence. In this sample, attractiveness did not predict health status. Correlations between adolescent facial attractiveness and health ratings (controlling for SES) were $-.04$, $.05$, and $-.07$ for adolescent, middle adult, and older adult health, respectively. (Similar values were observed for male and female participants.). Interestingly, attractiveness and *perceived* health were indeed correlated.

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[10] Some argue that the idea of certain exaggerated features being attractive is inconsistent with the hypothesis that ''average'' features are attractive (e.g., Alley & Cunningham, 1991; Perrett, May, & Yoshikawa, 1994). However, it is possible that the most attractive faces are those in which all features are close to the population mean except these particular secondary sexual facial characteristics (Grammer & Thornhill, 1993). Moreover, it is not clear why prominent cheekbones could not in fact be close to the mean of the population. This confusion may reflect different interpretations of the word ''average,'' which is intended to reflect a lack of deviation from the population mean, or prototypicality, not ''mediumness.'' For example, although male faces with wide chins and jaws may be described as ''exaggerated,'' if wide jaws are typically found in male faces, this feature could be simultaneously be described as ''exaggerated'' and also prototypical or ''average.''

Thus, adolescents' global facial attractiveness bore virtually no relation to their current or later health status. Similar results were recently reported by Shackelford and Larsen (1999), who examined the relations between college students' facial attractiveness, daily self-reports of seven physical symptoms (e.g., sore throat, nausea), and general cardiovascular health. No relationships between the health indices and attractiveness were reported for women, and attractiveness was negatively correlated with only one measures of male health (experiencing a runny/stuffy nose).

Do these data refute the hypothesis that preferences for the attractive features discussed previously are adaptations that evolved due to their actual links with health and/or fitness? It seems unclear whether evolutionary models *should* predict relations between global attractiveness and health in the current environment. There is no doubt that the health status of people living in industrialized Western countries is far superior to that of ancestral men and women—due to better medical care (or, any medical care at all, for that matter), better nutrition, and a much less harsh day-to-day environment. For example, people with somewhat less resistant immune systems may not suffer from especially poor health if they are properly immunized, well fed, and have reasonable shelter from environmental stressors (e.g., inclement or cold weather). Thus, the (comparatively) restricted range of this variable in our current environment may attenuate whatever relations existed between general attractiveness and health in the environment in which such adaptations evolved. An interesting way to follow up on this speculation would be to assess the relations between attractiveness and health in members of preindustrialized hunter/gather societies, where conditions are more similar to those that people endured during ancestral times.

V. An Evolutionary Psychology of Attractiveness: Questions, Critiques, and Implications

Evolutionary models seem well equipped to provide a theoretical context within which to explain the origin and function of attractiveness effects. However, an evolutionary perspective on attractiveness raises as many provocative questions as it answers. Some are conceptual. For example, although attractiveness is typically thought of as a morphological variable, recent work suggests that it may be better conceptualized as multimodal in nature and influenced by more than static facial and body cues. A second issue involves evolutionary psychologists' conceptualization of what most social psychologists would call simply ''attraction'' as a ''psychological adap-

tation,'' ''evolved preference,'' ''evolved psychological mechanism,'' or ''evolved strategy'' (each term refers to the same general concept). These terms are unfamiliar to many social psychologists and their intended meaning often misunderstood. Other controversial issues raised by evolutionary perspectives are methodological in nature. For example, Buss (1989) provides impressive self-report data that suggest men place greater value on attractiveness in a mate than do women. However, there has been considerable debate regarding whether self-report is the most appropriate methodological approach for studying evolved preferences, and—if not—what constitutes a better alternative.

Finally, some provocative theoretical issues raised by an evolutionary perspective on attractiveness preferences warrant attention. For example, although evolutionary models emphasize universality, human social behavior is far from uniform. Can evolutionary perspectives account for individual differences in responses to attractiveness? Second, if selection pressures have yielded preferences for attractiveness, it is puzzling that individual differences in the selected trait—attractiveness—continue to be observed in the population; if attractiveness has historically been preferred, why isn't everyone attractive? Other issues involve the mechanisms that underlie evolved preferences. Inherent in the conceptual definition of adaptation is the assumption that evolved preferences, such as those for attractiveness, are genetically encoded. This idea seems likely to evoke considerable debate among social psychologists. Finally, although most evolutionary discussions of attractiveness focus on romantic attraction, a review of the social psychological literature reveals that the attractiveness halo effect is observed in many other contexts; can evolutionary perspectives account for these effects?

A. THE NATURE OF ATTRACTIVENESS: CONCEPTUAL AND METHODOLOGICAL ISSUES

The conceptualizations of attractiveness available in the literature are far from uniform. Many researchers focus on the facial determinants of attractiveness (e.g., Berry, 1991; Langlois & Roggman, 1990), whereas others are concerned with attractive body characteristics (e.g., Singh, 1993a). Still others suggest that behavioral as well as physical characteristics influence attractiveness judgments (e.g., Buss, 1989). Moreover, whereas most researchers implicitly or explicitly differentiate between attractiveness (a stimulus characteristic) and attraction (a perceiver's response), others do not. For example, Symons (1995) uses the term ''sexual attraction/attractiveness as an index of sexual pleasure'' (p. 80). Symons further includes non-

physical qualities in addition to morphological characteristics in his conceptualization of attractiveness, as evidenced by his observation that "female [as opposed to male] sexual attractiveness depends more on . . . physical features and less on abstract attributes such as status and prowess" (Symons, 1995, p. 80). Finally, many evolutionary biologists broadly define the "attractiveness" of nonhuman species in terms of mating success; i.e., attractive males are by definition those males with whom females choose to mate (e.g., Ridley, 1992).

The important question is not whether one of these definitions is right, whereas the others are wrong. Instead, each reflects somewhat different conceptualizations, and a failure to appreciate this may lead to confusion. Moreover, one's definition of attractiveness (and attraction) have important methodological implications. Below, some of the various ways in which attractiveness may be conceptualized and the associated methodological implications are discussed.

1. The Multimodal Nature of Attractiveness

As noted, studies of attractiveness typically focus on visible morphological qualities. Thus, the terms "attractiveness" and "physical attractiveness" implicitly refer to those *visual* cues that are perceived to be attractive. Most researchers attend primarily to facial and, to a lesser extent, body appearance. As evolutionary perspectives posit that attractiveness reveals attributes such as health, reproductive status, and heritable fitness, a focus on facial and body characteristics makes sense. However, the perceptible stimulus cues that advertise these qualities may extend beyond morphological characteristics. Thus, an individual's overall attractiveness seems likely to be multimodal in nature and only approximated by assessments of facial or physical attractiveness.

a. Movement. Does people's style of movement influence their attractiveness? Consider two women: One is facially animated and expressive, whereas the other is unanimated, inexpressive, and exhibits relatively flat affect. Although the two might be perceived as equally attractive on the basis of a photograph, what is the likelihood that will be true in real life? With the exception of the literature on emotional expression, dynamic information is virtually ignored in the work on face perception (cf. Berry, 1994). However, patterns of facial motion provide a wealth of information about the people who display them. Research with point-light facial displays—visual displays that simultaneously highlight dynamic information and degrade structural cues—reveal that veridical information about age, gender, individual identity, and physical and social dominance can be

gleaned from patterns of facial movement (Berry, 1990a, 1994).[11] Moreover, sensitivity to this information emerges at a young age (Berry, 1991b). Although no work has examined whether patterns of facial motion influence perceived attractiveness, the links of these patterns to gender, age, and dominance make this a plausible hypothesis.

