Acquisition of the Algorithms of Social Life: A Domain-Based Approach

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Proposing that the algorithms of social life are acquired as a domain-based process, the author offers distinctions between social domains preparing the individual for proximity-maintenance within a protective relationship (attachment domain), use and recognition of social dominance (hierarchical power domain), identification and maintenance of the lines dividing "us" and "them" (coalitional group domain), negotiation of matched benefits with functional equals (reciprocity domain), and selection and protection of access to sexual partners (mating domain). Flexibility in the implementation of domains occurs at 3 different levels: versatility at a bioecological level, variations in the cognitive representation of individual experience, and cultural and individual variations in the explicit management of social life. Empirical evidence for domain specificity was strongest for the attachment domain; supportive evidence was also found for the distinctiveness of the 4 other domains. Implications are considered at theoretical and applied levels.

[I]nterdependence situations are at the basis, both phylogenetically and ontogenetically, of the varieties of interpersonal rules and tendencies observed in socialized adults. This assumption derives from the functional view that, for the most part, people are well-adapted to the situations they commonly encounter. (H. H. Kelley, 1984, p. 979)

Preparation of the young for social life has traditionally been studied within the framework of socialization theory. Effective socialization has typically been viewed as involving a generalized style of social influence. In addition, socialization as a concept has historically focused on the aware, explicit cognitions and intentional tactics used by parents or other societal representatives (and to a lesser extent, on the cognitions and tactics of the young). If, indeed, the preparation of the young for social life were viewed as involving a domain-general pattern of effortful tuition or influence, it would lose currency at several different levels. First, it would fail to give proper consideration to variations across context. Second, it would not properly consider implicit cognitions and behavioral routines that lie outside awareness. Third, it would not consider the organizational role of developmental processes within the central nervous system.

This article is specifically concerned with the acquisition of regulatory mechanisms that selectively and contingently prepare the young for the diverse features of social life. Rather than being prepared to engage in stable response patterns across contexts, the young may be seen as acquiring conditional responses of an

"if–then" nature (Main, 1990; Mischel & Shoda, 1995). Different rules are used to manage the distinctive problems associated with the basic domains of social life. For example, cues to the presence of danger may activate the attachment domain in the young—which in turn activates a mutual regulatory system that involves neurohormonal changes and social signals. Indeed, the ability to make use of such contingencies provides the basis for the individual's health, survival, and reproductive success. This type of domain-specific, if–then contingency is referred to here as a *social algorithm.* Cacioppo and Tassinary (1990) define *algorithm* as broadly referring to "any effective procedure for solving a problem or accomplishing an end" (p. 803). In offering this framing, it is possible to unpack and specify the notion of *parental sensitivity,* that is, the adaptive flexibility of caregivers to the needs of the young at different times and within differing contexts.

As an initial proposition, I argue that the recurrent problems of social life across human evolutionary history have led to the availability of algorithms for the potential management of the domains of social life. By *domains,* I am referring to the bodies of knowledge that act as guides to partitioning the world and that facilitate the solving of recurring problems faced by organisms within that world (Hirschfeld & Gelman, 1994). Distinctions are offered between the algorithms that organize (a) proximity-maintenance during late infancy with specific others in the service of safety (the attachment domain), (b) use and recognition of social dominance (the hierarchical power domain), (c) identification and defense of the lines that divide "us" and "them" in group[1] coalitions (the coalitional group domain), (d) management of the reciprocal obligations and benefits that are involved in communal life (the reciprocity domain), and (e) selection and protection of access to sexual partners (the mating domain). (For an illustration of the five domains, see Figure 1.) I propose that domains differ in the social problems to be solved, timing features (i.e., developmental course), computational processes (i.e., what social infor-

[1] The term *group* is used in the sense of an identity-based cooperating coalition (as opposed to the simple presence of shared identity features).
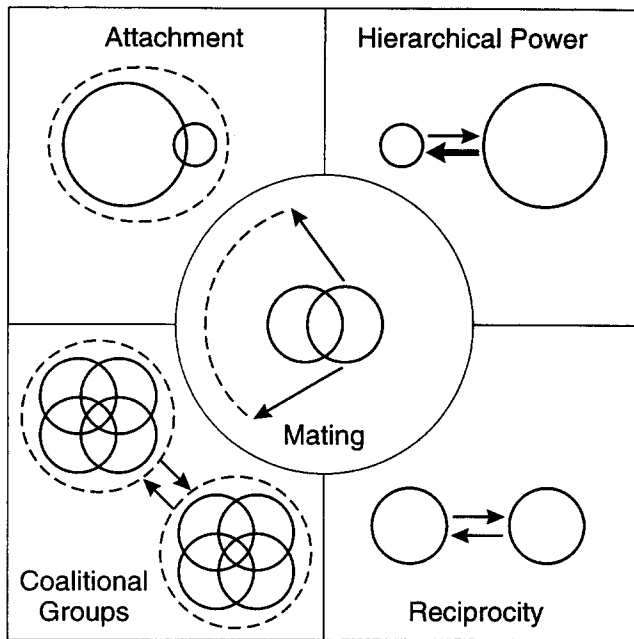
Figure 1. The five domains of social life. Shared reproductive interests are indicated by overlapping circles; negotiation or competition is indicated by arrows. Size differences reflect level of symmetry in control of resources. Dotted lines indicate presence of barriers in the service of defense of resources and/or protection against danger or rivals. The mating domain is positioned centrally as a reflection of its overlapping role with other domains among humans.

mation is sought and stored), neurohormonal regulating processes, and conditional types of social-emotional response patterns.

As a second proposition, I suggest that the domains of social life are fine-tuned to the environment at three different levels: (a) bioecological adaptation (Level 1), (b) implicit representation of experience (Level 2), and (c) explicit appraisal processes (Level 3). Each level contains some amount of flexibility in solving the problems of social life. Because there has been a tendency to think of developmental flexibility as occurring only by means of socialization, it is important to recognize that humans are also biologically "designed" (Level 1) to solve recurrent problems by alternative means (see, e.g., Markman, 1992). At Level 2, humans come to cognitively represent their individual experiences in organized ways that reflect their personal history (A. P. Fiske, 1992; Jackendoff, 1992). At the highest level of flexibility (Level 3), humans have the (evolved) capacity to reflect on and manage their environments to fit current needs. The three levels of organization typically (and most effectively) operate in concert. As pointed out by Cairns, Gariepy, and Hood (1990), "Developmental, experiential, and microevolutionary processes typically collaborate, rather than compete, in achieving social adaptation" (p. 53). From this perspective, it would be an error to think of preparation of the young for social life only as a cultural creation—as a force that overcomes natural human dispositions. Shared evolutionary history has not only prepared human beings for some range of probable environments (from the evolutionary past) but also serves to influence the ways in which they cognitively represent their experiences and the kinds of social environments they are likely to

create (Cosmides & Tooby, 1989). Ultimately, then, environments are themselves altered in the service of the problems to be solved within social domains.

In borrowing from evolutionary psychology, I am concerned with those processes that evolved to solve problems in the human environment of evolutionary adaptedness but that may or may not have functional value at the present time. As a very simple example, newborns show a specialized and universal sensitivity to faces (as opposed to other stimuli with similar dynamic or featural properties)—a sensitivity that facilitates their acquisition of knowledge about key components of the social environment (Morton & Johnson, 1991). As is described later, they also show sensitivities that were adaptive in the evolutionary past but are no longer functional (e.g., intense protest to nighttime separation). I argue that the formulations of contemporary evolutionary psychology—rather than running in opposition to socialization theory or social-cognition theory—provide a useful extension to such approaches in ways that more fully account for observed processes.

In reviewing the evidence for a domain-based view of algorithm acquisition, I give initial consideration to limitations in single-process, domain-general theories of socialization. Emerging evidence for the presence of distinctive social domains that operate according to different rules is then presented. I propose that five basic social domains operate on the basis of specialized algorithms and are acquired in relatively distinctive ways. Evidence is then reviewed for variability in the regulation of different domains as a function of (a) bioecological influences, (b) cognitive representations of social experience, and (c) parental and cultural management. The attachment domain is highlighted as providing the clearest evidence for the operation of a distinctive algorithm. Suggestive evidence is provided for the algorithms that appear to organize the other four domains of social life.

Limitations in Unitary, Domain-General Views

Unitary, domain-general views of preparation of the young for social life conceptualize relevant processes as following the same organizational principles across settings, tasks, and stages of development. For example, socialization notions developed within a learning theory framework had wide appeal by virtue of the parsimony of simple, universal principles that span the life course. Across species, cultures, age, and content, the same organizing principles applied.

Some of the earliest challenges to the idea of an all-encompassing set of rules came from within learning theory itself. Research conducted across species increasingly led to the conclusion that there are biological constraints on learning. That is, different species are set to learn particular responses very easily and are highly resistant to learning other responses (Breland & Breland, 1966). In the same way, it appeared that the learning processes that successfully accounted for certain kinds of acquisitional processes did not account for others. For example, the classic work of Garcia and his colleagues (Garcia & Koelling, 1996) with food aversion revealed that animals easily learned (in a single episode) to avoid food that made them sick. No counterpart could be found in avoiding any of the other things they might have done in the time period after eating a particular food and prior to becoming sick. Thus, there appeared to be a privileged association between particular kinds of stimulus events and the responses shown.

Seligman (1970), in a highly influential article, went on to question general-process notions of the laws of learning as a whole. In their place, he proposed that organisms are differentially prepared to associate different kinds of events and are highly resistant to associating other types of events. He provided examples of these variations across classical conditioning, instrumental training, discrimination training, and avoidance training. He also proposed that such variations are accompanied by covariations in physiological and cognitive processes. This break with traditional views of learning set the stage for consideration of distinctive knowledge acquisition processes in different domains.

Within learning theory, a second break emerged with the proposition that the processes that are involved in social learning are not simply a subset of general learning processes. Bandura (1977) introduced a concept of social learning, along with the notion that organisms learn by observing the actions of others. Although they may not imitate observed responses immediately, they are acquiring information that may be called forth when it is useful to do so. In addition, social efficacy was seen not simply as a process of skill acquisition but as a process that involved cognitive representations of events and the linkages between events. Thus, along with a focus on social processes came a concern with the cognitive organization of learning.

Within developmental psychology, it also became clear that knowledge acquisition does not always proceed according to the same rules. Some competencies (e.g., language) are acquired in ways that do not seem to involve reinforcement. Instead, children come into the world prepared to actively and easily acquire language skills (Chomsky, 1988)—a facility that is not shared in the ways in which they acquire other skills (e.g., reading).

Consideration of the processes that led to attachment posed a major threat to traditional learning theories. Attachment proved to be instantiated in response to certain physical features of others (e.g., softness, warmth) but was not influenced by such primary reinforcers as food (Harlow, 1971). Such processes also proved to be highly resistant to extinction.

Finally, some processes seemed to come "on-line" in response to a biological clock rather than by systematic learning processes. For example, children's social signalling behavior (e.g., their smiles, laughter) initially emerges in a rather regular form and in a regular time course with or without relevant experience (Freedman, 1964; Washburn, 1929); maintenance of such responses, however, requires their contingent association with other events. In a closely related pattern, children appear to be designed to give specialized attention to certain aspects of their world and to rapidly compute the features of that world. For example, they were found to give selective attention to faces at birth and to rapidly compute the information necessary to identify specific faces and the facial properties associated within their own species (Morton & Johnson, 1991).

Challenges also came from within social psychology. In this case, challenges were offered not only to the equivalence of social versus nonsocial cognition (Brewer, 1994) but also to the equivalence of interaction rules in different contexts. For example, M. S. Clark and Mills (1979) explored the rules that govern exchange versus communal relationships. They found that people who believed that there was no chance to get to know a stranger further liked that stranger more if he or she kept close track of the contributions of each to a shared task (an exchange rule); however,

if there was a possibility of getting to know the stranger, they liked that individual better if he or she failed to keep close track of the contributions made by each (a communal rule). That is, it appeared that there were different organizing rules for the two kinds of relationships.

Questioning of the equivalence of influence processes and outcomes across settings has a long history within socialization theory. Much of the controversy has concerned the nonequivalence of socialization processes across different behavioral domains. For example, prosocial responses (unlike many other responses) have not been found to be strengthened across contexts by concrete reinforcement (see, e.g., Eisenberg & Fabes, 1998) and may not even be consistently strengthened by social reinforcement (Grusec, 1991). Attention has also been given to the noncontinuity of children's social responses in different social contexts. For example, children's social responses are governed by different rules or algorithms within peer relationships than within authority-based relationships (Youniss, 1980). At the same time, recognition has been given to the fact that social algorithms or rules are better conceptualized as organized by context rather than formal relationship categories. For example, the rules that govern interactions between parents and children differ when temporarily framed as a play context (with implicit equality features) than when framed as an authority-based context (Dix, 1992).

What Are the Basic Domains of Social Life? Past Concepts and Evidence

The notion that social life is parsed into distinctive domains originated at the interface of social cognition, biopsychology, and developmental psychology. Correspondingly, it is useful to explore the ways in which theory and research within these diverse areas have foreshadowed the proposed domain-based view of social life.