In addition to facial motion, patterns of gait and body movement provide veridical cues to sex and age (e.g., Kozlowski & Cutting, 1978; Montepare & Zebrowitz-McArthur, 1988). Moreover, patterns of gait reveal psychological health (e.g., depression; McArthur & Baron, 1983) and would seem likely to reflect physical health, making gait and body movement likely influences on attractiveness. Montepare and Zebrowitz-McArthur (1988) asked people to make ratings of point-light walkers who varied in age and gender. Although attractiveness judgments were not obtained, perceivers showed considerable consensus in their ratings of how sexually appealing the target persons were ($\alpha = .86$). Moreover, young adult targets were judged to be sexier than either children or elderly adults, and this effect could not be attributed to differences in the perceived ages of the walkers. This finding further replicated across perceivers from different cultures (Montepare & Zebrowitz, 1993). Thus, people's characteristic styles of movement may influence their sexual attractiveness.

b. Auditory Information. Research reveals that people reliably discriminate voices along a dimension of attractiveness, that there is considerable consensus in judgments of the attractiveness of people's voices, and that the effects of vocal attractiveness on social perception parallel those of physical attractiveness: Individuals who have attractive voices are judged more positively than people whose voices are less attractive (Berry, 1990b, 1992; Zuckerman & Driver, 1989; Zuckerman, Miyake, & Hodgins, 1991). Moreover, children can reliably differentiate attractive from unattractive voices (Zuckerman & Hodgins, 1993), and vocal attractiveness influences the perceptions of children as well as of adults (Berry, Hansen, Landry-Pester, & Meier, 1994). Perhaps the most striking finding in this literature involves the strength of the cross-channel effects of vocal attractiveness. Zuckerman et al. (1991) demonstrated that vocal attractiveness accounted for a significant proportion of the variance in judges' ratings of the ''physical attractiveness'' of videotaped targets. Moreover, in some cases it was as

[11] Traditionally, point-light displays were created by filming a moving object (e.g., a face, a body) to which small light sources (e.g., reflective tape) are attached. The videotapes are then presented on a black and white monitor adjusted so that the display appears as a moving configuration of bright points moving against a black background. More recently, similar displays have been created by using software that systematically degrades standard videotapes. The primary characteristic of these displays, regardless of how prepared, is that they preserve dynamic information and conceal information about the moving object's structure.

strong a predictor of overall attractiveness ratings as was facial attrac-
tiveness.

What constitutes an attractive voice and why would such voices be pre-
ferred? Although research has not directly addressed these questions, a
few points are worth noting. First, vocal quality is reliably linked to sex.
This sex difference, however, does not develop until puberty, when male
voices undergo a characteristic shift in fundamental frequency that accom-
panies the appearance of secondary sex characteristics. Women's vocal
quality is also linked to their reproductive status, as there is evidence of a
hormonally induced shift in fundamental frequency associated with meno-
pause (Segre, 1971). Consequently, Sachs (1975) notes that "just as visual
cues serve to attract males and females to each other, sex differences in
[voice] probably also function as an attractive stimulus to the opposite sex"
(p. 169). Because the acoustic correlates of what is considered an attractive
male or female voice are not known, this suggestion is clearly speculative.
However, it seems reasonable to suggest that the preference for attractive
voices may have a functional basis.

c. Olfactory Information.   Although a vast literature exists on chemical
communication among other species, there is a dearth of research on the
role of odor in human communication. In one of the few discussions of
links between odor and human social perception, Levine and McBurney
(1981) note that this lack of attention may reflect the fact that "behavioral
scientists . . . may feel that the discussion of odors is inappropriate . . .
social psychologists may feel that odor is an obvious and trivial variable
that does not warrant serious investigation . . . it is perhaps worth noting
that until recently, similar arguments were made about physical attractive-
ness" (p. 180). Although psychologists apparently fail to appreciate the
impact of olfactory cues on attractiveness and attraction, it would appear
that the general public does not, as evidenced by the rather extensive
market for deodorants, after shave lotions, and perfumes.

Recent studies demonstrate that smell does influence the people's judg-
ments of the attractiveness of members of the opposite sex and suggest a
functional basis for these preferences. Eggert, Wobst, Zavazava, and
Muller-Ruchholtz (1994) asked women to rate the odor of men's shirts.
Women found especially attractive the smell of shirts worn by men who were
the most genetically dissimilar to them. As offspring of immunogenetically
dissimilar parents are more resistant to pathogens than are offspring of
genetically similar parents, women who were more attracted by the scents
of genetically dissimilar men would experience greater reproductive success
over evolutionary history. Consequently, preferences for these scents may
have evolved over time. Using a similar methodology, Gangestad and
Thornhill (1998; see also Thornhill & Gangestad, in press) found that

women liked best the scents of men who were low in fluctuating asymmetry which, as discussed previously, is a marker of heritable fitness. Interestingly, this relation was only revealed for those women who were in the fertile phase of their menstrual cycles. Thus, although little data is available on human olfaction and attractiveness, these studies suggest that smell may indeed contribute to sexual attractiveness, and the links between odor and attraction may have an evolutionary basis.

2. Methodological Issues

To summarize, the term ''attractiveness'' is often used in rather imprecise ways. Some use the terms attractiveness and attraction interchangeably. A more common problem is that an individual's overall attractiveness is assumed to be conceptually equivalent to facial attractiveness or overall physical attractiveness. The work described previously on variables such as averageness, fluctuating asymmetry, and waist-to-hip ratio clearly reveal that dimensions of facial and body appearance are important determinants of overall attractiveness. However, the available data on movement, vocal, and olfactory cues suggest it is probably unwise to assume that judgments of attractiveness are typically based entirely on static visual cues.

This has some important methodological implications for studies of attractiveness. Zuckerman et al.'s work on cross-channel attractiveness effects, in particular, makes clear that obtaining a ''pure'' measurement of the kind of attractiveness in which one is interested may require limiting the stimulus information available to judges. For example, if a researcher is interested in the impact of variations in structural facial attractiveness on interpersonal attraction, measurements of targets' attractiveness should be based on soundless, nondynamic stimuli. If one is interested in vocal attractiveness, judges' ratings should be based on vocal information only. These judgments can then be correlated with more ecologically valid judgments of attractiveness made ''in person'' or on the basis of videotapes. The primary point is to appreciate that overall attractiveness appears to be multimodal in nature and influenced by more than static facial or body cues.

B. THE NATURE OF PREFERENCES: CONCEPTUAL AND METHODOLOGICAL ISSUES

1. Attractiveness Preferences as Psychological Adaptations

Whereas social psychologists typically use the term ''attraction'' to refer to responses to attractiveness, evolutionary models tend to favor

terms such as "evolved preferences" or "evolved psychological mechanisms" to refer to the effects of attractiveness on perceivers. What exactly is the nature of "preferences" in evolutionary theories? Attractiveness preferences are considered an example of an adaptation—an inherited characteristic that evolved due to the fact that it increased the likelihood of survival or reproductive success. Many tend to think of the outcomes of such selection pressures as physical in nature (e.g., thumbs and taste buds are both examples of adaptations). However, some adaptations are psychological and consist of domain-specific psychological mechanisms that evolved because they successfully solved adaptive problems.

For example, tendencies to fear spiders and snakes represent psychological adaptations or evolved mechanisms. They became increasingly prevalent in the population because those who possessed these fears were more likely to survive and reproduce than those who did not. Similarly, preferences for attractive mates or mates who display and provide resources theoretically evolved because people who possessed those preferences experienced more reproductive success than those who did not. Although these adaptations vary widely in the behaviors to which they give rise (i.e., fleeing versus flirting), they have in common several key elements. According to Buss (1995), all psychological adaptations "solved specific adaptive problems in human ancestral environments . . . are triggered by only a narrow range of information . . . are characterized by a particular set of procedures or decision rules; and produce behavioral output that presumably solved the adaptive problem in ancestral times" (p. 7). As noted, psychological adaptations are further thought to be genetically based and heritable—just as thumbs and taste buds are specified in the genetic materials passed from parents to offspring, aversions to spiders and snakes and preferences for certain kinds of mates are thought to be specified in the genetic information passed from generation to generation.

Terms such as "psychological adaptations," "evolved psychological mechanisms," "evolved preferences," and "strategies" may produce misunderstandings about the nature of how these tendencies play out in daily life. One misunderstanding results from the perhaps unfortunate use of the term "strategy." Strategy is certainly not meant to imply "planning" on the part of the evolutionary process. Moreover, as others point out (e.g., Buss & Schmitt, 1993), this term is also not intended to imply intentional, goal-directed planning on the part of the individual. For example, if a women pursues a short-term strategy with an exceptionally attractive man, she does not consciously estimate his level of heritable fitness and then contemplate the extent to which this might translate into reproductive

advantages for her potential offspring. Instead, she simply experiences a strong attraction upon which she decides to act.

A related misunderstanding—again, perhaps due to the use of phrases such as "evolved psychological mechanisms" or "strategies"—is that the output of these mechanisms involves cognitive evaluations, devoid of emotion or affect. To the contrary, many emotional responses are thought to constitute adaptations (Tooby & Cosmedies, 1990a). For example, Buss (1999) notes that "emotions such as anger, distress, and upset are key human psychological solutions that have evolved to solve adaptive problems" (p. 313). In fact, intense negative emotional states probably were especially useful in solving such problems because they effectively focus our attention on potential threats and then motivate action. Similarly, intense positive emotions such as sexual desire and attraction draw people's attention to potential mates and motivate subsequent behavior. Thus, when we speak of, for example, men's "preferences" for attractive women, this term is not meant to imply some abstract cognitive appraisal; instead such preferences are experienced as intense emotional states, such as attraction, desire, lust, and (possibly) love.