Cognitive Psychology

Ideas of modularity or domain-specificity originated within the field of perceptual and cognitive psychology. These ideas were introduced initially by Chomsky's (1988) notions of specialized mechanisms for the acquisition of language and subsequently by Fodor's (1983) notions of modularity within the field of perception. Fodor argued that such processes are fast, mandatory, associated with neuroanatomical mechanisms, innately specified, encapsulated from background experience, and domain specific. Within cognitive psychology, there has been an emergent interest in the categorization of knowledge—either as an implicit recognition of the external structure of the world (see, e.g., Rosch & Mervis, 1975) or as a construction that is imposed on the world (Murphy & Medin, 1985). Although the early focus of attention was on nonsocial knowledge, the same basic processes have been applied to social knowledge, for example, theory of mind concepts, emotion categories, personality types, and kin categories (Baron-Cohen, 1995; Malt, 1995). There has, however, been a continuing debate concerning the extent to which the architecture of the brain is best thought of as an equipotential processing system or a system that consists of special-purpose processing modules (see, e.g., Hirschfeld & Gelman, 1994).

Social Psychology

Within the field of social psychology, consideration has been given to the continuities and distinctions in the ways in which human beings process and interact within different social domains. As noted earlier, M. S. Clark and her colleagues (e.g., M. S. Clark, Helgeson, Mickelson, & Pataki, 1994; M. S. Clark & Mills, 1979) explored the social rules that govern exchange versus communal relationships. From a broader standpoint, Baldwin (1992) suggested that greater attention should be given to the notion of relationship schemas, that is, the organized cognitive representations of relationships with others. Such schemas include interpersonal "scripts" that serve to guide interactions.

A. P. Fiske (1992) proposed an account of the organization of social domains that bridged the fields of anthropology and social psychology. He proposed that human relationships are spontaneously categorized by perceivers into four basic types: communal sharing (CS) relationships (relationships that involve equal sharing and common identity among group members), authority ranked (AR) relationships (hierarchical relationships characterized by unequal dominance or resources), equality matched (EM) relationships (relationships characterized by tit-for-tat provision of benefits between members), and market priced (MP) relationships (relationships in which members act on the basis of rationally weighed subjective utilities of member resources and actions). A. P. Fiske described these typologies as distinctive modules—each of which involves "a distinct form of representation, used for integrating and interpreting experience and guiding action in a specific sphere" (p. 690). He suggested that relationship computations involve nominal scaling in the CS domain, ordinal scaling in the AR domain, interval scaling in the EM domain, and ratio scaling in the MP domain. However, he also pointed out that these modules may be implemented in different ways in different cultures. A. P. Fiske also proposed that there may be a regular sequence in the ontogeny of these four relationships: CS → AR → EM → MP—thus providing a potential developmental framework for the acquisition of domain-relevant processes.

Social Psychobiology

Coming from a developmental psychobiology perspective, Panksepp and his colleagues (Panksepp & Miller, 1996; Panksepp, Nelson, & Bekkedal, 1997; Panksepp, Siviy, & Normansell, 1985) have been concerned with the neural circuitry that mediates social-emotional systems. Although accepting the reasonability of shared neurochemical influences across different types of social relationships, Panksepp, Nelson, and Bekkedal (1997) argued that "existing data are beginning to allow the conclusion that special purpose motivational systems also exist within the mammalian brain" (p. 80). In delineating these motivations, Panksepp has suggested four distinguishable systems (play system, panic system, lust system, and acceptance system) and allows for the possibility of a fifth system (social dominance system). In his own research, he has been particularly concerned with the play system and with two systems (panic and acceptance) that combine within attachment relationships.

Evolutionary Psychology

Contemporary evolutionary psychology has been extensively concerned with the various domains of social life. For example,

concern has been directed to the mechanisms that serve to regulate mating relationships, kin relationships, friendships, dominance hierarchies, and so on (Kenrick & Trost, 1997). Some domains (mating, caregiving within kin relationships) have often been viewed as "primary" in that they are most central to reproductive success (Bowlby, 1969, 1973, 1980). Cosmides and Tooby (1992) have presented one of the most fully articulated positions with respect to the modularity of social–cognitive processes, that is, the computational mechanisms that have evolved to solve recurrent problems across human history.

Coming from an evolutionary systems perspective, Caporael and her colleagues (e.g., Caporael, 1997; Caporael & Baron, 1997) have been concerned with the evolutionary origins of human social coordination. She has proposed four core social configurations, each of which has a characteristic group size and task. The proposed configurations include dyads (two-person groups, e.g., parent–child associations), work/family groups (small, face-to-face groups with a common task orientation, e.g., foraging, gathering, or hunting groups), demes/bands (small, interacting communities), and macrodemes/macrobands (larger groups that involve shared identity and communication but that do not involve regular face-to-face interaction). Each of these configurations is seen as involving different types of coordination and different types of interdependence. Dyads, as the most critical and ancient configuration, make central use of coordination in the synchronized accomplishment of key social tasks. The central function of work/family groups involves the sharing of cognitive resources in solving a shared problem. Demes represent a basic economic unit that facilitates the shared construction of common knowledge. Macrodemes represent a seasonal collection of bands that share language (and thus can report on the condition of distant habitats and events).

Behavioral Ecology

Other investigators have applied a behavioral ecology approach to the distinctions that appear in the organization of social life. From this perspective, regulatory systems that evolved to handle different aspects of social life emerged in response to different ecologies across phylogenetic history. For example, attachment patterns (parental investment in the care of the young) represent a central feature of mammalian relationships. Parental investment fosters reproductive advantages for those animals in which the young show a prolonged period of dependence during which they are at risk for predation. At the same time, even phylogenetically lower animals may also show responses to their young that are characterized by basic attachment features (i.e., protection activities). For example, both parents among the burying beetle (*Nicrophorous orbicollus*) create and defend their nests from aggressive conspecifics (Robertson, 1993). Parental defense is, in turn, a highly effective way of reducing offspring mortality as a result of predation (Kudo & Ishibashi, 1996).

Another relational pattern that has emerged at various points in phylogenetic history involves reciprocal exchange processes between conspecifics (Wilkinson, 1988). For example, reciprocal exchange processes are manifested in blood-sharing among vampire bats (Wilkinson, 1988), reciprocal grooming among a wide variety of mammals (see, e.g., Mooring & Hart, 1997; Muroyama,

1991), and mutual social assistance among primates (deWaal & Luttrell, 1988).

Group processes (recognition and differential response to own group versus other groups) have evolved repeatedly among social animals. For example, they are present among a variety of social mammals (Harcourt & de Waal, 1992) and extend to some of the responses shown by social insects (see, e.g., Feneron & Jaisson, 1995).

Finally, the dominance-oriented interactions that are used to manage access to resources are broadly distributed across species. Hierarchical interactions have been found among fish, reptiles, birds, and mammals (Ellis, 1993), and even among insects (see, e.g., Dugatkin, Alfieri, & Moore, 1994).

However, the unevenness (in presence and form) of such processes suggests that the similarities seen within nonhuman species are analogous (evolved to serve the same function), not homologous (evolved from the same ancestral form), to human processes. These similarities reflect the recurrent adaptive problems that have emerged within social life.

Developmental Psychology

Within developmental psychology, there has been a continuing interest in potential differences in socialization across settings. One group of researchers has framed the distinctions between socialization contexts as reflecting variations in parenting goals across different contexts or situations (see, e.g., Dix, 1992; Grusec & Goodnow, 1994; Hastings & Grusec, 1998). For example, Dix (1992) proposed that parenting goals can be subdivided into those that reflect the parent's personal goals (goals that translate into concerns with child obedience), empathic goals (goals that focus on satisfying the child's emotional needs), and socialization goals (goals that are concerned with the ultimate welfare of the child in terms of learning important values and lessons). Hastings and Grusec (1998) have proposed a somewhat similar tripartite system of goals: parent-centered goals (focused on power assertion), relationship-centered goals (focused on warmth, negotiation, and cooperation), and child-centered goals (focused on reasoning). In reviewing the literature on enduring versus variable features of caregiving, Holden and Miller (1999) pointed to the role of context and concluded, "(T)he question of paramount importance is under what conditions, in what ways, to what extent, and why does child rearing vary or change" (p. 248).

In addition, distinctions have been offered between parental versus peer socialization. For example, Piaget (1948) proposed that the only true socialization took place between peers—an idea echoed from a very different theoretical perspective by Harris (1995). From either vantage point, the relationship between parents and children (an authority-based relationship in most contexts) can be distinguished from children's interaction with peers, relationships that more characteristically involve symmetrical, bilateral, exchange processes. On a broader level, Laursen and Bukowski (1997) proposed that close relationships (parent-child, sibling, peer, and romantic) can be distinguished in terms of the organizational systems involved and the ways in which such relationships change across the course of development. In similar fashion, Dunn (1993) has suggested that although children show some level of intrapersonal continuity across relationships, they also show differences in their relationships with parents, siblings, and friends.

MacDonald (1992) has applied an evolutionary approach to socialization processes. Specifically, he proposed a discrete systems theory of socialization based on an evolutionary perspective. He proposed "the existence of specific biological systems as the basis of human relationships. Because different systems are involved, it is consistent with compartmentalization, that is, the possibility that people can have radically different relationships with others depending on the context" (p. 765). In discussing different systems, he was particularly concerned with the distinctiveness of relationships based on attachment and relationships based on affection. He proposed that attachment relationships are regulated by fear (in response to separation from or absence of the attachment object) whereas affectional relationships are regulated by positive feelings of warmth and affection. He went on to note that attachment systems are ubiquitous among the primates but affectional ties are less common; even when affectional ties are present, the processes involved are independent of those shown within attachment relationships.

Another concern with domains arose in the field of moral development. Nucci, Turiel, and their colleagues (e.g., Laupa & Turiel, 1995; Nucci, 1985; Turiel & Davidson, 1986) proposed that a distinction should be made (and regularly is made within communal life) between the moral domain and the conventional domain. At a very young age, children understand the difference between basic morality (a domain that involves universal concerns with welfare, justice, and rights) and social conventions (a domain that involves consensually agreed-on behavioral uniformities that facilitate the organized functioning of group life). Children view these domains as differentially enforceable, and violations of domain rules are seen as subject to different types of sanctions. Smetana, Nucci, and their colleagues (e.g., Nucci & Smetana, 1996; Smetana, 1996; Smetana & Asquith, 1994), using a domain-based approach to social–cognitive development, have been concerned with the subjective views of moral, conventional, prudential, and personal domains by parents and their children across the course of development. A high level of generality has been found in such processes; for example, parent–child conflicts and reasoning about issues of personal jurisdiction have been observed within both collective and hierarchical societies (Yau & Smetana, 1996). Turiel (1998) has argued that the social reasoning and actions of individuals are heterogeneous and reflect their shared multiple orientations to the social world. From this perspective, it is an error to conceptualize cultures as providing qualitatively distinct ways of thinking about or coping with social life. Instead, orientations are shared (to a greater or lesser extent) across cultures.

Summary

Across many different perspectives, the possibility has emerged that there are systematic differences in the problems to be solved and the nature of problem resolution across the domains of social life. Although a number of investigators have been selective in their comparison of domains, others have proposed a broad taxonomy of domains. Despite the fact that the taxonomies that have been generated from different areas and involve different "lists," there is some consistency in the basic domains proposed. Attachment (or some variation of attachment) is regularly included.

Table 1
Basic Domain Features

Domain (problem to be solved)	Information	Developmental timing	Key neurohormonal regulators	Social-emotional responses (if–then contingencies)
Attachment (safety maintenance)	Relevant stimulus features of O, e.g., faces, voices; specific identity of O; proximity to O; predator/stranger cues	1	Opioids, oxytocin	If possible threat: proximity-seek; if separation: distress call (careseeker) or search (caregiver); if reunion: tranquility
Coalitional group (defending, acquiring shared resources & territory)	Grouping features (socially important categories); conformity cues(S, O); intergroup threat cues; exclusion cues; defection cues	4	Opioids, testosterone	If scarce or threatened resources: intergroup conflict; if group win: elation, schadenfreude, & out-group contempt; if group loss: shame & protective repair; if group exclusion: fear & sadness; if defection: retribution
Mating (select & maintain/protect access to high value mate)	Gender cues; relatedness cues; attractiveness (cues to reproductive value); accessibility cues; cues to rival threat; cues to parental investment	5	Opioids, oxytocin, androgens & estrogen	If high value, accessible O: court; if bond: infatuation/love; if threat from rival: jealousy/mate guarding
Reciprocity (maximize joint outcomes for functional equals)	Investment potential; continuous update of reciprocity history; cheater detection	2	Serotonin	If reciprocity history or potential: provide support & matched positive affect; if S cheats: guilt/repair; if O cheats: annoyance-hurt; seek repair
Hierarchical power (optimize welfare & balance of control between those of unequal power)	RHP (including dominance) of S & O; threat intention cues from O; resource provision cues from O	3	Testosterone	If high RHP: assertion, confidence; if low RHP: submission, anxiety; if threat cue from O & high RHP: anger & aggression; if threat cue from O & low RHP: fear & appeasement

Note. Regulatory systems that are involved in general management of environmental threat are not included. In addition, neurohormonal regulators typically act in combination and thus involve other hormones not listed here. O = other; S = self; RHP = resource-holding potential.

Group processes are regularly included but are often merged with attachment processes. Equality-based relationships are regularly included (although descriptions of peer relations sometimes combine reciprocity processes between individuals and coalitional processes within groups). Some variation of hierarchical power or dominance is regularly included as an organizing principle for social relationships. Finally, romantic or mating relationships are included in taxonomies that focus on adult processes.

What Are the Basic Domains of Social Life? A Proposal

The five social domains considered here include attachment interactions, equality-based reciprocal interactions, dominance-based hierarchical interactions, identity-based coalitional group interactions, and romantic or mating interaction (see Table 1). The five domains are grouped into those that may be thought of as involving bonding processes (attachment, coalitions, mating) or continuous negotiation processes (reciprocal, hierarchical).[2] In evaluating the evidence for the specificity of these social domains, I examine those findings that suggest that domain regulators (a) operate primarily within a particular domain, (b) are effective within that domain, and (c) are irrelevant/ineffective for the organization of other domains.

The focus here is on acquisitional or instantiation processes. At the same time, it is easy to see that the domains described characterize basic interaction processes across the life course. Social domains are based on social problems to be solved within context-defined interactions rather than formal relationships (e.g., parent–child relationships, friendships). The focus on domains facilitates

the understanding of changing interactions between the same individuals. Interaction conflict often occurs when a formal relationship continues to be the same (e.g., parent–child, friendship, romantic partner) but the current features of the interaction shift. A classic example involves the changing nature of interactions between parent and child in early adolescence. As another example, friends may experience temporary conflict when involved in interactions based on algorithms that are inconsistent with equality (e.g., a supervisor–subordinate relationship).

Among human adults, these domains are frequently merged. Most notably, romantic pair-bonds are often organized in ways that involve reciprocity, hierarchy, long-term attachment, and a shared identity (the "we" aspect of pair-bonds). However, there is variability across individuals, cultures, and species in the extent to which and the ways in which domains are combined. As a result, consideration is given here to the distinctive, defining, and most

[2] One key difference in the taxonomy presented here from that proposed by A. P. Fiske (1992) involves the focus on acquisition processes and biological mediating mechanisms. A second difference involves the distinction offered here between attachment and group domains (subsumed within A. P. Fiske's communal domain). The two domains, although sharing a feature matching component, differ in their algorithms. The reciprocity domain is defined to include long-term as well as short-term processes in the mutual provision of matched benefits. As a third distinction, the mating domain is added here as a central feature of social life. Although this domain is implemented at older ages, organizational processes begin at very young ages.

commonly shared features of social domains. In this way, a closer look can be taken at the basic building blocks that may be integrated in different ways within different species, cultures, and individuals.

The basic features of the five domains to be described include:

(1) The key problem(s) to be solved within each domain. Domains are presented as acting to facilitate the solution of basic, universal adaptation problems.

(2) Computation/calibration of domain-relevant information. The first step in the implementation of the algorithms of social life involves what may be thought of as *domain instantiation*, that is, the initial computation of domain values. The notion of computation was first used within cognitive psychology. Beginning with Simon's (1962) work, an account of children's cognitive development was offered in which use was made of a computer metaphor. From this perspective, the architecture of the child's mind was described as analogous to a computer program or set of programs ("designed" to acquire and manipulate information through the use of regular rules). Developmental change was seen as involving a self-modifying set of rules, representations, and psychological processes (Keil, 1998).

Biologists have more typically used the concept of calibration in describing similar processes. In doing so, they essentially retain the dictionary definition of calibrate ("to check, adjust, or systematically standardize the graduations of a quantitative measuring instrument," Morris, 1969). For example, many animals have the capacity to perceive and store information on time, space, and number (Gallistel, 1989). These value-setting capacities allow for such complex processes as assessing and storing the position of the sun at different times of the day as an aid to navigation (as observed in desert ants by Wehner & Srinivasan, 1981).

Social animals may be thought of as initially computing/calibrating discrete social values (e.g., identity) in some domains and continuous values in other domains (e.g., the relative dominance of others). Domain-relevant information is subsequently reassessed (recalibrated or recomputed)—either as a continuous process or as a time- and event-linked process.

(3) Timing and developmental issues. In considering the implementation of domains, it is important to review evidence concerning their developmental course. For example, domain-relevant information may be acquired and used concurrently; alternatively, domain-relevant information may be acquired at relatively early ages but not used until requisite brain development or neurohormonal development has occurred.

(4) Domain-relevant involvement of neurohormonal regulating processes. No argument is made for fully domain-specific physiological regulating processes. For example, endogenous opioid systems appear to regulate all domains that involve identity-based bonding processes. In addition, two systems are quite generally involved in preparing the organism for emergency situations. The sympathetic-adrenomedullary system (SAM), as a fast organizer of responses to emergency situations, influences the implementation of any domain that requires quick mobilization for action. The hypothalamic–pituitary–adrenocortical axis (HPA) prepares the organism for continued engagement with stressful events—and thus is involved in regulating domain activities that involve slower accommodations to sources of threat. Because of the generality of SAM and HPA systems in preparing the organism for action, specific illustrations of such activation within domains are not

reviewed systematically. On the other hand, some responses systems (e.g., oxytocin) may be more directly tied to processes within particular domains.

(5) Domain-relevant social-emotional responses. The final step involves social-emotional signalling, and other social strategic activity of an if–then nature. Such responses are also described in terms of characteristic subjective emotional experiences.

In describing the domains of social life, I begin by proposing the nature of the shared (default) algorithms that organize such domains. In this section, the focus is on the uniformities in their apparent design across individuals, times, and cultures. In the following section, I go on to consider the variations in the ways in which domains are acquired as a function of differences in internal and external environments, individual experiences, and culturally shared experiences.

Attachment Domain

What is the central problem to be solved within the attachment domain? In Bowlby's (1969) original formulations of attachment in humans, he conceptualized attachment as an evolved system that primarily served the function of proximity-maintenance and protection of the young—in particular, when they become mobile and move out to explore their (potentially dangerous) world. The attachment system may be thought of as a complementary relationship between the distress system of a dependent child and the protective system of a caregiver—a coevolved system (Panksepp & Miller, 1996). Processes that occur within the attachment domain most commonly serve the shared interests of parents and their offspring. From the standpoint of the infant, attachment represents a safety-maintenance system that is essential for survival (Panksepp et al., 1985). From the standpoint of the parent, attachment involves an empathic, protective system (Dix, 1992) that promotes the survival of the young—and thereby the reproductive success of parents (Eisenberg & Mussen, 1989; Panksepp et al., 1985).

At the same time, the attachment system also involves unshared goals between parent and infant. Because human infants are born at a very early point in development (Altmann, 1987), there is an exceptionally long period of dependency. Thus, there is a need for very high levels of parental investment for the young to survive. During the early months of life of a healthy infant, attachment serves the interests of both parents and infants, that is, the reproductive interests of both are served by the infant's survival. However, with the advent of other children, the vested interests of mother and child may diverge (Trivers, 1974; Wilson & Daly, 1994), that is, the child's interests are best served by continued maternal investment, but the mother's reproductive interests may potentially be better served by reallocation of (some portion of her) attention to the next child (Fairbanks, 1993). Thus, the attachment goals of parents are spread across their offspring rather than being exclusive to an individual child.

Infants, in turn, have fewer options than parents in the strategies they may engage to optimize their reproductive success. Consistent with this notion, adults appear to be broadly interested in the young whereas infants are more tightly motivated to maintain an attach-

ment with a specific other or specific others. They do not as easily have the option of courting substitute parents.

What information is sought within the attachment domain? For both caregivers and the young, the information-seeking component of the attachment domain involves establishment of the specific identity of another individual (or individuals) who have a prespecified set of stimulus features. Attachment, from the standpoint of parents, begins with positive responsiveness to the stimulus properties of the young. Adult humans have a very general attraction to babyish faces (Zebrowitz, Kendall-Tackett, & Fafel, 1991). In addition, the cry of the young has very broad signal value in attracting adult attention (Ostwald, 1963). From an encoding standpoint, adults across cultures share a strong tendency to produce infant-directed speech (baby talk) in response to infants (Fernald et al., 1989) or to baby-faced children (Zebrowitz, Brownlow, & Olson, 1992). At the same time, mothers also show ready identification of the specific stimulus features of their own young. For example, infant cries are so unique that they quickly allow the identification of individual infants (Gustafson, Green, & Cleland, 1994).

In complementary fashion, infants have a preference for familiar others who show particular stimulus features. An important indication of the specificity of the attachment domain is the distinctiveness of the information used as a basis for value setting. Although provisioning (e.g., access to food) serves as one of the positive consequences of the attachment system, infants do not appear to compute the adequacy with which this function is met as a basis for their attachment responses (Harlow, 1971). Instead, their selective attraction to potential objects of attachment is more closely organized around a variety of stimulus features that have been associated with mothers across evolutionary history (e.g., softness, warmth). Infants also show sensitivity to specific cues associated with their own mother. For example, young infants (both humans and other primates) have been found to have a preference for their mother's smell—a smell that appears to be associated with breast milk (Bartoshuk & Beauchamp, 1994; Schaal, 1988). This ancient sensitivity allows infants to locate their mothers.

In the same way, shared play activities (although sometimes provided by primary caregivers) do not serve as the basis for infant attachment. Thus, young children (and young nonhuman primates) seek primary caregivers when they are in a state of distress but are more likely to seek peers in order to foster a positive or playful interaction (Bowlby, 1969; Bretherton, 1985; Higley et al., 1992). Children as old as 8 to 10 years still view their parents (and not their friends) as a primary basis of all types of emotional support and seek physical closeness to them when distressed (Shaver & Hazan, 1993). As an extreme test, Higley et al. (1992) observed the attachment responses of rhesus monkeys who were peer reared versus mother reared. Although infants raised without mothers did show attachment responses to a preferred peer, mother-reared infants demonstrated significantly more intimate contact and relief from distress in response to mothers than did peer-reared infants in response to preferred peers. These combined findings suggest that mothers provide more attachment-consistent affordances than do peers.

In the continued maintenance of the attachment domain, relevant information for its adaptive functioning is continuously monitored. For example, navigational information (the direction and distance of the attached other) is monitored—particularly in the presence of potential threat. When the young first become mobile, they become particularly involved in monitoring the location of their caregivers (Cassidy, 1986).

What are the timing features for activation of the attachment domain? The timing features of attachment show a high level of variability across species. Precocial animals (such as chicks or ducklings) demonstrate many of the processes that serve to regulate attachment on the first day of life. Indeed, parakeets have even been found to solve complex (social) object permanence tasks (e.g., searching for a mother who has disappeared from view) on the first day of life (Funk, 1996).

Among human infants (as with other semialtricial or altricial animals), the relevant regulatory features come on-line at different points in the course of development. Although sensitivity to social cues (e.g., the mother's voice) begins during the prenatal period (DeCasper & Spence, 1991; Hepper, Scott, & Shahidullah, 1993), it is striking in the early neonatal period. For example, neonates have been found to prefer their mother's voice (i.e., increased sucking to produce voice of mother but not others) and selectively orient (i.e., show heart rate declines) to their mother's voice on the first day of life (DeCasper & Fifer, 1987; Ockleford, Vince, Layton, & Reader, 1988). In addition, newborns are more likely to visually track facelike stimuli than scrambled faces within the first hour of life (Johnson, Dziurawiec, Ellis, & Morton, 1991). Such selective attentional vigilance allows an opportunity for identification of the defining features of others. Thus, relevant features of the mother's appearance may be learned quickly following birth. For example, there are indications that recognition of the mother's face can be established in the first 2 days of life (Field, Cohen, Garcia, & Greenberg, 1984).

Following a period of high initial receptivity to social cues, there is a decline in preference for facelike stimuli, imitation of facial movements, and head orienting to sound sources (Johnson, 1992). Early competencies are generally thought to reflect the operation of subcortical structures. These reflexlike behaviors drop out sharply during the second month of life (Johnson, 1990). However, as cortical circuitry continues to develop, the preferential response to faces reappears (during the third month). Processes available at birth may be thought of as acting in the service of initial algorithm value-setting; at a later stage, these same stimuli move under the control of higher centers. As observed by Johnson (1992),

> The first of these systems directs the attention of the young animal toward the appropriate class of objects to learn about in the absence of any prior specific experience. The second system is concerned with learning about the characteristics of the objects to which attention has been directed by the first system. (p. 54)

During this later period there is also a dampening of both behavioral and adrenocortical reactivity to stress (Gunnar, Brodersen, Krueger, & Rigatuso, 1996; Lewis & Ramsay, 1995). Possibly, such dampening facilitates the infant's increase in exploratory processes.