2. Methodological Issues: Self-Report versus Behavioral Measures

What is the most appropriate way to study evolved preferences? A common method of assessing what people prefer in a partner is to simply ask them. For example, participants in Buss' cross-cultural study rated on a 4-point scale the importance of various qualities (e.g., "good looks") in a mate. Other types of self-report measures ask people to estimate the minimum acceptable level or the ideal level of various qualities in a mate (e.g., Kenrick, Sadalla, Groth, & Trost, 1990; Regan, 1998a) or to rank order the importance of various mate characteristics (Buss, 1989). The majority of studies of mate preferences, in fact, use self-reports (e.g., Buss & Barnes, 1986; Howard, Blumstein, & Schwartz, 1987, Regan & Berscheid, 1997; Sprecher, Sullivan, & Hatfield, 1994). As mentioned previously, these studies generally reveal that both sexes value attractiveness, but men indicate that attractiveness is somewhat more important to them in a partner than do women.

Such approaches have advantages. The measures are straightforward and easy to administer. Moreover, they do not resort to inferences about what people want based on other overt behaviors. However, there are some problems with these approaches. One concern is that people are not consciously aware of what qualities attract them to a member of the opposite sex. People often have little insight into the determinants of their perceptions and feelings, a point elegantly made by Nisbett and Wilson (1977).

Moreover, this lack of insight rarely stops people from proffering explanations of their responses (Nisbett & Wilson, 1977). It seems plausible that what people think they want in a partner does not correspond with the qualities that actually trigger their attraction to members of the opposite sex. Anecdotally, this may be illustrated by the often heard lament that ''I just keep falling for the wrong (wo)man.'' Thus, one concern is that people have little insight into the causes of their desires, and self-reports actually reflect stereotypical beliefs about the determinants of men's and women's attraction.

To the extent that participants have limited experience with relationships, this becomes a greater concern. This is well-illustrated by Buss' (1995) discussion of within-gender variability in romantic jealousy. Briefly, jealousy is proposed to be a psychological adaptation that alerts people to potential rivals and motivates them to engage in mate retention tactics. However, a woman is predicted to be most upset by her partner's emotional infidelity, as such entanglements may threaten his commitment to and channeling of resources to her and her children. Men, on the other hand are expected to be most distressed by sexual infidelity, as males are highly attuned to threats to a partner's sexual exclusivity, due to ultimate concerns regarding parental certainty.

Several studies provide clear support for the predicted sex difference (e.g., Buss, Larsen, Westen, & Semmelroth, 1992; Buss, Shackleford, Kirkpatrick, Choe, Hasegawa, Hasegawa, & Bennett, 1999). However, considerable within-gender variability is found as well. For example, although 60% of the men in Buss et al.'s 1992 study reported being most distressed by the thought of a partner's sexual infidelity, 40% reported being the most upset by the idea of a partner's emotional infidelity. Buss (1995) reports that most of the men who did not respond in the predicted fashion had never been involved in a serious sexual relationship and suggests that the adaptation of sexual jealousy may need to be ''switched on'' before people can accurately articulate how they would feel in this context. Consequently, studies that feature self-reported mate preferences should take participants' relationship history into account, particularly in light of the undergraduate samples typically included in these studies.

An interesting twist on using traditional self-report measures to study mate preferences involves the analysis of personal ads, in which people describe themselves and the kind of partner they seek (e.g., Kenrick & Keefe, 1992; Thiessen, Young, & Burroughs, 1993). These have the clear advantage of eliminating demand characteristics as a source of bias, as the listed preferences are not provided by people as part of an experiment. An even more compelling advantage is that the data reflect actual attempts to attract mates or partners; the ads placed and responses to them are real

behaviors with real consequences for real people. However, descriptions of what one wants in a partner still constitute a form of self-report. Basing inferences about mate preferences from personal ads again assumes that people can provide an accurate list of the specific qualities that will lead them to experience attraction and can decide based on reading a list of a person's attributes to whom they will be attracted. Nevertheless, this is an innovative and valuable way of gaining insight into what people seek in romantic partners.

The primary alternative to studying mate preferences via self-report involves examining who actually approaches and ultimately pairs off with whom. For example, if women prefer older men, and men prefer younger women, actual age differences between partners should reflect these preferences. Indeed, studies of marriage statistics provide support for the evolutionary hypotheses that men generally prefer younger partners presumably due to the links between youth and reproductive status, whereas women prefer older men due to the links between age and status and resource acquisition. (Actually, in the interest of brevity, this summary of men's and women's age preferences is a bit simplistic; cf. Kenrick & Keefe, 1992, and Kenrick, 1994 for more complete articulations). Similarly, some studies compare the attractiveness of spouses and romantic partners. This work reveals assortative mating on physical attractiveness (e.g., Murstein, 1972; Price & Vanderberg, 1979), with interspousal correlations averaging around .50 (Lykken & Tellegen, 1993; Feingold, 1988). Thus, the relation of attractiveness to people's actual mate choices seems relatively clear; people tend to pair off with partners who are similar to them in attractiveness. However, what does this ''matching effect'' tell us about people's preferences? One possibility is that people actually prefer similar others. However, an equally plausible interpretation is that people prefer highly attractive partners, but less attractive people have difficulty securing them (Kalick & Hamilton, 1986).

The problem is that behaviors are not clear indicators of preferences, but instead reflect the interaction of preferences, or adaptations, and environmental constraints (Buss, 1991a; 1992; Symons, 1979). When constraints are low, behaviors may correspond directly with preferences. When constraints are high, however, the correlation between preferences and behavioral measures—such as measures of marital assortment—may be low. The interaction of preferences and constraints on behavior is vividly illustrated by a consideration of the sexual behaviors of gay men (Bell & Weinberg, 1978; Baily et al., 1994). The available data indicate that gay men have many more casual sexual encounters than do heterosexual men, heterosexual women, or gay women. One interpretation of these data is that homosexual men are more prone to unrestricted sexual behavior than are other

people. However, another interpretation is provided by Symons (1979). He argues that the desire for sexual variety and casual sex is no stronger in gay men than in heterosexual men. Instead, there are fewer constraints on homosexual men's behavior. Specifically, their potential partners—other men—share their interest in casual sex. Thus, although gay and heterosexual men may have similar preferences for sexual variety, heterosexual men's behaviors are constrained by the fact that their potential partners—women—are less likely to engage in these activities.

How might this apply to work on attractiveness? Evolutionary perspectives predict that men have evolved preferences for physically attractive women. However, several diary studies of social experience report that attractive women do not report more opposite-sex interactions than do less attractive women (Reis et al., 1980, 1982; Berry & Landry, 1997). If these data are accurate, does it necessarily mean that men do not prefer to interact with attractive women? Could it instead be the case that attractive women actively discourage advances from all but the most desirable males? Might it be that men want to approach attractive women but refrain from doing so because rejection is deemed likely? Again, situational constraints make it difficult to draw conclusions about what people want from what they actually do (or, in the case of the high interspousal correlation observed for attractiveness, from what they actually get).

The point is not that examining the relation of variables such as attractiveness to partner choice is not worthwhile; it certainly is. Questions such as who approaches whom and who marries whom are important regardless of whether behaviors directly corrspond to preferences. In addition, in contexts where few constraints are observed—i.e., if the preferences of partners complement one another, as in the case of gay men—behaviors may be good indicators of what people actually want. The important point is to avoid assuming that behaviors translate neatly into preferences. Finally, there may be some cases in which assumed constraints can actually be used to make predictions about behavioral outcomes. For example, recall the general prediction of sexual strategy theory that women will place a higher value on resources than attractiveness in potential mates, whereas the reverse will be true for men. This suggests that because attractive women have the fewest constraints on their mate choices, they will be most likely to secure what they want. Conversely, men with the most resources should have the fewest constraints on their choices. This suggests that among romantic partners or spouses, there will be cross-character assortment on these variables; i.e., a correlation between women's physical attractiveness and markers of men's access to resources. Several studies have indeed revealed such a relationship (e.g., Taylor & Glenn, 1976).