The distress call system also appears to emerge by a relatively fixed clock. For example, distress vocalizations do not emerge among human infants in response to separation until around 7 to 8 months (Kotelchuk, Zelazo, Kagan, & Spelke, 1975). Despite the differences in types of early infant care across cultures, the timing of onset of this response pattern is quite regular across these

diverse settings (Konner, 1982). The processes that regulate the distress component of the attachment domain continue across the life course but in diminished form. In nonhumans, they often become inactive. The slowing of attachment-based distress responses appears to occur in response to increasing levels of testosterone in adolescence, and indeed, the slowing process is accelerated by the administration of testosterone (Herman & Panksepp, 1981). Among humans, such changes may contribute to the frequently observed decreases in dependency on parents at this age (see, e.g., Steinberg & Silverberg, 1986). In short, the attachment domain is activated, modulated, and deactivated in a time- and event-linked fashion.

What are the neurohormonal regulators of the attachment domain? Among humans (as well as nonhumans), there are indications that nonparental males and females are differentially sensitive to infant signals. For example, nonparental males show heart rate deceleration to infant cries whereas nonparental females are more likely to show heart rate acceleration (Power, Hildebrandt, & Fitzgerald, 1982); these gender differences hold true even when amount of experience is controlled (Lin, 1998). Because most of the research on neurohormonal regulation of the attachment domain has been limited to females, it should be kept in mind that the responses of males may reasonably differ.

The distress vocalizations of the young, the retrieval processes of mother, and the reward value of reunion are highly regulated by neurohormonal processes (Hofer, 1987; Panksepp et al., 1985) in a well-orchestrated cascade. Under natural circumstances, the distress of the young—arising from either changing internal states or separation from the mother—activates reductions in opioid activity of the young. Reductions in opioid activity, in turn, activate the distress vocalizations of the young. Such vocalizations lead to reductions in the opioid activity of the mother and promote her caregiving activity. Ultimate reunion may be thought of as producing a chemical reward for both mothers and infants, that is, reunion leads to increased production of endorphins (which leads to a calm, peaceful state).

The attachment system is also under the control of oxytocin (a neuropeptide released into the bloodstream through the actions of the posterior pituitary; Nelson & Panksepp, 1996). Oxytocin facilitates maternal responses and isolation-induced distress calls in the young. It appears to be involved in the establishment of social preferences. It does not, however, act to facilitate nonsocial preferences (e.g., taste preferences)—an indication of its regulatory specificity. Consistent with its function within identity-based relationships, oxytocin plays an important role in social recognition processes, that is, elevations in oxytocin serve to increase recognition of conspecifics seen in a brief encounter (Popik & van Ree, 1991).

Evidence for the distinctiveness of pharmacological regulation of the attachment system is indicated by the highly specific effects of experimentally produced changes in such systems (within nonhuman animals). That is, the administration of opioid agonists and antagonists can simulate or interfere with naturally occurring processes in terms of the behavioral responses they trigger. For example, the administration of opioid agonists (e.g., morphine) to rat pups produces the same effects as does reunion; that is, it leads to a reduction in distress vocalizations of the young and disrupts maternal retrieval processes (Panksepp & Miller, 1996; Panksepp et al., 1985). If, however, the reunited pair are given naltrexone (an opioid antagonist), they do not show relief from distress. In the same way, naloxone, an opioid antagonist, leads to an increase in distress vocalizations in the young, which in turn leads to increases in oxytocin production in mothers.

As an example of adaptive long-term "setting" of neuroendocrine systems within the attachment domain, direct experience with the young may produce changes in the arousability of relevant brain systems. For example, increased experience with the young facilitates the functioning of oxytocin-based brain chemistries; these changes, in turn, may facilitate subsequent functioning within the attachment domain (Panksepp & Miller, 1996).

How is the attachment domain regulated in terms of social-emotional responses? The primary problem to be solved within the attachment domain is the maintenance of proximity with those with whom one most closely shares reproductive interests. In response to separation, social responses are directed to distress calls on the part of the young and search and recovery responses on the part of parents. Proximity, in turn, acts to facilitate both the safety and provisioning of the young.

As an indication of the specificity of attachment responses, the social signals that serve to regulate the attachment domain differ from those that regulate other domains. On the basis of their longitudinal study of maternal responsiveness and infant crying during the first 9 months of life, Hubbard and van IJzendoorn (1991) concluded that different effects result from maternal responsiveness to severe distress cries (present early in life and presumably acting as regulators of the attachment domain) versus maternal responsiveness to instrumental cries (emerging later during infancy and presumably acting as regulators of strategic hierarchical negotiations). That is, prompt maternal responsiveness to infants' distress cries (hunger or pain cries) is more likely to lead to reductions in crying bouts at later ages (a pattern that is inconsistent with learning theory predictions). At the same time, delayed responsiveness to infants' instrumental cries (e.g., cries associated with socially directed signalling activity such as looking or pointing) is more likely to lead to reduced crying bouts at later ages (consistent with the tenets of learning theory).

As an additional indication of domain specificity, the types of social responses that are preferred (and maximally influential) in achieving attachment goals are specific to this interaction domain. For example, certain patterns of vocal prosody (baby talk, or "infant direct speech") serve to comfort an infant experiencing distress (see, e.g., M. Papousek & Papousek, 1990). These same vocalizations may be triggered by those who show other cues to helplessness or dependency, for example, the elderly (see, e.g., Caporael, Lukaszewski, & Culbertson, 1983). However, this speech style may have negative consequences for these recipients (reductions in perceived competence).

Summary. The attachment system is instantiated and regulated in ways that are somewhat analogous to certain kinds of addiction processes (Panksepp et al., 1985). Responses to relevant stimuli are acquired rapidly, produce pharmacologically induced state benefits, and are resistant to the effects of domain-irrelevant reinforcement. Specific to this domain is the involvement of a particular pattern of neurohormonal regulators and a family of social-emotional regulators.

Coalitional Group Domain

What is the central problem to be solved within the coalitional group domain? At the most basic level, the problems to be solved within the group domain involve the facilitation of mutual defense and acquisition/protection of resources through coalitional activity (Tooby & DeVore, 1987). Influences within coalitional groups include maximization of shared benefits within the group relative to those outside the group. Those outside the group are excluded from sharing in available benefits. In addition, isolated individuals do not benefit from shared defensive activity or resource-generating activities associated with groups. From an evolutionary standpoint, group processes may be thought of as central for survival in the environment of evolutionary adaptedness.

In general, coalitional group processes are activated in response to external threats to the group or competition for scarce resources (LeVine & Campbell, 1971; Sherif, Harvey, White, Hood, & Sherif, 1954). At an individual level, it has also been suggested that threats to mortality trigger terror—which, in turn, is reduced by increased investment in coalitional processes and support of coalitional values (Greenberg et al., 1990). That is, as mortality increases in salience, derogation of and aggression towards outgroup members and in-group favoritism increase (McGregor et al., 1998). As a familiar example, one may think of increases in patriotism during wartime.

In general, coalitional motives and sensitivity to coalitional cues appear to be stronger in males than females. For example, the Premacks (Premack & Premack, 1994) suggested that boys are more sensitive than girls to group-based distinctions—a speculation that is confirmed in the empirical work of Yee and Brown (1992). Across cultures, boys are more likely to show a preference for group interactions than are girls (Thorne & Luria, 1986). Although the preponderance of observations of such distinctions has been concerned with middle childhood, subtle preference differences emerge among children as young as 3 and 4 years of age. For example, Benenson (1993) demonstrated that boys showed greater enjoyment of a puppet show (i.e., they smiled and looked more) during performances that involved groups (of puppet characters) than during performances that involved dyads (two puppet characters); in contrast, girls enjoyed depictions of dyadic interactions more than group interactions.

What information is sought within the coalitional group domain? The coalitional group domain shares with the attachment domain a focus on identity processes. However, in the case of the group domain, the focus is on the social categories rather than the unique identity of particular individuals. One's own social identity is jointly established by one's similarity to some and differences from others on socially important dimensions. The definition of who "we" are is based on differences from some other social grouping (LeVine & Campbell, 1971; Tajfel, 1982).

As part of the sensitivity of neonates to faces, the young quickly come to identify the general facial features of their own species (Morton & Johnson, 1991) as well the specific features of caregivers. It is not until a few months later that infants first categorize humans into social groupings. By 2 to 3 months of age, they respond with greatest interest to those faces that have the most species-typical features (and that are culturally defined as attractive; Langlois et al., 1987). Even before birth, the young are

sensitive to the vocal productions of conspecifics in their environment; for example, among humans, heart rate declines are shown in response to human voices (Hepper et al., 1993). In short, there is a prepared sensitivity to visual and auditory information that aids identification of species-typical features and systematic grouping variables within the species. Premack and Premack (1994) have suggested that awareness of the properties of groups emerges (during late infancy) as a "primitive" perceptual capacity (as supported by the tendency to bring similar objects together by 10 months of age; Sugarman, 1983). However, if infants are shown that physically dissimilar objects move together with each other, these objects are subsequently interpreted as a group. From this perspective, the awareness of intragroup and intergroup properties may be present as a basic perceptual capacity.

Although the young show an early perceptual sensitivity to grouping distinctions that are universally shared (e.g., age, gender), they show a more slowly emerging response to arbitrary grouping distinctions (e.g., race/ethnicity). Thus, the child first learns to identify racial/ethnic groups by verbal labels and associated affect rather than perceptual features (Hirschfeld, 1996). It is not until later that in-group preference is also associated with active segregation and out-group derogation processes. Hirschfeld (1996) argued that children have an early capacity to conceptualize notions of like kind versus unlike kind before they are fully aware of the relevant perceptual distinctions and before they act on the basis of that awareness. He suggested that

> Race is part of the child's expanding social ontology; it is an early step in cataloging and discovering the relevance of human groups. . . . Children do not find races because they are there to be found. They find races because they are following an impulse to categorize the sorts of things there are in the social world. (p. 345)

What are the timing features for activation of the coalitional group domain? The basic capabilities that are needed for the activation and calibration of the group domain may be thought of as coming on-line in steps (in a manner that is coordinated with brain development and development of neurohormonal regulatory systems). In the first few months of life—with early development of the perceptual system and the brain—infants reveal their emerging capacity to categorize social stimuli into meaningful groupings. This process begins with the ability of infants (by 5 months of age) to recognize basic socially significant categorical differences between people (gender and age; Fagan & Singer, 1979).

Very young children show a particular receptivity to the rules of group life (Emde, Biringen, Clyman, & Oppenheim, 1991). That is, they are willing collaborators in the acquisition of the routines and practices of those in their close environment. The acquisition of group rules does not occur in response to external reinforcement and appears to represent an early form of internalization. From 2 to 4 years of age, children are more likely to display ritualistic and repetitive behavior (D. W. Evans et al., 1997), along with a focus on exact enactment of conventional routines ("getting it right"; Emde et al., 1991). Good-night rituals, dressing routines, eating patterns, et cetera must all be accomplished in a highly specific and uniform way. Such ritualistic behaviors are more common at this age than they are at either younger or older ages.

However (as noted above), it is not until middle childhood that children show consistent in-group preference and out-group exclusion in their actions (see, e.g., Hirschfeld, 1996; Thorne & Luria,

1986). In middle childhood, children also show increasing sensitivity to the triggers to group processes. For example, thoughts of death make children generally anxious at younger ages, but they do not lead to increasing in-group favoritism and out-group derogation until late in middle childhood (Florian & Mikulincer, 1998). At the same time, children also show increasing flexibility in their use of coalitional information; for example, they show an increasing ability to understand that there are individual differences within racial groupings (Doyle & Aboud, 1995). It is also during this same period that children show striking increases in social comparison processes (Rholes, Newman, & Ruble, 1988), along with emergent ability to make use of minimal cues in distinguishing in-groups and out-groups (Sherif et al., 1954). The timing of these changes also co-occurs with increases in the maturation of the frontal cortex (Stauder, Molenaar, & Van der Molen, 1993)—increases that facilitate information integration ability.

What are the neurohormonal regulators of the coalitional group domain? The coalitional domain appears to share with the attachment domain regulatory processes that involve the opioid system (as suggested by Panksepp and his colleagues; e.g., Panksepp et al., 1985). The administration of naloxone (an opioid antagonist) to juvenile macaques was found to increase their overall level of motivation for social contact with group companions (as well as with their mothers; Schino & Troisi, 1992). This included not only grooming solicitations but also time spent in passive contact with companions; at the same time, it led to decreases in provision of grooming and social play (reciprocity-based processes). The combined pattern suggests an enhancement of proximity motivation rather than reciprocity motivation. The coalitional domain also shares with the hierarchical power domain regulatory processes involving testosterone. That is, group wins and losses (even when experienced vicariously) are followed by increases and decreases in levels of testosterone (Bernhardt, Dabbs, Fielden, & Lutter, 1998).

How is the coalitional group domain regulated in terms of social-emotional responses? Regulation of interaction within the group domain is organized around the preference for those who are similar on important dimensions, combined with hostility to and derogation of those outside the group. Within groups, shared norms serve to facilitate the smooth, coordinated flow of group-level activities.