C. CAN EVOLUTIONARY PERSPECTIVES ACCOUNT FOR INDIVIDUAL DIFFERENCES IN ATTRACTIVENESS PREFERENCES?

1. How Might Adaptations Yield Individual Differences in Attractiveness Preferences?

The emphasis on cross-cultural agreement in evolutionary accounts of attractiveness preferences is understandable. These data are of such interest, in part, because cross-cultural commonalties are not predicted by sociocultural perspectives. More importantly, however, evolutionary theories of attractiveness are rooted in the concept of sexual selection, and directional sexual selection for a particular trait of preference attenuates variance in that attribute. As noted previously, evolved adaptations such as those posited to yield attractiveness preferences are typically universal in nature (e.g., Tooby & Cosmedies, 1990a). However, the idea that an evolutionary perspective automatically predicts universal uniformity in perceptions and behavior is simplistic (e.g., Buss & Greiling, 1999; Springer & Berry, 1997). A sophisticated evolutionary model needs to address individual differences as well as consensus in people's responses to attractiveness.

If adaptations are species typical (e.g., Tooby & Cosmedies, 1990a), how do evolutionary models account for variability? Clearly, a single inflexible approach to a particular adaptive problem will not work for all people under all conditions. Consider, for example, the posited evolved preferences of men for casual sex and of women for mates with resources. Characteristics of an individual and his or her environment moderate the reproductive success that results from acting on these preferences. For example, physically unattractive men are less successful in attracting short-term mates than are attractive men (e.g., Gangestad & Simpson, in press; Gangestad & Thornhill, 1997b; Gangestad, Thornhill, & Yeo, 1994). Thus, an unattractive man might be better off, reproductively speaking, if he commits to and invests in few long-term mates, whereas a highly attractive man might attain greater reproductive success by pursuing numerous short-term partners. Similarly, women who live in environments with a high prevalence of pathogens would have greater reproductive success if they value male attractiveness (indicating health and fitness) over resources. However, in environments where pathogen loads are low, women might be better off placing greater value on potential mates' resource investment.

If adaptations are entirely insensitive to constraints on the effectiveness of a particular strategy, they seem too inflexible to account for human reproductive success. How could these mechanims maintain sufficient flexibility to deal effectively with such constraints? Buss (1991b) articulates

four evolutionary mechanisms by which adaptations may produce individual differences in people's preferences or behavioral strategies: (a) the evolution of heritable alternative strategies, (b) the heritable calibration of psychological adaptations, (c) the developmental calibration of adaptations, and (d) situationally contingent alternative strategies.

2. Heritable Alternative Strategies

Individual differences may result if different adaptations evolved for different groups of people who repeatedly encountered contrasting adaptive problems. Such a mechanism is proposed, for example, to explain why many aspects of sexual attraction and behavior are better described as sex typical than species typical (Buss, 1991b, 1995). Consider the sex difference in people's interest in casual sex (Oliver & Hyde, 1993). Theoretically, this evolved because engaging in sex with greater numbers of partners increased men's reproductive success more than women's. Consequently, preferences for sexual variety became especially prevalent among men (Buss & Schmitt, 1993). Sex differences in preferences for casual sex, therefore, are thought to reflect differences in men's and women's evolved adaptations. Although the evolution of sex-typical preferences does not address individual differences observed within each sex, this example does illustrate how different adaptations may evolve for different groups of people—in this case, men and women.

Gangestad and Simpson (1990) propose that within-sex differences in sociosexuality are the endproduct of the evolution of different strategies or adaptations. Sociosexuality refers to reliable individual differences in people's willingness to engage in casual sexual relations. ''Unrestricted'' individuals tend to engage in sex earlier in relationship and at lower levels of commitment than do more ''restricted'' individuals. Consistent with the predictions of SST just described, females do tend to be more restricted than males. However, within-gender variability is also observed. Let's consider the case of individual differences among women. (Individual differences among men are discussed later). Women's sociosexuality scores do show considerable variability and, interestingly, this within-sex variability is bimodal in nature (Gangestad & Simpson, 1990). If men's reproductive success is linked to partner number but women's is not, why would an appreciable number of women adopt a relatively unrestricted style?

Simpson and Gangestad (1992) argue that individual differences in women's sociosexuality evolved because different women pursued different mating strategies each of which increased their reproductive success, albeit by different avenues. Assume women's sexual style (i.e., restricted versus unrestricted) was at some point randomly distributed. Some women, as

proposed by the good provider model, may have increased reproductive success by requiring evidence of men's commitment and investment of resources before allowing sexual access. Restricted women were probably more likely than unrestricted women to engage effectively in this strategy. A second strategy that might increase women's reproductive success, as proposed by the good genes model, is requiring evidence of high levels of heritable fitness (i.e., physical attractiveness) before engaging in sex. Information about heritable fitness is readily available and could influence mating decisions made early in a relationship. Moreover, unrestricted women's willingness to engage in sex in lieu of demands for commitment and resources would allow them to be highly selective along this dimension. Consequently, unrestricted women's reproductive success may have benefited through their exchange of sexual access for especially high-quality, attractive mates; i.e., those high in heritable fitness. This suggests that both restricted and unrestricted styles might have evolved in women, albeit by different mechanisms. Although both restricted and unrestricted women's approaches theoretically increased their reproductive success by increasing the ''quality'' as opposed to the quantity of their offspring, the former group accomplished this by securing resources and the latter group by securing genetic benefits.

One might reasonably counter that it would make the most reproductive ''sense'' for women to require both resource investment and evidence of heritable fitness in mates. However, Simpson and Gangestad (1992) point out that such demands were unlikely to be satisfied. The number of available males both high in genetic fitness and willing to invest sufficient resources were probably few and far between. Thus, women who were willing to ''trade off'' or forego one preference in order to obtain the other likely had greater reproductive success than women who were not.

If this line of reasoning is correct, it can account for within-sex variability in sociosexuality as well as the bimodal distribution of women's sociosexuality. However, what does sociosexuality have do with attractiveness preferences? Recall that preferences for male attractiveness are thought to result from its correlation with heritable fitness. If unrestricted women evolved preferences for heritable fitness, whereas restricted women evolved preferences for evidence of resoures, sociosexuality should predict within-gender differences in attractiveness preferences. Consistent with this prediction, unrestricted women place more importance on physical and sexual attractiveness in romantic partners, whereas restricted women place greater importance on qualities such as responsibility and loyalty in a partner (Simpson & Gangestad, 1992). These data are consistent with the idea that the evolution of different adaptive strategies in mate selection may be a source of individual differences in attractiveness preferences.

3. Heritable Calibration of Psychological Adaptations

Another avenue to individual differences is provided by the proposal that adaptations have built in decision rules that evaluate environmental input and produce different responses accordingly. Although an adaptation may be universal, different sets of proximate environmental constraints may yield differences in the thresholds that activate a particular mechanism. For example, concern about potential mates' levels of attractiveness would be more advantageous for people in geographical areas characterized by high levels of pathogens than for those living in less threatening environments. Gangestad and Buss (1992) compared the relative importance of potential mates' physical attractiveness to inhabitants of 29 cultures and indeed found that people living in environments with high levels of pathogens valued attractiveness more than did those living in cultures with lower levels of pathogen stress. The authors proposed that people may have evolved mechanisms that track environmental variables such as pathogen load and weight their preferences accordingly.

4. Developmental Calibration of Psychological Adaptations

An additional way that environmental inputs may produce individual differences in evolved strategies is suggested by theoretical models that focus on the impact of early environmental factors on the development of female reproductive strategies (e.g., Belsky et al., 1991; Draper & Harpending, 1982). These models note that one predictor of differences in women's propensities to engage in short- versus long-term mating strategies is the presence of early conditions that lead to the ''expectation'' of an environment characterized by scant and unpredictable resources and relatively short-lived and unpredictable pair-bonds; i.e., an environment in which short-term mating is most advantageous. These early experiences are posited to ''shunt'' later biological maturation and preferred strategies in directions that would be best suited (in terms of reproductive success) to the kind of environment signaled by those early cues. Belsky et al. (1991) note that ''in essence, we argue that early experiences and the psychological and biological functioning they induce lead individuals to engage in either a ''quantity'' or a ''quality'' pattern of mating'' (p. 650). Whereas Belsky et al.'s model focuses on a broad range of such environmental cues, Draper and Harpending's (1982) model focuses more narrowly on the extent of male parental investment and the stability of the pair-bonds to which women are exposed at a young age. Both models predict, however, that cues that signal an unstable environment—in which stable long-term mating strategies would be less effective—lead to the development of a pattern of short-

term reproductive strategies, whereas the absence of such cues leads to the development of more restricted strategies. The available data support the general predictions of these models (e.g., Belsky et al., 1991; Ellis & Garber, in press; Ellis, McFadyen-Ketchum, Dodge, Pettit, & Bates, 1999).