Early responses to groups are also revealed through emotional reactions—positive affect to the in-group, negative affect or schadenfreude (joy in response to the suffering of others) to the out-group, and fear in response to group exclusion. One of the earliest indications of differential affective responses based on similarity (a basic regulator of the group domain) has been observed in monozygotic (MZ) twins during the second year of life (Zahn-Waxler, Robinson, & Emde, 1992). In general, MZ twins have been found to act as a more cooperative unit than do dizygotic (DZ) twins (Segal, 1984). Thus, it is interesting to note that the more empathy and prosocial activity MZ twins directed to each other, the less empathy and prosocial activity they directed to those outside the twinship. In contrast, a positive correlation between such activities was observed for DZ twins. The differential responses shown by MZ twins might be thought of as providing a very early example of the opposed reactions to "us" versus "them," that is, the extent to which positive reactions to own group are associated with negative reactions to those outside that grouping.

At the same time, there is emerging evidence to suggest that in-group preferences and positivity sequentially precede out-group exclusion and hostility (Brewer, in press). Further research is needed to determine the developmental course and conditionality of these two aspects of group processes.

Those individuals who fail to conform to group conventions or standards of similarity (e.g., conventional appearance or behavior) or who fail to experience anxiety in response to potential group exclusion may experience less reproductive success than those who are more responsive to group mandates (Baumeister & Tice, 1990; Caporael & Brewer, 1991). At a more immediate level, this process is reflected in the higher levels of self-esteem (see, e.g., Phinney, Cantu, & Kurtz, 1997) and group acceptance of children who are strongly invested in the coalitional domain, for example, children who maintain group segregation barriers (Bigler, Jones, & Lobliner, 1997; Sroufe, Bennett, Englund, Urban, & Shulman, 1993). Among humans, it has been suggested that threat of group rejection is a near-universal elicitor of fear (Ellsworth, 1994).

Children also appear to show dramatically different empathic responses to in-group and out-group children. For example, witnessing the distress of another child (who is not defined in terms of group identity) may lead to empathy or assistance in a dyadic setting, but the same event may trigger aggression and derogation within a group setting if the other child is defined as a member of an out-group. For example, Thorne and Luria (1986) noted the escalating levels of contagious excitement when a group (of boys) directed physical or verbal aggression to a marginalized child—a process in which empathy for that child's distress is attenuated; indeed, they showed pleasure in response to the suffering of out-group others (schadenfreude). It appears, then, that the processes that occur within the group domain do not parallel those within other domains. In addition, such processes (e.g., gang activities) are relatively immune to the costs or benefits that may be provided by those in a position of hierarchical power outside the group (see, e.g., Sherman et al., 1998).

Summary. In summary, group membership is typically defined in terms of positive evaluation of and preference for those who are similar and automatic devaluation of and negative action against outsiders—a process that has no counterpart within other domains (Brewer & Gardner, 1996; Premack & Premack, 1994). Processes that govern group relations focus on conformity (similarity maintenance) within the group and exclusion of outsiders (barrier maintenance)—processes that do not serve as regulators of other domains.

Mating Domain

What are the central problems to be solved within the mating domain? Among humans, the central problems to be solved within the mating domain are optimal selection, retention and protection of access, and bonding in the service of care of shared offspring (Kenrick & Trost, 1997). There are both overlaps and differences between the sexes in the selection criteria and types of retention and protective activities. It has traditionally been proposed that males maximize their reproductive success by investing their efforts in establishing paternity certainty with one mate while also maintaining simultaneous access to other potential mates; females, on the other hand, are understood as maximizing their reproductive success by investing efforts in pair-bonding with a

male who reliably provides the resources needed for optimal caregiving (Buss, 1995; Kenrick & Trost, 1997).

The evidence for such distinctions suggests cross-culturally consistent but relatively weak gender biases (see, e.g., Hatfield & Sprecher, 1995; Sprecher, Sullivan, & Hatfield, 1994). For example, males are somewhat more influenced by facial attractiveness than are females (Feingold, 1990). At the same time, both males and females are strongly influenced by the facial attractiveness of prospective partners (Sprecher et al., 1994). It has been suggested that facial attractiveness in humans serves as a predictor of parasite resistance (see, e.g., Thornhill & Gangestad, 1993); however, the extent to which facial cues predict health is still subject to debate (see, e.g., Kalick, Zebrowitz, Langlois, & Johnson, 1998).

It has also been noted that females are more influenced by matched preferences than are males (see, e.g., Surra & Longstreth, 1990); as is noted later, preference matching serves as a potential basis for reciprocal relationships (and thus, the possibility of merging mating and reciprocal domains). In addition, women show greater romantic attraction than do men to prospective partners who demonstrate good quality of communication (Sprecher & Duck, 1994), a feature that is generally more important for friendship attraction than for romantic attraction. At the same time, both males and females are strongly influenced by cues (e.g., prosocial tendencies) to the probability of parental investment (Graziano, Jensen-Campbell, Todd, & Finch, 1997).

In this article, the focus is on the ways in which the algorithms of social life are acquired by the young. Therefore, relatively greater attention is given to the ways in which the young are prepared for mate selection in later years. Only a brief summary is offered of adult processes. In addition, the focus here is on the most basic, universally observed processes; variations are discussed in later sections.

What information is sought within the mating domain?   Value setting of two kinds is involved in the mating domain. The first involves the features that are used in establishing mate value, that is, the selection criteria that are used in selecting prospective mates. As noted above, males and females show a great deal of overlap in the values they use in evaluating mate potential; at the same time, they often show differences. For example, males may be more attracted to cues to youth and fertility whereas females may be more typically attracted to cues to hierarchical power and dominance (Buss, 1995). To the extent the cues used in social relationships reflect evolutionary factors, they are anchored in the ancestral past. Thus, it is not surprising to find that cues to males' current status or power (rooted in contemporary definitions) are poorly related to their reproductive success (Perusse, 1993). Instead, young males have been found to have more mating opportunities when they have "dominant-looking" faces (e.g., prominent brow and chin; Mazur, Halpern, & Udry, 1994). These facial characteristics have been found to be predictive of higher testosterone levels (Dabbs, 1997) and thus represent cues that may have been adaptive in the evolutionary past (because of the probable association between testosterone and immunocompetence). As pointed out by Graziano et al. (1997), female attraction to male dominance cues (unlike attraction to male prosocial tendencies) appears to occur at an automatic, unaware level.

The mating domain shares with the group domain a focus on kin recognition (pragmatically operationalized on the basis of familiarity; Westermarck, 1922). In the mating domain, however, the identification of kin serves to prevent rather than instantiate association. That is, incest aversions prevent mating patterns that would increase susceptibility to the expression of harmful recessives in the shared gene pool or the harmful effects of pathogens (because of the similarity of the microenvironments of kin and thus the capability of pathogens to evade their shared immune systems; Tooby, 1982). As a result, the young need to acquire and store information about others that will provide useful markers at a later age concerning their kinship status. Although the reproductive advantages that follow from incest aversion are based on veridical kinship, the markers used for kin are probabilistic in nature. In the evolutionary past, those individuals with whom one was most familiar in early childhood were very likely to be kin. Thus, familiarity served as a reliable index of kinship. As a result, incest aversion may make use of familiarity as a cue to relatedness (Westermarck, 1922). Hence, there is a natural aversion towards sexual relations among those who have been closely associated in childhood. A compelling instance of such processes involves the virtual absence of marriage between children raised together in a kibbutz. Despite the absence of any formal or informal prohibitions of such pairings, children raised together fail to show an interest in becoming romantic partners (Shepher, 1983).

In general, mating occurs between those who are matched in "resources" (e.g., physical attractiveness; Murstein, 1972). However, couples are often matched in complex ways (as pointed out by Sprecher, 1998). Thus, a woman's physical attractiveness may be balanced against the resource-holding potential of a man. Such matching processes appear to be an outcome of the mating selection process rather than serving as a desired goal (e.g., people are most attracted to those who are the most physically attractive, but successful pairing is likely to occur among those with matched resources). The extent to which couples are similar or matched has not been found to be a good predictor of relationship stability when other variables are controlled (as concluded by Sprecher, 1998).

What are the timing features for activation and regulation of the mating domain?   Initial response to cues to mate selection (e.g., attractiveness features) begins in the first few months of life (Langlois et al., 1987). However, direct indications of preferences based on these features emerge across the course of early childhood and continue to increase in middle childhood (e.g., Langlois & Styczynski, 1979).

Another timing issue in the mating domain concerns the instantiation of incest aversion. There is some evidence that close association with others in the first 4 to 6 years of life appears to establish sexual disinterest or aversion to those individuals in later years (Shepher, 1983; Wolf, 1995). Early contact appears to establish something akin to an imprinting process—a process that serves to prevent rather than foster future sexual relationships.

Among humans, paternity certainty is typically regulated by a generalized pattern of sexual jealousy (Buss & Schmitt, 1993). At lower phylogenetic levels, however, timing features are used in the establishment of paternity certainty. For example, certain strains of (male) mice who, under ordinary circumstances, would cannibalize the young, show a period of gentleness to the young that is synchronized with the probability that the young are theirs, that is, the period of gentleness emerges 18–20 days following copulation—the usual period of gestation (Perrigo, Bryant, & vom Saal, 1990).

Recent findings have suggested that the attractiveness of others may be subject to proximal timing factors. Penton-Voak et al. (1999) found that women are generally attracted to men with slightly feminine facial features but shift to become attracted to men with more masculine features when they are ovulating. Men's masculinized (computer-enhanced) faces are interpreted as more dominant, older, and more masculine; their feminized faces are interpreted as higher on "parental quality" (Perrett et al., 1998). Masculine features (because of their association with higher levels of testosterone) may signal immunocompetence. Thus, women's sensitivity to the reproductive potential of males may increase when they themselves are most likely to conceive; in contrast, their attraction to men who provide cues to parental investment potential is greater when the likelihood of conception is less. The combination suggests the possible reproductive advantages of a mixed sexual strategy among women.

What are the neurohormonal regulators of the mating domain? As might be expected, androgens and estrogens have been found to be associated with amount of mating activity. Among humans, eroticism appears to be influenced by adrenal testosterone among both males and females. For example, Cashdan (1995) found a positive relationship between number of sexual partners and levels of androgens and estradiol for young women. Among young males, higher levels of testosterone are associated with higher levels of copulatory activity (Sapolsky, 1991).

Elevations in oxytocin (influenced by reproductive hormones) are broadly influential on sexual as well as maternal and other positive social behaviors (Fisher, 1998; Pedersen, Caldwell, Jirikowski, & Insel, 1992). That is, association with romantic partners (e.g., reunion within attached dyads) appears to yield a neurohormonal payoff and is sometimes referred to as the *satisfaction hormone* (Caldwell, 1992). There have been some suggestions that the brain dopamine system and dopamine-like psychostimulants (e.g., phenethylamine) account for feelings associated with romantic infatuation (Liebowitz, 1983); however, hard evidence for this effect is still lacking.

At the same time, there are other hormonal processes that are linked to selection and motivational processes within the mating domain (Fisher, 1998). The attraction/selection process is associated with elevations in SAM activation (e.g., increased epinephrine; Fisher, 1998). For example, both males and females show heart rate increase in response to thoughts of a rival (Buss, Larsen, Westen, & Semmelroth, 1992). Thus, behavioral responses to rivals may be at least partially mediated by these physiological processes.

How is the mating domain regulated in terms of social-emotional responses? Universally observed processes in the social-emotional regulation of the mating domain include (a) courting and romantic "capture" during relationship initiation, (b) sexual jealousy as a means of protecting exclusive access to a mate, and (c) bonding in the service of long-term care of offspring. Courting includes both the display of attractive features and the signalling of sexual receptivity. Specific attention has often been given to jealousy-induced aggression during early periods within mating relationships (see, e.g., Wekerle & Wolfe, 1999; White & Koss, 1991). Bonding/adult attachment processes (and resultant relationship stability/satisfaction) have been found to show a high level of individual variation and are discussed later in terms of the cognitive organization of mating relationships.

Since the early observations of Darwin, there has been an awareness of the social signalling processes distinctively associated with mating. Social signalling of sexual receptivity during relationship initiation is typically reflected in flirtation routines. Receptive females have been found to display such invitational cues as head tilts and coy smiles, combined with body cues to interest/attentiveness; receptive males are more likely to combine invitational cues (e.g., smiles/laughs combined with flirtatious glances) with cues to social dominance (Simpson, Gangestad, & Nations, 1996). The positive emotion that is most uniquely associated with the mating domain is infatuation, or passionate love (Hatfield & Rapson, 1996). This emotional state is quite generally described as occurring suddenly and as having an uncontrollable, obsessive quality (Kelley, 1983); thus, the onset of infatuation may be thought of as occurring in response to being emotionally and cognitively captured by the object of one's attraction (Lyon & Bugental, 1994). Companionate love (a less distinctive emotion) is associated with the enduring and shared bonds of mating.

The most domain-specific negative emotion is sexual jealousy. Although sexual jealousy has no necessary connection with aggression (Barnett, Martinez, & Bluestein, 1995), it provides the primary reason for violence in mating relationships (see, e.g., Brisson, 1983; Daly & Wilson, 1988). Approximately one third of both men and women have been found to both inflict and receive some form of physical aggression during courtship relationships (White & Koss, 1991); in addition, resultant fatality rates are equivalent across the sexes (Van Hasselt, Morrison, Bellack, & Hersen, 1988). Physical evidence of battery-consistent injuries to women (facial injury) has been found across cultures and time (as assessed from bone records; Walker, in press).

Summary. In summary, the mating domain is described as distinctively organized to optimize reproductive outcomes in selecting and protecting access to sexual partners and providing for the shared care of offspring. There is evidence for both overlaps and differences across sexes within such processes. At a neurohormonal level, the mating domain makes use of a variety of systems in solving the complex problems within this domain.

Reciprocity Domain

What is the central problem to be solved within the reciprocity domain? Reciprocity-based interactions serve the function of facilitating coordinated, matched, mutually beneficial action processes between related or unrelated individuals (Caporael, Dawes, Orbell, & Van de Kragt, 1989; Hoffman, 1981; Rowell, Wilson, & Cords, 1991). Reciprocity is defined here in terms of the provision of equivalent benefits (including affective benefits) over a period of time between functional equals. Social reciprocity has been repeatedly observed as an organizer of primate interaction (de Waal, 1992; Silk, 1992) and is occasionally seen as an organizer of interactions in lower species (Wilkinson, 1988). Primates show regular evidence of mechanisms that involve keeping track of past benefits provided by others and reciprocating those benefits at a later time. Reciprocity extends past simple in-kind exchanges and is reflected in an elaborate cost-benefit accounting that transcends specific behavioral currencies or contexts (Silk, 1992). Among humans, social exchange processes are more typically described as involving short-term accounting processes, whereas long-term accounting processes (generalized notions of reciprocal obligation)

are more typical of enduring partnerships. Such long-term accounting processes are more common among friends or siblings than between acquaintances (Knight & Chao, 1991).

Early experience with reciprocal relationships includes the relationship between parents and children. Although reciprocal interactions are typically more common among peers, parents may set aside their usual authority role to engage in reciprocal activities such as play (see, e.g., Fogel, 1993). When this happens, the nature of the interaction may change dramatically. For example, play interactions tend to presume equality and thus are not used as situations for enforcing compliance. When the relationship between parents and children is temporarily framed as symmetrical, their interactions may be thought of as characterized by equal levels of mutual fate control or mutual behavior control (Kelley, 1979; Kelley et al., 1983).

A distinction has been made in the developmental literature between the problems solved within the reciprocity domain as opposed to those solved within the group domain. A specific concern has been with the distinctions between reciprocated friendship and peer acceptance—a process that is more consistent with the group domain (Bukowski & Hoza, 1989). Friendships are strongly characterized by the provision of such benefits as mutual validation and shared self-disclosure (Asher & Coie, 1990; Berndt & Ladd, 1989; Bukowski, Newcomb, & Hartup, 1996; Fehr, 1996). Peer acceptance, on the other hand, reflects the child's positive involvement in group-level activities and sense of belongingness within the group (Furman & Robbins, 1985; Ladd, Kochenderfer, & Coleman, 1997). Although there is some low level of empirical overlap between these domains, there is a very high level of unshared variance (see, e.g., Ladd et al., 1997).

What information is sought within the reciprocity domain? Reciprocal interactions require a long-term accounting of the relative costs and benefits that have been provided by both parties (or an actuarial prediction of the probable benefits that might be obtained in the future). Thus, the computational structure of the algorithm has an interval nature (A. P. Fiske, 1992) and involves the balancing of benefits.

Evidence for the specificity of computational processes within this domain comes from the work of Cosmides and Tooby (1992). These investigators empirically tested the hypothesis that the human mind is designed to keep track of the reciprocal provision of benefits within social interactions and to detect violations of those implicit contracts ("cheater detection"). They demonstrated that humans easily solve complex logical problems (e.g., those involved in the Wason task) when they are framed as social contracts in which an individual must pay some cost or incur some obligation in order to receive a benefit. Identical problems—lacking the reciprocity implications—pose higher levels of difficulty. As an indication of the specificity of these processes, priming individuals for reciprocity problems does not facilitate their ability to solve precautionary problems (a primary concern within the attachment domain; Fiddick, 1998).

Although little test has been made of the operation of such sensitivities in children, there is indirect evidence that even young children engage in implicit contracts of this type. For example, a key point of contention in the friendship of young children involves conflict driven by accusations of failure to share, failure to help, failure to acknowledge each other's accomplishments, or failure to provide support in a dispute with others (Rizzo &

Corsaro, 1988). In other words, conflicts often revolve around violation of reciprocity rules.

Finally, information may be sought regarding future reciprocity. It has often been noted that long-term close relationships seem to operate in the absence of documented reciprocity. This has led to speculations as to how such relationships could indeed have evolved, that is, in what way could the selfless provision of benefits to nonkin serve as an adaptation? Tooby and Cosmides (1996) have proposed a way of accounting for this apparent paradox. They have suggested that relationships are initially established on the basis of their "investment potential." Individuals invest in relationships that provide cues to the possibility of potential benefits at some later time. Thus, people seek continued interactions with those who have some unique potential benefits to offer (e.g., they may share specialized interests), who provide cues to their interest in continued contact and thus may be available to provide benefits (e.g., they return phone calls and initiate calls), who provide cues to their general reliability and trustworthiness (e.g., they keep their word), and for whom they have some unique, potential benefits to offer in return (e.g., holding a respected position in some shared community). Evidence regarding children's formation of friendship strongly supports the importance of similarity of preferences (Kupersmidt, DeRosier, & Patterson, 1995), along with cues to reciprocity and trustworthiness (Youniss, 1986).

What are the timing features for activation of the reciprocity domain? Early in life, reciprocal processes between mothers and infants appear to be universal. Adamson and Bakeman (1991) have documented the ways in which infants accommodate to and shape their early social environments first through social alertness, then through interpersonal engagement, and finally through joint object involvement. With the development of relevant perceptual and neural systems, capacities for shared involvement with and shared representation of the social world become apparent. In summarizing the literature, Adamson and Bakeman concluded that "these studies indicate that when face-to-face interaction or object-focused play occurs, mothers and infants from different cultures all mutually regulate their attention and affect and negotiate shared intentions, and all follow the same developmental progression" (p. 33). Central to the proposed continuity between early mutuality and social reciprocity is the sequenced exchange of positive affect.

Mutuality also emerges early in vocal activity. At around 3 to 4 months of age (a period of rapid increase in cortical development), infants engage in vocal dialogues that not only involve coaction but also involve turn-taking exchanges (see, e.g., Beebe, Alson, Jaffe, Feldstein, & Crowne, 1988; M. Papousek & Papousek, 1989; P. Papousek, 1995). Such exchanges are regularly associated with positive affect. The importance of timing (and stage of neural development) for calibration processes is indicated by deficits in the dialogic abilities of preterm infants. That is, preterm infants are less able than full-term infants to establish coherencies in their affective involvement with their mothers (Lester, Hoffman, & Brazelton, 1985).

What are the neurohormonal regulators of the reciprocity domain? At the current state of knowledge, evidence regarding the neurohormonal regulation of the exchange domain is only suggestive. In general, a link has been found between elevated levels of serotonin and higher levels of affiliative behavior and reduced negative affect/aggression; conversely, reduced levels of serotonin

have been linked to increases in negative affect/aggression and decreases in sociality (Kaplan et al., 1997; Knutson et al., 1998). In nonhuman primates, elevated levels of serotonin are also associated with grooming activity, a central regulator of reciprocal interactions (Mehlman et al., 1995). Among juvenile rats, serotonin depletion leads to qualitative changes in the nature of social play activities. With serotonin depletion, behavioral asymmetries within play bouts increase; as reciprocity decreases, the nature of play activities becomes more agonistic (Knutson & Panksepp, 1997). Conversely, serotonin augmentation leads to reductions in play asymmetries (and a more reciprocal interaction style; Knutson, Panksepp, & Pruitt, 1996). Among normal adult humans, administration of a selective serotonin reuptake inhibitor has been found to lead to increases in affiliative behavior on a cooperative puzzle task (Knutson et al., 1998).

How is the reciprocity domain regulated in terms of social-emotional responses? The reciprocity domain involves the management of costs and benefits between functional equals. As suggested by Trevarthen (1988), "humans are born with a self-regulating strategy for getting knowledge by human negotiation and cooperation" (p. 39). That is, they come with a tool kit that sets them up for easy acquisition of the skills of mutual regulation and coordinated actions with others. Trevarthen has referred to such sensitivities as involving an innate capacity for intersubjectivity. Such capacities involve sensitivity to mutuality of social responses, for example, gaze, voice, touch, and affective signals.

Much of the positive, playful interaction between parents and infants involves imitation routines and reciprocity-based games such as peek-a-boo (see, e.g., Parrott & Gleitman, 1989). Reciprocal processes may also be regulated by affect matching (Stack & Muir, 1992). Even unrelated adults who imitate toddlers have been found to be more likely to foster imitative responses and positive social engagement with those children (Eckerman & Stein, 1990). Such interactions should be distinguished from rough and tumble play in that they operate primarily in the service of establishing reciprocity rather than hierarchical dominance.

Parpal and Maccoby (1985) have provided empirical evidence supporting the differences in parent–child interactions during authority-based (i.e., hierarchical) interaction versus reciprocity-based interaction. They observed that mothers who engaged in their usual interaction style (including control efforts) were much less successful in eliciting cooperative behavior from their children than were mothers who were instructed to establish a more equalitarian interaction in initial play. This suggests that reciprocal processes are regulated by different processes than are authority-based ones. Parpal and Maccoby proposed that shared positive affect (rather than verbal reinforcement) may act to regulate such interactions.

As toddlers, children demonstrate nonverbal imitation as a key regulator of positive interactions with their peers (Eckerman, Davis, & Didow, 1989). Reciprocity has even been found to have positive consequences in the "interactions" between two-year-olds and toy robots, that is, verbal dialogues were more likely to be fostered in interaction with reciprocating robots than nonreciprocating robots (Dunham, Dunham, Tran, & Akhtar, 1991). Such interactions may be thought of either as an early type of social contract or as information that reveals their social investment potential. Even adults appear to establish implicit social contracts with inanimate objects—in particular when those objects (e.g.,

computers) have humanlike features such as vocal production or the display of an animated face (Kiesler, Sproull, & Waters, 1996). Participants in a prisoner's dilemma game behaved in very similar ways with both human and computer partners. They typically proposed cooperation (and kept their promises) with either human or computer partners that engaged in advance discussion (shared promise-making) but were less likely to cooperate (or keep promises) with partners who did not engage in advance discussion. Thus, even the simple framing of a task in social exchange terms fosters features of reciprocal relationships.

Implicit violations of a social contract have clear repercussions for the relationship. Across cultures, such violations foster negative affect (see, e.g., Stipek, Weiner, & Li, 1989). They also activate repair motives, including efforts to obtain an apology from the offender, avoidance of the offender, or forgiveness of the offender (see, e.g., McCullough et al., 1998). Even in infancy, children of depressed mothers (who fail to reciprocate positive affect) show reductions in their positive initiations or engagement with that parent (Bettes, 1988; Field, Healy, Goldstein, & Guthertz, 1990; Zlochower & Cohn, 1996).

The distinctiveness of the reciprocity domain is suggested by the specificity of the means used to resolve conflicts. Conflicts in peer groups (e.g., classmates) or within sibling or parent–child interactions (hierarchical power domain) are often solved through coercion and submission (Laursen, Hartup, & Koplas, 1996)—tactics that are uncommon within reciprocal relationships. Those who operate as reciprocal peers are more likely to make use of compromise, negotiation, and constructive explanation. Similar distinctions were found by Fabes, Eisenberg, Smith, and Murphy (1996) in children's conflict resolution strategies with well-liked peers versus peers who were not well liked.

Summary. In summary, there is emerging evidence to suggest that the reciprocity domain involves the long-term prediction and accounting of the equality of benefits provided (including affective benefits) and received within dyadic interactions. When one member of the partnership fails to reciprocate positive benefits, the other member is likely to experience negative affect and to engage in efforts to repair the violation. Neurohormonal regulatory processes, in turn, may involve pharmacological agents that foster affiliation.

Hierarchical Power Domain

What is the central problem to be solved within the hierarchical power domain? Hierarchical relationships involve the management of interests between individuals with unequal control, resources, or resource-holding potential. Such interactions involve the provision (or possible provision) of benefits (e.g., protection, resources) or limitation of costs (e.g., aggression) by the more dominant individual in return for the compliance or deference of the less dominant individual. As pointed out by Kelley and Thibaut (1978), interdependent relationships (even when they involve unequal resources) typically involve benefits to both parties. Unlike the use of dominance/force with out-group members or objects of prey (interactions that involve unilateral self-interest), hierarchical interactions involve the establishment of an optimal position of dominance rather than destruction of another individual; for example, hierarchical power struggles are often followed with peace-making activity (see, e.g., deWaal, 1989). Although the hierarchi-

cal power domain is often combined with other domains (e.g., the attachment domain, the exchange domain) to produce charismatic leaders, democratic leaders, authoritative parents, and so forth, the basic processes involved in hierarchical interactions involve the management of dominance interactions in ways that maximize the interests of the more dominant individual and limit harm to the less dominant individual. At times, parents, teachers, or (older) siblings—as well as more powerful peers—are regulators of social hierarchies (see, e.g., Brody, Stoneman, & MacKinnon, 1982).