Again, such mechanisms might contribute to within-gender variability in attractiveness preferences. In particular, women raised in environments that shunt them toward a tendency to favor short-term mating strategies would benefit most from a preference for physically attractive (high fitness) partners. Although no data directly examines whether women from, for example, father-present and father-absent backgrounds differ in the value they place on mates' attractiveness, women raised in environments in which male parental investment tends to be relatively low tend to be particularly concerned with men's physical attractiveness (Wesfield & Billings, 1988). Research on the relations between early environment and later responsiveness to attractiveness is an intriguing area for future research.

5. Situationally Contingent Alternative Strategies

Gangestad and Simpson (in press; see also Campbell, Simpson, & Orina, 1999) propose a model of individual differences in mate selection that emphasizes a fourth evolutionary mechanism. In particular, their "strategic pluralism" model argues that people may have evolved *conditional* adaptations that are sensitive not only to environmental factors (e.g., pathogen prevalence, father-presence/-absence at a young age) but also to the likelihood that a particular strategy will be successful given the attributes of the individual. Although their model does not focus exclusively on attractiveness, it does have implications for understanding individual differences in attractiveness preferences. In particular, Gangestad and Simpson point out that in short-term mating contexts, women place a high value on the physical attractiveness of potential mates, and, similarly, women who are likely to adopt an unrestricted sexual style value attractiveness (e.g., Gangestad & Simpson, 1990). This suggests that the benefits that accrue to a man from pursuing a short-term strategy vary as a function of his attractiveness. If less attractive men are relatively unsuccessful when they pursue short-term strategies, their reproductive success, like women's, becomes less tied to quantity of offspring and more to the quality of those offspring they produce. Thus, attracting and investing heavily in a long-term mate may be the most advantageous strategy available for these men. Conversely, if highly attractive men are strongly preferred by women as short-term mates, their reproductive success may benefit more from pursuing numerous casual partnerships.

Gangestad and Simpson's point is that if individual differences in attractiveness significantly moderate the success of a particular strategy, adaptations should be sensitive to those differences and direct behavior and preferences accordingly; ''men should possess adaptations that conditionally reflect their interest in and effort toward obtaining short-term mates rather than adaptations that are non-conditional in nature . . . men should have evolved a conditional desire for short-term mating'' The key adaptation should be decision rules about when the how to allocate reproductive effort wisely and contingently, rather than a universal, inflexible desire for short-term mates (Gangestad & Simpson, in press, p. 14). Thus, individual differences in attractiveness are posited to alter the nature of men's mating preferences and direct them to the strategy that will work best for them. Consistent with Gangestad and Simpson's model, the available data do suggest that men's physical attractiveness predicts the amount of effort they allocate the short-versus long-term mating (cf., Gangestad & Thornhill, 1997b; Waynforth, 1999).

In sum, evolutionary models tend to emphasize universality in evolved preferences, but they also predict individual differences. Unlike sociocultural perspectives, however, evolutionary models maintain that individual differences in attractiveness preferences should be lawful in nature and reflect systematically both the characteristics of the individual (e.g., men may be somewhat more responsive to attractiveness than women) and the proximate environment (e.g., people may value attractiveness most in places where disease is widespread); they should *not* reflect arbitrary, idiosyncratic differences among individuals.

6. Individual Differences in Perceptions of Attractiveness

In addition to individual differences in *preferences* for attractiveness, several lines of research reveal some interesting differences in *perceptions* of attractiveness that warrant mention. These include the effects of exposure to highly attractive opposite-sex individuals on the attractiveness judgments of people in long-term relationships and intraindividual shifts in the perceived attractiveness of opposite-sex individuals in the context of casual sex.

a. Perceptual Shifts in Long-Term Mating Contexts. Kenrick and his associates reported that observers rate a particular target's attractiveness differently as a function of the level of attractiveness of other targets they observe. For example, a moderately attractive women was rated as less attractive by participants who had previously been exposed to photographs of highly attractive women than by participants who viewed photographs of moderately attractive women (Kenrick & Gutierres, 1980). Kenrick, Gutierres, and Goldberg (1989) further found that men (but not women)

who viewed highly attractive members of the opposite sex rated their current relationship partner as less attractive than did men who viewed women of moderate attractiveness, a finding replicated by Kenrick, Neuberg, Zierk, and Krones (1994). Interestingly, women, but not men, also perceive *themselves* as lower in mate value after exposure to highly attractive same-sex targets (Gutierres, Kenrick, & Partch, 1999).

Why would exposure to attractive women decrease the perceived attractiveness of men's current partners? One possibility goes back to men's propensity for casual sex. If a man temporarily perceives his long-term mate as less attractive while he is in the presence of a highly attractive potential alternative partner, perhaps he will be more likely to take advantage of a possible opportunity for casual sex. If so, an argument could be made that this mechanism evolved because it increased men's reproductive success by increasing partner number.

Whatever the function of this effect, Simpson, Gangestad, and Lerma (1990) reported a somewhat contradictory finding in their study of differences in attractiveness judgments as a function of the relationship status of the judge. In two studies, participants who were involved in an exclusive dating relationship rated attractive opposite-sex targets as less physically and sexually attractive than did participants who were not involved in relationships. The effect replicated for male and female perceivers and was not explained by differences in the physical attractiveness of the raters (i.e., there was no support for the alternative explanation that people in relationships are more attractive than those not in relationships and attractive people hold higher standards in evaluating the appeal of other people). Simpson et al. suggest that their data may reveal a psychological mechanism designed to promote pair-bonding and relationship maintenance and reduce the threats of physically attractive alternatives during the early stages of mating relationships.

b. Perceptual Shifts in Short-Term Mating Contexts. The research just described reveals the effects of exposure to attractive members of the opposite sex on the attractiveness judgments of people engaged in long-term relationships. Additionally, two interesting accounts of *intra*-individual differences in perceptions of attractiveness are reported in the context of short-term mating. The first, sometimes called the "closing time phenomena," was originally documented by Pennebaker, Dyer, Caulkins, Litowitz, Ackerman, and Anderson (1979). Researchers asked bar customers to rate the physical attractiveness of opposite-sex patrons. Participants' attractiveness ratings increased as the evening progressed. When last call approached, and opportunities for pairing off with the remaining patrons significantly decreased, these perceptual shifts were greatest. Initially, this study was criticized on the grounds that the shifts were likely due to increased levels

of alcohol. However, Gladue and Delaney (1990) replicated the procedure and obtained measures of the amount of alcohol their participants consumed. Similar increases in the perceived attractiveness of members of the opposite sex were again revealed for both men and women and were not explained by levels of alcohol consumption. Buss (1999) suggests that this shift may reveal a "psychological solution to the problem of sexual accessibility—a context-specific lowering of standards as the likelihood of sexual accessibility starts to drop" (p. 171).

Although this interpretation perhaps mistakenly assumes that all or most of the participants in these studies were interested in pursuing short-term sexual opportunities, it is an intriguing one. As discussed previously, when asked to rate how important various qualities are in partners, men tend to "relax" their standards for short-term as opposed to long-term mates in virtually every domain *except* physical attractiveness (Buss & Schmitt, 1993; Kenrick et al., 1990). These data suggest, however, that men may indeed relax their attractiveness standards. The perceptual nature of this shift makes it plausible that men are not aware of their changing standards; their perception is that the available women are actually "prettier" at closing time, not that attractiveness doesn't matter.

Note that women as well as men show evidence of the closing time effect. For example, Gladue and Delaney reported a significant increase in women's ratings of men's attractiveness as the evening progressed. Moreover, the rate of increase or perceptual shift across time in women's ratings was as great as that observed for men. The function of this shift for women is puzzling. As noted previously, women tend to hold as high standards for short-term as for long-term partners. Moreover, the major reproductive benefit that theoretically accrued to women who historically pursued short-term strategies was access to highly attractive males with higher levels of genetic fitness than they might otherwise attract. Thus, it would seem especially important for women's perceptions of physical attractiveness *not* to become "blurred" in this context.

Another perceptual shift that purportedly occurs in men's evaluations of women in the context of short-term matings is an abrupt decrease in perceived attractiveness immediately after sex. Although not empirically documented, Buss (1994) provides anecdotal accounts of this shift and suggests that this "morning after" effect (or, perhaps more accurately, "minute-after" effect) may serve some functional purpose; "one may speculate that the perceptual shift . . . in attractiveness following orgasm may function to prompt a hasty departure to reduce risks to the man such as getting involved in an unwanted commitment or incurring reputational damages" (pp. 84–85). Joint consideration of the "closing time" phenomena and the "minute-after" effect suggest another plausible interpretation: The

latter may reflect falsely elevated presex evaluations of attractiveness that return to baseline once they have served their purpose. Buss' interpretation implies an additional decline in perceived attractiveness from (objective) baseline, not just from the elevated presex levels. Teasing apart these different explanations will require the comparison of presex and postsex evaluations of short-term partners with objective measures of attractiveness, a most intriguing, albeit methodologically challenging, avenue for future work.

D. WHY DO INDIVIDUAL DIFFERENCES IN ATTRACTIVENESS PERSIST?

Darwin (1871, p. 901) noted that ''As women have been long selected for beauty, it is not surprising that some of their successive variations should have been transmitted exclusively to the same sex; consequently that they should have transmitted beauty in a somewhat higher degree to their female then to their male offspring, and thus have become more beautiful according to general opinion than men. Women however, certainly transmit most of their characters including some beauty to the offspring of both sexes; so that the continued preference by the men of each race for the more attractive women . . . will have tended to modify in the same manner all the individuals of both sexes'' (p. 901).

Darwin's point was that sexual selection usually reduces variability in the preferred attribute. For example, peacocks sport huge tails because peahens preferentially mated with males with such plumage. Males who were unable to produce this handicapping ornament were shut out of the mating system. Males who could, however, attracted mates and their brilliant plumage—a sex-linked characteristic that can be directly transmitted from fathers to their male offspring—became prevalent in the population. Eventually bright, large tails became a sex-typical characteristic.

If attractiveness is preferred in human mates, why isn't everyone attractive? Why does variability in physical attractiveness persist in the human population? Several factors likely contribute to variability along this dimension. First, unlike the ''attractiveness'' of peacocks, human physical attractiveness reflects a highly complex constellation of characteristics. Consequently, the assumption that human attractiveness is directly passed from parents to children is a dubious one. Second, although selection-based sex-typical attractive characteristics are often observed in animal species, those species have different mating systems than do humans. In particular, the complexity introduced into the human mating system by the importance of male as well as female choice renders the elimination of variance in the

attractiveness of either sex unlikely. Each of these issues is considered in turn.

1. Is Attractiveness Inherited?

The assumption that selection for a trait will reduce its variance assumes that the trait is directly passed from parent to offspring, as in the case of peacock tails. However, what would happen if people who chose attractive mates had more reproductive success than other people, *but* there was no correlation between the attractiveness of parents and their offspring? In this case, attractiveness preferences would be expected to evolve, but individual differences in the trait to remain. Surprisingly, there is no literature bearing on the relation of the physical attractiveness of human parents to that of their children. However, it seems likely that the extent to which attractiveness can be inherited lies somewhere between the two extremes just described. Although some evidence suggests that children resemble their parents physically (cf., Christenfeld & Hill, 1995),[12] family resemblance does not necessarily translate into similarity in attractiveness; siblings born to the same parents can vary widely in physical attractiveness. Clearly, there is no ''attractiveness gene'' that directly transmits parental attractiveness to offspring. Instead, human physical attractiveness depends on a complex combination of many variables. Some of these, such as markers of heritable fitness, seem likely to be passed on to offspring. In this case, it is the superior fitness (e.g., quality of immune system; resulting pathogen resistance) that is heritable. The associated attractive aspects of physical appearance are essentially by-products of the inherited trait rather than inherited traits themselves. Similarly, variations in secondary sex characteristics deemed attractive (e.g., prominent jaws in men) may be genetically transmitted from father to son. On the other hand, some determinants of attractiveness are clearly not individual differences that are passed on from parent to child. Consider, for example age-related characteristics such as smooth skin that are deemed important to women's attractiveness via their links to reproductive fitness (e.g., Buss, 1989). These reflect *intra*individual rather than *inter*individual variables; *everyone* exhibits more attractive features during youth and less attractive features later. Moreover, a number of behavioral and environmental factors influence attractiveness that are likely not inherited from parents (e.g., availability of good nutrition, propensity for physical activity). Thus, although there seem to be some heritable

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[12] Christenfeld and Hill actually found that independent judges can only match children to fathers—not mothers—at rates greater than chance when children are quite young. Ten and 20-year-old children were not matched to parents on the basis of physical appearance at rates greater than chance.

components of attractiveness, it appears that there are sufficient nonheritable influences on attractiveness to ensure its continued variability in the population, despite the selection pressures that produce attractiveness preferences.

2. Selection in Human versus Animal Mating Systems

Why sexual selection produces sex-typical attractive traits is relatively clear in polygamous animal species in which female preferences dominate. Consider a mating system in which the most "attractive" available males (i.e., the "alpha" males) are preferred by, obtain sexual access to, and produce offspring with numerous females and less "attractive" males tend to be shut out of mating opportunities.[13] The preferred characteristics of the favored males would rapidly become better represented—and, eventually, sex typical—in future generations. If human mating systems worked in a similar way, this might prove true for humans. To illustrate the point, assume for the sake of argument that there was a human "attractiveness gene" that was passed directly from parent to offspring. Assume also a mating system in which female choice dominated. If women preferred only the most physically attractive men, shut all other men out of the mating system, and adopted a polygamous strategy (i.e., many women mated with the selected men), the only children produced would be the extremely attractive children of those few men. Variability in attractiveness would soon be attenuated. Consider the reverse case. If male choice dominated, only the most attractive women were selected as mates, and less attractive women were shut out of the system, the population would rapidly become attractive, and variability along this dimension would again diminish.

Clearly, neither of these scenarios describe human mating, in part because neither male nor female choice totally dominates mating decisions. Attractive people historically must have had somewhat greater reproductive success than unattractive people or preferences for attractiveness would not evolve. However, it is unlikely that this success was the result of the exclusion of all but the most attractive individuals from mating and reproduction, as is the case in some animal species. Rather, attractive people probably reaped increased reproductive success by increasing the quantity and quality of their mates. In sum, the questionable heritability of attractiveness com-

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[13] This depiction is actually a bit overstated. Even in mating systems in which female choice dominates, less desired males are unlikely to be completely shut out of mating. For example, in a number of species, less "attractive" males successfully use so-called "sneak" strategies to produce opportunities for mating despite the fact they are less desired by females as mates (Howard, 1981).

bined with these complexities of the human mating system provide a plausi-
ble explanation of why variability in human attractiveness is observed.

3. Are We All Attractive But Just Don't Know It?

Finally, it's worth noting that even in animals such as the peacock, there
are individual differences in male ''attractiveness''; although all males have
large, bright tails, some males (those with lower parasite loads) have larger
and brighter tails than do others. Perhaps although we perceive a wide
range of attractiveness in those around us, people are indeed on average
more attractive now than in ancestral times, and the range and variability
of attractiveness may be attenuated in the current environment. Thus,
although some variance in attractiveness may persist for the reasons just
outlined, variability may have decreased as a result of selection pressures
that historically favored the reproductive success of more as opposed to
less attractive people.

E. WHAT GENETIC MECHANISMS UNDERLIE EVOLVED
   PREFERENCES FOR ATTRACTIVENESS?

As noted previously, adaptations or evolved preferences are assumed to
be genetically specified. As Buss (1999) points out ''an adaptation must
have genes 'for' that adaptation. Those genes are required for the passage
of the adaptation from parents to children; hence the adaptation can be
inherited'' (p. 36). As a general point, this seems obvious. All humans have
thumbs and taste buds, and few would argue that these elements of human
design are not genetically encoded. Even the argument that preferences
such as those for foods rich in sugar and fat are genetically based would
not be seriously questioned by many. However, the issue quickly becomes
more controversial when specific, complex social behaviors or attitudes—
for example, mate preferences—are posited as adaptations. To many, the
argument that preferences for such qualities as attractiveness or resources
are genetically encoded sounds speculative at best (e.g., Barta, 1999; Burn,
1996; Scher, 1999; see also Eagly & Wood, 1999), and this premise of
evolutionary views will not be readily embraced by many mainstream social
psychologists in lieu of compelling data.