Competencies acquired within the hierarchical power domain may be thought of as preparing the young for the negotiation of interests within future hierarchical interactions. In their early negotiations with parents (or others in authority), children learn how to strategically negotiate benefits and escape harm from those who are in control of resources and outcomes (La Freniere & Charlesworth, 1983). At the same time, they learn the complementary role of negotiating compliance from others when they themselves come to have a dominance or resource advantage.

Recently, there has been an increased appreciation of the adaptive significance of the negotiation of disagreements between parents and children, as well as between peers. Disagreements between those of unequal dominance offer opportunities for the development of negotiation skills (Kuczynski & Kochanska, 1990; Kuczynski, Kochanska, Radke-Yarrow, & Girnius-Brown, 1987). The functionality of such processes is suggested both by the positive consequences that follow from adaptive use of negotiation and by the maladaptive consequences that follow from deficits in negotiating hierarchical interactions. As pointed out by Kuczynski, Kochanska, Radke-Yarrow, and Girnius-Brown (1987), "Particularly important from a social skill perspective are active, indirect forms of resistance: children's attempts to negotiate with, bargain with, or persuade parents to modify their demands" (p. 800).

Although the regulation of social hierarchies is important in the lives of both males and females, its role as an organizer of peer interactions predominates in males. Beginning in early childhood, hierarchical struggles are more common among boys than girls (Maccoby, 1988). For example, rough and tumble play represents a common venue for the establishment of dominance hierarchies among young males (Panksepp, 1993; Pellegrini & Smith; 1998; Symons, 1978).

What information is sought within the hierarchical power domain? By definition, the hierarchical domain is asymmetrical in nature. That is, one individual has (or seeks) a higher level of control and greater options than the other individual. Correspondingly, the basic computation that is involved in the social hierarchy algorithm is ordinal in nature (A. P. Fiske, 1992). The basic concern is with relative levels of dominance. As such, it involves the assessment of the resource-holding potential (RHP; Parker & Rubenstein, 1981) of self and others; the notion of RHP has the advantage of subsuming physical dominance capability as well as access to desired objects and events. Such assessments allow the individual to adaptively judge the utility of a dominant or a submissive strategy within interactions that involve competition for resources or control (Price, Sloman, Gardner, Gilbert, & Rohde, 1994).

Unlike the reciprocity domain (in which continuous, mutual monitoring and correction are used as a means of accomplishing interdependent goals), individual monitoring of others within hierarchical interactions is a stronger requirement for those with lesser hierarchical power (S. T. Fiske, 1993). Whereas those in a

position of higher power can act to control their own outcomes (and thus need not attend to others), those in a position of lower power are best able to protect their own interests by carefully monitoring those in a position of higher power.

What are the timing features for activation of the hierarchical power domain? Nonhuman animals have been found to be sensitive to cues to social dominance (from conspecifics) even before they are sensitive to cues to the presence of predators (Cheney & Seyfarth, 1985). However, the onset of sensitivity to dominance cues emerges across the course of the first year of life for human infants. For example, infants do not appear to be able to understand punishment routines until they are a little older (see, e.g., Gralinski & Kopp, 1993).

There is evidence that sex differences in behavioral involvement in hierarchical activity may be set late during gestation and for a short time period following birth (Breedlove, 1992; Mazur & Booth, 1996). Although still subject to debate for humans, there are indications that early hormonal differences may organize the architecture of the brain in ways that are manifested behaviorally at later ages. For example, greater exposure to testosterone prenatally (as a function of endogenous testicular secretions for males or the introduction of exogenous androgens for females) has been found to foster play styles more common for boys (e.g., rough and tumble play). Rough and tumble play (important in establishing hierarchical interactions among males) appears to follow a well-defined activation clock across species. The activation course reflects an inverted U function in which rough and tumble play activity increases and then declines late in middle childhood (Panksepp, 1993).

In early adolescence, hierarchical power struggles come to the fore in parent–offspring interactions. The increased challenges (as reflected in antisocial behavior) posed during adolescence are universal and striking in their level of intensity (Moffitt, 1993). Across these years, there is an increasing level of conflict and distance between parents and adolescents (W. A. Collins & Russell, 1991; Fuligni & Eccles, 1993). The changing nature of hierarchical interactions is at least partially under the control of changing androgen levels of the young—changes that occur for both sexes but are more pronounced among boys. A number of researchers (Inoff-Germain et al., 1988; Moffitt, 1993; Susman et al., 1987; Udry & Talbert, 1988) have observed that increases in antisocial behavior (e.g., resistance to adult authority) are associated with increases in testosterone, even when visible signs of stage of puberty are held constant.[3] In addition, the time course shown in the prevalence of rough and tumble play (declines in middle childhood) are associated with increases in testosterone (Panksepp, 1993), suggesting that testosterone may serve to turn off early types of playful hierarchical struggles at the point that

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[3] The evidence of such relationships is complex. For example, Schaal, Tremblay, Soussignan, and Susman (1996) found that adolescent boys who were more socially dominant with strangers also showed higher levels of testosterone; however, boys who were typically both physically aggressive and unpopular with peers showed relatively low levels of testosterone. Discrepancies indicate the importance of giving separate consideration to prosocial versus antisocial uses of power, as well as to the relative success of power assertion attempts.

dominance encounters assume the possibility of more serious harm.

What are the neurohormonal regulators of the hierarchical power domain? Hierarchical interactions are also regulated by neurohormonal processes. Observations of the hormonal changes that occur among males during dominance struggles reveal a reciprocal pattern of influence. Testosterone levels are both a reflection of current hierarchical status and a facilitator of hierarchical power (e.g., intermale aggression; see, e.g., Dabbs, 1992). As testosterone rises, individuals are more likely to engage in competitive activity and thus increase their chances of rising within a dominance hierarchy; the experience of successful dominance (winning), in turn, serves to increase their levels of testosterone release still further. In contrast, loss of status within a dominance hierarchy has been associated with reductions in level of testosterone and elevated heart rate, along with general desynchronization of physiological rhythms (Miczek & Tornatzky, 1996; Sapolsky, 1991) and dysregulation of the HPA axis (see, e.g., Blanchard et al., 1998).

Among humans, the role of androgens (total testosterone, free testosterone, and androstenedione) as a regulator of hierarchical interactions applies to both males and females. For example, high levels of androgens are associated with more dominant self-ratings and social behaviors among adolescent and young adult women (see, e.g., Cashdan, 1995; Inoff-Germain et al., 1988). However, the higher levels of testosterone found for males (beginning prenatally) serve to influence the greater absolute level of male involvement in hierarchical activity.

How is the hierarchical power domain regulated in terms of social-emotional responses? The hierarchical power domain involves the appropriate regulation of behavior in response to the RHP of self versus others (Price et al., 1994). Dominant, escalating strategies (e.g., power assertion) are adaptive for those who have greatest control over resources, whereas submissive, de-escalating strategies (e.g., appeasement) are more adaptive for those who lack resources (Price et al., 1994).

The tactics used by parents are (normatively) consistent with children's activation clock for this domain. That is, physical punishment (a dominance-based tactic) is both uncommon (only 1.7% of U.S. mothers spank their infants; Straus & Gelles, 1988) and ineffective in infancy (e.g., spanking will not lead to a cessation of infant cries). In the later stages of infancy, caregiving adults first reveal controlling communication patterns through their use of vocal intonation (and associated facial expressions). For example, they demonstrate distinctive vocal patterns in their first use of prohibitions with infants (e.g., short, loud, staccato speech). These sound patterns, in turn, regularly elicit inhibitory responses from infants (Fernald, 1993; Fernald et al., 1989), even when spoken in an unfamiliar language. Similar response patterns have been observed in different cultural groupings (German, Italian, and Japanese), supporting the notion of universality in the significance and impact of dominance signals. This system also serves to facilitate the child's acquisition of sound–language associations in that prohibition sounds accompany words that signify prohibition ("No!"). This suggests the activation of an unlearned communication system that sets the stage for later manifestations of dominance within parent–child relationships.

The full manifestation of the hierarchical domain is not demonstrated until children start to walk. When children experience the greater autonomy associated with mobility, they also show increases in active resistance to adult control efforts. When children reach this major milestone—in particular, if they are early walkers—they experience clear changes in the nature of their interaction with parents (Biringen, Emde, Campos, & Appelbaum, 1995). With these changes, interactions more frequently involve a struggle for control (Kuczynski et al., 1987; Strayer & Trudel, 1984). During the second and third year, dominance struggles escalate (Emde et al., 1991).

When children become mobile, the primary short-term social regulation of hierarchical interactions involves the contingent management of the outcomes (or resources) of others—as controlled by the selective use of positive reinforcement, punishment, and frustrative nonreward. There is little question that such parental strategies facilitate short-term compliance (Baumrind, 1996; Larzelere, 1996a, 1996b). The domain specificity of such processes is indicated by the relative ineffectiveness of the use of reward and punishment in other domains. For example, the use of power assertive tactics (including use of concrete rewards) appears to be ineffective as a means of fostering empathy—a response that is associated with the attachment domain. That is, power assertive tactics by parents are ineffective regulators of children's concern for others (Eisenberg & Miller, 1990; Hastings & Grusec, 1998). In addition, the processes involved in power-based socialization also appear to be antithetical to those involved in reciprocity-based socialization (Kochanska, 1997).

The possession of a resource advantage (winning a contest, being accorded a position of power) is regularly associated with prideful affect—in particular, within more individualistic cultures (Mosquerra, Manstead, & Fischer, in press). In contrast, loss of position within a hierarchy is regularly associated with elevated levels of anxiety and fear-related responses—in particular, among males (Sapolsky, 1991).

Summary. In summary, the hierarchical domain is organized in the service of negotiating interactions between those who have (or seek) unequal control or resources. Computational processes focus on relative dominance and RHP cues, and regulation focuses on the use of strategies that maximize one's own position of control or that limit harm from a more dominant individual. The strategies used in managing hierarchical interactions are infrequently used (and are typically ineffective) in managing other types of interactions.

Variability in the Acquisition of Social Algorithms

Level 1: Bioecological Variability

The domains of social life, although showing a fairly high level of design specificity, are also open to variations and change as a function of the features of the environment. At the most basic level, such flexibility begins at the level of the brain. In most instances, plasticity at the level of the brain allows for easy adaptation to the range of environments that have occurred repeatedly across evolutionary history. In addition, the basic domains of social life come equipped with flexible response options—a concept described within evolutionary biology as involving *facultative polymorphism*. As noted by Markman (1992),

> Equipping an animal with redundant means of achieving the same outcome offers a greater likelihood of success because any single

mechanism has some probability of failing. Several mechanisms can work together to achieve a given end as when motivational, attentional, and learning abilities converge on a given solution. Alternatively, some mechanisms can serve as backup when dominant means fail. (p. 90)

At a more commonsense level, facultative polymorphism reflects versatility in biological design, that is, the alternative means that are available for solving recurrent problems of adaptation. The combined concepts of neurogenesis (new growth in the central nervous system) and facultative polymorphism are captured with the notion of *allostasis* ("the ability to achieve stability through change"; McEwen, 1998).

At the same time, flexibility is not infinite. Maladaptive changes may occur in response to experience—presumably, when contemporary experience lies outside the range of recurrent events within human evolutionary history. If environmental demands exceed the response options available or that may be acquired, the adaptive range of potential coping mechanisms is exceeded. In addition, if environmental demands are continuous, the unrelenting activation of response systems may exceed the organism's capacity. Such processes have been described as involving *allostatic load*, that is, the destructive wear and tear on adaptive systems as a function of their chronic overactivation (McEwen, 1998).

Early stressors begin during the prenatal period. For example, extreme prenatal stress of mothers may have a continuing effect on the hormonal levels of the young across the course of development (see, e.g., A. S. Clark, Wittwer, Abbott, & Schneider, 1994; Schneider, 1992; Vallee, Mayo, Dellu, & Le Moal, 1997; Wadhwa, Dunkel-Schetter, Chicz-Demet, Porto, & Sandman, 1996). In response to extreme postnatal events such as early abuse, wartime conditions, or institutionalization, there may be interference with usual brain development (see, e.g., Francis et al., 1996; Ginsberg, Hof, McKinney, & Morrison, 1993; Gunnar, Schuder, Morison, Ames, & Fisher, 1999; Perry, 1994; Rots et al., 1995; Siegel et al., 1993; Suchecki, Mozaffrian, Gross, Rosenfeld, & Levine, 1993). Such extreme experiences may act to set the endocrine system in maladaptive ways (Carlson & Earls, 1993; Granger, Weisz, & Kauneckis, 1994; Gunnar et al., 1999; Putnam & Trickett, 1997; Teicher et al., 1997). Children who have been maltreated have been found to manifest different patterns of HPA activity from those of nonmaltreated children (Bugental, 1999; Hart, Gunnar, & Cicchetti, 1996). Even children who have experienced lesser levels of stress (e.g., father absence) may show aberrations in the functioning of the HPA axis (Flinn, Quinlan, Decker, Turner, & England, 1996). The continuous bombardmemt of the hippocampus with stress-induced cortisol acts to limit dendritic branching and reduces the capacity of neurons to recover from neurological insult—a process that ultimately fosters such negative outcomes as impaired learning and memory (Bremner & Narayan, 1998). Unsurprisingly, the damaging effects of trauma on brain development have been found to be greater at younger than at older ages (Bremner & Narayan, 1998; Gunnar, in press).