Evolutionary psychologists do tend to be a bit glib when making such
assertions. For example, Buss (1995, 1999) is fond of pointing out that
human nature—psychological as well as physical—evolved via natural se-
lection, and he offers creationism and seeding theory as the only possible

alternatives.[14] Few social scientists would likely take issue with this initial observation. The problem is that Buss' argument moves quickly from general human nature to specific behaviors and preferences; if we all agree that human nature evolved via natural selection, then we all agree that all psychological mechanisms evolved in this manner, and then we all agree that all preferences and behavioral propensities associated with those proposed mechanisms are inherited. This is a big conceptual leap; it seems likely that many social psychologists have ideas about why men prefer attractive women and why women prefer men with resources that do not assume those preferences are genetically coded, decreed by God, or the work of extraterrestrials. For example, perhaps women who preferred men with resources did experience greater reproductive success than other women. Perhaps those women also communicated to their daughters the importance of choosing a mate who had sufficient resources. It seems possible that the transmission of preferences from parent to child might occur through modes other than genetic transmission.

The point is not that attractiveness preferences are not a psychological adaptation, or that psychological adaptations are not inherited, or even that attractiveness preferences are not genetically encoded. The data on infants' visual preferences for attractive faces, in fact, provide some support for the idea that attractiveness preferences are ''hardwired.'' However, it would be refreshing to hear evolutionary psychologists directly acknowledge the importance of empirically evaluating whether those human social preferences posited to be adaptations are indeed genetically specified. Skeptical social psychologists might be more receptive to evolutionary accounts of preferences such as those for attractiveness if these critical and controversial points were put forth as hypotheses that need to be tested rather than as foregone conclusions.

Thus, a basic assumption of evolutionary models that warrants greater empirical attention is that evolved preferences, such as those for attractiveness, are genetically specified. A related issue is that—given these models posit a genetic basis for such preferences—critical details about the nature of the genetic mechanisms though to underlie their evolution are rarely articulated (Eagly & Wood, 1999). For example, many evolved preferences are not only posited to be genetically transmitted from parent to child, but, specifically, from fathers to sons or from mothers to daughters. Consider the argument that women have evolved preferences for partners with resources (e.g., Buss & Schmitt, 1993). Assuming these preferences are genetically transmitted, why aren't preferences for resources transmitted to male as

[14] Seeding theory (cf. Buss, 1995) is the idea that life originated somewhere other than on Earth and was later somehow brought to Earth, either intentionally (e.g., by extraterrestrials) or coincidentally (e.g., by a meteorite).

well as female offspring? Similarly, assume that men have evolved prefer-
ences for sexual variety. Why aren't those preferences passed on to their
daughters?

Consider, for a moment, the genetic transmission of physical sex differ-
ences. All humans carry the genetic material responsible for the develop-
ment of both male and female characteristics, including reproductive organs
and secondary sex characteristics. However, only one set of characteristics
develop in a given individual. Specifically, one's biological sex (or, more
specifically, the presence or absence of a particular gene located on the
male Y chromosome) acts as a switch, activating one of two sets of genetic
programming. Although only ''female'' programming is activated in fe-
males, and only ''male'' programming is activated in males, both sets of
genomes are present in all people (see Tooby & Cosmides, 1990b, for a
lucid discussion of these points).

The genes that purportedly yield psychological sex differences—i.e., sex-
specific preferences for physical attractiveness, resources, or sexual vari-
ety—may operate in a similar fashion. Thus, although women may pass
the genetic material responsible for their preferences for resource-laden
mates to all of their offspring, this programming may be activated in only
their female children. Conversely, preferences posited to have evolved
uniquely in males may be encoded into the genetic material a man passes
on to all of his offspring, but only activated in males. Clearly, this proposition
is speculative. However, the fact that evolved physical sex differences are
genetically controlled in such a fashion makes this a plausible mechanism for
the sex-specific transmission of posited evolved psychological mechanisms.
Evolutionary psychologists' accounts of evolved psychological adaptations
would benefit greatly from more discussion of the nature of these mecha-
nisms. Again, social psychologists who are skeptical about the ability of
such models to explain human social behavior might be more receptive to
accounts that attend to the issue of the nature of the specific mechanisms
posited to yield evolved psychological adaptations.

F. WHY DO ATTRACTIVENESS PREFERENCES PERSIST?

Note that evolutionary accounts of the origins of attractiveness prefer-
ences focus on the idea that preferences for physically appealing members
of the opposite sex translate into reproductive success. However, given
the availability of effective contraception, safe abortions, and fertility-
enhancing medical procedures, it is unlikely that attractiveness predicts
actual reproductive success in the current environment. Consider, for exam-
ple, Buss and Schmitt's hypothesis (1993) that men's desire for attractive-

ness in a long-term mate originates, in part, from the fact that attractiveness advertises reproductive value (i.e., the number of children a women could have in the future). Most women in our culture actually produce considerably fewer children than they could. Moreover, advances in medicine and health care allow women, in many cases, to successfully delay having children until well into their 30s and 40s. This suggests that attractiveness preferences based on cues related to reproductive status no longer benefit men's reproductive success. Similarly, consider women's preferences for attractive male attributes such as high cheekbones and facial symmetry, which are posited to have evolved because those features advertise health and genetic fitness. Again, it seems highly unlikely that these preferences lead to increased reproductive success in the current environment. In fact, despite evidence that people who are attractive have more sexual partners and more opportunities for sexual relations than do less attractive people (e.g., Feingold, 1992; Gangestad & Thornhill, 1997b; Mazur, Halpern, & Udry, 1994), there is no evidence that attractiveness is related to the number of children people actually produce (e.g., Kalick et al., 1998).

Given this disconnect, why are attractiveness preferences observed? Recall that these preferences evolved because they solved adaptive problems encountered in our evolutionary *past,* not the present. Current environmental conditions may have changed to the point that evolved adaptations are unrelated to or even hinder survival and reproductive success. Buss (1999) provides such an example in his discussion of evolved preferences for fat-laden foods. Although this preference favored survival in an environment in which these resources were difficult to obtain, it actually threatens survival in our current environment, where such foods are readily available. Thus, adaptations or evolved preferences can only be understood by reconstructing the environmental conditions that characterized the time period during which the adaptation evolved. Despite the fact that the attractiveness of one's mate is probably uncorrelated with reproductive success in the present environment, during ancestral times, greater reproductive success typically came to those people who preferred and selected attractive mates than to those who did not.

G. CAN AN EVOLUTIONARY PERSPECTIVE EXPLAIN THE EFFECTS OF ATTRACTIVENESS ON NONSEXUAL ATTRACTION?

This chapter's emphasis on sexual attraction is no accident, as most evolutionary-based predictions about physical attractiveness focus on mate selection. However, the social psychological literature reveals that benefits

accrue to physically attractive individuals in domains other than that of romantic popularity. Why would it be beneficial to prefer physically attractive people in nonsexual relationships? Evolutionary models make several predictions about attractiveness preferences in nonromantic relationships.

1. Platonic Attraction to Adults

Thornhill and Gangestad (1993) propose that costs accrued to those who failed to identify poor health and low parasite resistance in people other than likely mates. For example, the benefits obtained from sharing resources with a partner in a reciprocal social alliance depends on the survival of that partner. Thus, more benefits were realized by people who selected healthy alliance partners than by individuals who selected unhealthy ones. To the extent that physical attractiveness signals health, Thornhill and Gangestad propose that humans may have evolved preferences for attractive partners in these nonsexual roles. Although this hypothesis is yet to be tested, Thornhill and Gangestad further suggest that variables such as fluctuating asymmetry may predict the selection of social as well as sexual partners.

2. Children's Attractiveness

Many studies reveal that infants and children are reliably differentiated in terms of physical attractiveness (Langlois et al., in press). Moreover, a number of studies demonstrate that cute or attractive infants and children are perceived more positively and in some cases treated preferentially (e.g., Stephan & Langlois, 1984; Hildebrant & Fitzgerald, 1983). Theories of mate preferences, of course, have little to say about the impact of attractiveness on responses to children. However, at least one evolutionary model specifically predicts such effects.

The discriminative or differential parental solicitude model (cf. Daly, 1990; Daly & Wilson, 1988) is an extension of Trivers' theory of parental investment. Briefly, the logic of the theory is as follows: Reproductive success ultimately depends upon more than successful mating and reproduction; it also depends upon the successful development of one's offspring and their eventual reproductive success. Moreover, parental care can enhance offspring development and later success. However, there are finite limits to the amount of care and attention that can be allocated to any individual offspring. Consequently, Daly and Wilson note "it follows that selection should have favored discriminative mechanisms of parental psychology, mechanisms that will assess the probable utility to the parent of alternative ways of allocating parental effort" (1988, pp. 91–92). This implies that

parents may invest more heavily in higher ''quality'' offspring, that is, those of greater viability and fitness. As viability seems linked to infant attractiveness (e.g., Maier, Holmes, Slaymaker, & Reich, 1984), a tendency for preferential allocation of resources to more attractive offspring—especially when resources are scarce—may have evolved (cf. Mann, 1992 for a longer discussion of this possibility).

In sum, evolutionary models have focused more on the role of physical attractiveness in sexual attraction than on its effects on other kinds of relationships. This is not surprising, as much of the work on evolution and social behavior in general has focused on mating relationships. However, evolutionary social psychologists are expanding their focus to include a variety of domains, including friendships (e.g., Shackelford & Buss, 1996) and family relations (e.g., Daly, Salmon, & Wilson, 1997). These initial speculations about why attractiveness influences non-romantic alliances, such as same-sex friendships and parent-child relations suggest that evolutionary principles can be usefully applied to the analysis of the function of attractiveness in a variety of domains. This remains a relatively unexplored but challenging area for study.

VI. Final Observations

A. EVOLUTION, SCIENCE, AND VALUES

As the previous discussion suggests, a number of important and interesting questions need to be addressed before the evolutionary psychology of attractiveness is fully understood. Nevertheless, the integration of these literatures has great potential to stimulate new lines of theory and research. However, some may still find the ''mating'' of an evolutionary perspective and the attractiveness literature disturbing. As noted, social psychologists were slow to embrace the study of physical attractiveness in general, and some have continued to be less than receptive to data and theory stemming from a functional perspective on attractiveness. Moreover, evolutionary perspectives on human social behavior have been the target of their share of controversy. Some of these debates are scientific in nature and revolve around alternative theoretical interpretations of data or the inadequacy of certain methodologies to test specific predictions (e.g., Eagly & Wood, 1999). Other sources of controversy, however, center around concerns about the extent to which scientific theory does or does not—and should or should not—reflect our personal, political, and moral values.

One objection to the theoretical perspective presented here is that it is "undemocratic." People may be troubled by the finding that variations in attractiveness have profound interpersonal consequences. As noted by Aronson (1969) "at some level, we would hate to find evidence indicating that beautiful women are better liked than homely women—somehow this seems undemocratic. In a democracy, we like to feel that with hard work and a good deal of motivation, we can accomplish almost anything" (p. 160). The disturbing points seem to be that (a) it's unfair that the benefits of attractiveness are withheld from some people who can do nothing to remedy the situation and (b) it's unfair that the benefits of an attractive appearance accrue to others who did nothing to earn them. However, even if we could somehow change the content of people's preferences, similar inequities would result.

Buss (1996) does a good job of illustrating this, and the following is borrowed liberally from his example. Consider the consequences of a hypothetical successful campaign that somehow changes the content of people's mate preferences from variables such as attractiveness to a more "reasonable" standard, such as intelligence.[15] Like attractiveness and most other human qualities, the distribution of intelligence is decidedly not democratic—it approximates normality. Moreover, as is the case with attractiveness, a sizable proportion of the variance in intelligence is probably not readily amenable to change. As a consequence, men would no longer compete for attractive women and women for successful men; intrasex competition among both sexes would instead focus on attracting the most intelligent of the other. Although academic types might like this new arrangement, the further one's placement along the normal curve from the high end of the distribution, the less happy one would probably be. The point is not whether intelligence is a more reasonable criterion for selecting a mate than attractiveness, but instead that most talents and abilities are distributed in an unequal fashion among members of the population; physical attractiveness is no more or less guilty of this than are other human characteristics.

A related objection is that evolutionary approaches provide justification for behaviors that culture or society deem undesirable. To illustrate, the hypothesis proffered by SST and related theories that men evolved preferences for greater sexual variety than women has been harshly criticized for implicitly sanctioning "double standards" regarding men and women's sexual behavior (e.g, Brooks, 1997; Hyde, 1996). For example, Brooks (1997) asserts that "according to [evolutionary] theorists such as Symons and Buss, men objectify women, compete for the most desirable women,

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[15] In fact, both sexes value intelligence highly in a mate (Buss, 1989).

and resist intimate connection *because it is good for them*'' (p. 46; italics added). To the contrary, evolutionary psychologists repeatedly emphasize that particular propensities are posited to have evolved because they were ''good'' only in the narrow sense of increasing reproductive success. Whether a particular behavioral propensity or preference evolved has nothing to do with its moral ''goodness.'' As Buss (1994) notes, such an interpretation ''confuses a scientific description of human behavior with a moral prescription for that behavior . . . judgments of what should exist rest with people's value systems, not with science or with what does exist'' (pp. 16–17). In a similar vein, although the premise of this chapter is that attractiveness preferences are evolved adaptations, this view does not negate the fact that attractiveness stereotyping can have deleterious consequences, does not imply that discrimination based on appearance is acceptable because it is ''natural,'' and does not condone sexist views of men's and women's value.[16] Moreover, this theoretical perspective does not purport that behavioral responses are somehow ''fixed''; the tremendous variability of human behavior in all domains, including the sexual arena, clearly demonstrates otherwise.

As this implies, a further objection to an evolutionary perspective is that it embraces genetic determinism and views evolved behavior as rigid and inflexible (e.g., Brooks, 1997; Lipps, 1997). Again, this is not a view endorsed by evolutionary psychologists, who have been careful to point out that psychological adaptations are highly sensitive to environmental input (e.g., Buss, 1990; Gangestad & Simpson, in press). Again, consider the position taken here that attractiveness preferences are the end product of evolved psychological adaptations. Note, however, that the rigidity and inflexibility of these mechanisms is certainly *not* the theme of this chapter. Men and women do not set their sights on the most physically attractive member of the opposite-sex they can find and doggedly pursue him or her despite repeated rejections and the presence of alternative choices. To do so would not only be maladaptive, it would probably be perceived by most as a sign of serious psychopathology. Instead, evolved strategies seem exquisitely designed to be sensitive to an array of factors that affect their implementation. Women become especially selective about men's attractiveness in

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[16] The (inaccurate) perception of evolutionary models such as SST as ''sexist'' seems to stem in part from the hypothesis that men especially value the ''superficial'' quality of attractiveness in women (e.g., Buss & Schmitt, 1993). The dual model approach favored here actually argues against this sex difference in *preferences* and suggests instead that the locus of the sex difference is the nature of the *mechanisms* that yield attractiveness preferences in men and women. However, people who are disturbed by the sex differences predicted by SST will probably not be any happier with the proposition that, least under some conditions, women are just as ''superficial'' as men.

short-term contexts (Buss & Schmitt, 1993; Gangestad & Simpson, 1990; Kenrick et al., 1990). Men who are not highly attractive tend to favor long-term commitments over casual sexual encounters (Gangestad & Simpson, in press; Gangestad & Thornhill, 1997b). Women raised in environments in which stable pair-bondings are unlikely become especially attuned to male attractiveness (e.g., Wesfeld & Billings, 1988). People of average attractiveness tend to pair off with opposite-sex individuals who are similar to them in attractiveness (Feingold, 1988; Lykken & Tellegen, 1993). Both sexes become more attuned to attractiveness in environments in which pathogen levels are high (Gangestad & Buss, 1992). These data do not reflect mechanisms that are inflexible or insensitive to contextual and environmental factors; in fact, they suggest precisely the opposite.

B. CONCLUSIONS

Berscheid and Walster (1974) noted that the theoretical underpinnings of attractiveness effects were not well understood. In the 25 years that have ensued since their comments, the attractiveness literature essentially remained data in search of a theory. Many social scientists took the position that preferences for attractiveness reflect capricious cultural norms and whims spread through socialization and exposure to the media. Although such mechanisms probably perpetuate and amplify the influences of attractiveness on social perception, they do not address the origins of attractiveness preferences. Moreover, emerging lines of research during the past decade—including evidence of cross-cultural consensus in attractiveness judgments, infant sensitivity to variations in attractiveness, and the ''kernel of truth'' in judgments based on appearance—point to a function of attractiveness that goes much deeper than arbitrary cultural preferences. The integration of these data with emerging models of evolutionary perspectives on human social behavior can provide an understanding of the form and function of attractiveness that has to date been missing; in effect, these data may well have found their theoretical ''home.''

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INDEX

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CONTENTS OF OTHER VOLUMES

355

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