Flexibility within the attachment domain. Attachment processes begin very early in life. As a result, such processes provide good exemplars of initial accommodation to different ecologies. As the simplest example of adaptive flexibility, infants and caregivers are equipped with alternative means of maintaining proximity. Such flexibility allows for varying possibilities in the prob-

able caregiving arrangements that may be necessities within different environments. For instance, just as one may negotiate through space as a function of visual, auditory, or tactual information, proximity-seeking within attachment relationships may be accomplished by visual, auditory, or tactual means. Within Western cultures, it is typical for mothers and infants to maintain high levels of visual engagement. However, in other cultural settings (e.g., the Gusii of Kenya), prolonged gaze is rare (LeVine, 1990; LeVine & LeVine, 1988; Tronick, 1989). Within such cultures, mothers are likely to maintain close contact by other means; for example, mothers may hold their infants more than do Western mothers. Even within Western cultures, touch and gaze appear to act in a compensatory fashion (see, e.g., Stack & Muir, 1992). In short, the attachment task of proximity-maintenance is shared across cultures (and individuals) but the means of implementation vary.

However, when children's social environment falls outside some normative range (i.e., environments not present in human evolutionary history), they may fail to acquire needed social skills. For example, children who experience trauma as a result of maltreatment (e.g., extreme physical abuse) may fail to establish any regular means of solving the problems of the attachment domain; as a result they show major problems in their later social behavior (Lyons-Ruth, Alpern, & Repacholi, 1993). Although infanticide has been present across human evolutionary history, there is emerging evidence that injury-producing physical abuse of older children may be of more recent origins. Bone records from recent burial sites (within the last 200 years) provide evidence of child injuries consistent with abuse; in contrast, no comparable evidence is available from earlier burial sites (Walker, in press). This suggests the possibility that the more isolated family lifestyles that followed the industrial revolution may have fostered or allowed unmonitored physical abuse of the young.

Flexibility within the coalitional domain. Flexibility occurs within the coalitional domain in terms of both the extent to which and the means by which group coalitional processes are established. Coalitional processes are generally more prevalent within settings that are characterized by high threat to boundaries and resources. For example, gangs are more common and pose a greater threat in urban than in rural areas (W. P. Evans, Fitzgerald, Weigel, & Chvilichek, 1999). The extent to which such coalitional activities are adaptive are, however, dependent on a variety of moderating factors (Grotevant, 1998). For example, strong group identity among minority youth may be adaptive if they also identify with larger societal groups (Phinney, Ferguson, & Tate, 1997). In contrast, group identity that is accompanied by disidentification with larger groupings may yield high costs (Steele, 1997). In the smaller groups that characterized living arrangements in the human evolutionary past (Caporael, 1997), it is probable that the coalitional activities of the young coincided with the interests of the larger group.

In addition, coalitional rules are differentially maintained by adults versus the young themselves in different ecologies. Although knowledge about the rules and activities of group life is transmitted both by parents and by the young (Rogoff, Mistry, Goncu, & Mosier, 1993; Smetana, 1997), primary sources of coalitional knowledge and implementation of group norms vary. In many Western, middle-class cultures, parents regularly serve as conveyers and enforcers of group norms during the early years of

childhood (see, e.g., Dunn & Brown, 1991; Gralinski & Kopp, 1993). In more collective cultures, children's peer groups serve as primary transmitters and enforcers of group norms across age groups. Although variability in the conveyance and enforcement of group norms is adaptive up to a point, it may be maladaptive at extreme levels. For example, school settings that foster and encourage peer implementation of academic norms may provide academic benefits but incur social costs. As an illustration, *ijime* (bullying) has become an increasing problem in Japanese schools. Although bullying is a problem in other countries, such activities typically involve individual children. When bullying activities involve group action against norm violators, such actions are more likely to produce more extensive harm (Ono, 1996; Sutton & Smith, 1999).

Flexibility within the mating domain. Different ecologies may also lead to alternate ways of solving the problems of the mating domain. For example, Cashdan (1995) has proposed that women follow alternate routes in mate selection. If the chances for paternal investment are high, women compete for access to males (the "traditional" route). Alternatively, if the chances of paternal investment are low, they compete directly with both males and females for hierarchical advantages—and thus reduce their reliance on the potential caregiving involvement of a mate. It has also been suggested (Belsky, Steinberg, & Draper, 1991; Draper & Harpending, 1982) that early experiences set the reproductive strategies of the young. For example, children growing up in father-absent homes (because of divorce) seek early, short-term sexual relationships with multiple partners—consistent with the expectation that pair-bonds do not endure and that paternal investment is uncertain. These conceptions allow for the possibility of flexibility in the adaptive options that may be used in solving the problems of the mating domain within different ecologies.

More extreme experiences serve to limit possibilities for solving problems of the mating domain. For example, when the young are exposed to high stress (and associated neurohormonal changes), they subsequently show abnormalities in the functioning of the hypothalamic–pituitary–gonadal (HPG) axis (Susman, Worrall, Murowchick, Frobose, & Schwab, 1996). Among young women, these changes may ultimately lead to delayed puberty or high rates of fetal loss if menarche is achieved. Among males, changes may lead to reductions in spermatogenesis and testosterone production. Although there is some evidence that extreme stress may also foster precocious maturation (Belsky, Steinberg, & Draper, 1991), the currently known hormonal routes of influence from the HPA to the HPG axis are more consistent with delays (Trickett & Putnam, 1993).

Flexibility within the reciprocity domain. Variable ecologies not only represent stable differences in the lives of the young, they also reflect changes within individual lives. At various points in the life course, individuals may have a relatively unfavorable balance of resources or RHP (e.g., during pregnancy, injury, illness). Although the associated needs can be met by assistance from kin, there is an adaptive advantage to having the capability of establishing reciprocal relationships with unrelated others (e.g., when migration occurs to new environments and new groups). Such advantages are high for social-emotional support as well as material support. By establishing mutual aid networks, one produces long-term benefits for both self and the collaborative partner.

Current environments often include a range of options in terms of cultures that are strongly rooted in notions of reciprocity and interdependence (e.g., many Asian and Latin American cultures; Parke & Buriel, 1998) versus highly individualistic cultures that give greater focus to social independence. It is an open question as to whether human beings are designed for flexible accommodation to group living based on either motivational system. At one extreme, very low involvement in interdependent relationships (establishing mutual social support networks) with others is more likely to act as a risk factor (see, e.g., Wadhwa et al., 1996) rather than as an alternative coping style. In addition, extremes of social independence tend to be associated with elevated violence (Robarchek & Robarchek, 1998).

Flexibility within the hierarchical domain. Children's early involvement in hierarchical domains varies with the abundance of resources available in the environment. At the most basic level, periods of caloric scarcity have been found to foster competitive activity—as mediated by reductions in cholesterol levels and resultant increases in sympathetic nervous system activity (Kaplan et al., 1997). At an indirect level, different ecologies have also been found to be consistently associated with parenting tactics. Power-assertive parenting is more common in contexts characterized by scarcity of resources or threat to resources (Hess, 1970). Parent–child relationships organized in terms of hierarchical power are observed in many groups that are characterized by low resources, for example, inner-city African American families (Harrison, Wilson, Pine, Chan, & Buriel, 1990; Hess, 1970; Kelly, Power, & Wimbush, 1992), low-education groups in Spain (Palacios, 1990), and the Druze in Israel (Wainryb & Turiel, 1994).

Up to a point, flexible strategies in response to resource availability are adaptive. Children may be better prepared for a harsh environment if they are directly or indirectly toughened for this experience (see, e.g., Ogbu, 1985). If, however, such power-assertive tactics are excessive, they have negative consequence for children—including increased risk for maltreatment (Belsky, 1993) and increased risk for the children themselves showing a maladaptive level of aggression (Dodge, Bates, & Pettit, 1990).

Summary. Humans appear to have biologically set options that (for the most part) provide optional routes for solving recurrent problems of adaptation. Such options represent alternative means for solving problems in response to changing ecologies. If, however, current ecologies fall too far outside those that have been present in the human evolutionary past, preset adaptations may not be available.

Level 2: Cognitive Flexibility in the Representations of Domains

The domains of social life may also be differentially organized at a cognitive level. Level 2 regulatory processes represent organized ways of solving recurrent problems within the individual's own life course. Just as the young show a special perceptual sensitivity to particular kinds of stimuli, they also show a capacity to store experience-based information in integrated ways. The content of stored information (as organized knowledge structures) appears to involve a taxonomy that may be thought of as preformatted by evolutionary history (A. P. Fiske, 1992; Jackendoff, 1992).

In considering the nature of the cognitive representation of domains, it may be suggested that flexibility in knowledge structures—up to a point—allows an adaptive "tailoring" of domains to fit the individual's history. Under ordinary circumstances, the differential cognitive organization of interactions as a function of individual history represents an adaptive process in the fine-tuning of the algorithms that regulate domains.

At this second level of control, social domains come under the integrated control of both higher cortical centers and subcortical centers as participants come to cognitively represent domain-relevant information. This process focuses on the representation of social information in organized ways that include linkages to relevant physiological responses, emotional-motivational variables, and behavioral routines (see, e.g., Bargh, Chen, & Burrows, 1996; Bargh & Gollwitzer, 1994; S. T. Fiske & Pavelchak, 1986). Within developmental psychology, such processes have been thought of in terms of internal working models (Bowlby, 1980); within social–cognitive approaches, they have been thought of in terms of relationship schemas (see, e.g., S. M. Andersen & Glasman, 1996; Baldwin, 1992). Such model-building systems may thus be thought of as selectively receptive to environmental cues and capable of generating alternative responses—a cognitive adaptation.

Attachment domain. Developmental researchers have typically focused their attention on the acquisition of working models as organizers of attachment relationships (Bowlby, 1980; Bretherton, 1990). Representations of attachment relationships involve expectations of self and others (within such relationships), beliefs about self and others, and affective appraisals of the relationship. Variations in such models may, then, serve as organizers of conditional behavioral strategies in accomplishing the tasks of the attachment domain (Cassidy, 1994; Main, 1990). For example, infants may come to differ in their ways of optimizing proximity with mothers as a function of the working models they build of that relationship (Cassidy, 1994; Chisholm, 1996). If, however, their representations fall too far outside preformatted design features, they may fail to facilitate the accomplishment of domain goals.

With experience, initially unlearned physiological responses eventually become coupled with cognitive representations of the attachment relationship (see, e.g., Izard, Haynes, Chisholm, & Baak, 1991; Kraemer, Ebert, Schmidt, & McKinney, 1991). It has been suggested that, among humans, sensorimotor or homeostatic processes are the central regulators of attachment relationships during the first 6 months of life (Pipp & Harmon, 1987); these processes are subsequently supplemented by later changes that reflect both physiological development and emerging cognitive–affective organization of relationships (Hofer, 1987).

At the broadest level, working models acquired in infancy have been conceptualized as forming the basis for the cognitive organization of all social relationships—in particular, close social relationships (Bowlby, 1969, 1973, 1980). However, little empirical attention has been given to testing this assumed continuity. As an exception, Rabiner, Keane, and MacKinnon-Lewis (1993) determined the correlations between older children's cognitive representations of parents and their cognitive representation of peer relationships. Using this strategy, Rabiner et al. found no relationship between children's beliefs about parents and their beliefs about their friends. There was, however, an association between beliefs about parents and beliefs about unfamiliar peers, suggesting

that working models of relationships with parents may represent a default expectation—an expectation that is, however, easily displaced when a friendship relationship is established.

The specificity of domains has also been studied in less reactive ways, using standard social–cognition paradigms. For example, A. P. Fiske demonstrated that information-processing errors (e.g., misnamings, memory errors) tend to be consistent with domain-based categories or grammars (A. P. Fiske, 1993; A. P. Fiske, Haslam, & Fiske, 1991). So, for example, an individual might easily confuse the names of two exemplars of a particular domain (members of some such group as the family) but would be unlikely to confuse the boss's name with the name of a family member.

The specificity of domains has also been demonstrated when the schematic representation for one domain is applied to a different domain (a potential mismatch). As an example of a domain mismatch, those adults who represent their caregiving relationships with the young in a hierarchical or dominance-oriented way are more likely to report an insecure attachment history with their own parents (Grusec & Mammone, 1995) and to demonstrate an insecure attachment history with their own children (Bugental & Martorell, in press).

Coalitional group domain. Across the course of development, the child is constantly acquiring new information concerning the markers of social groupings (as categories), along with cultural knowledge regarding those categories. Whereas acquisition processes within other social domains are focused heavily on the individual experiences of the child, acquisition processes within the group domain are strongly influenced by culturally shared knowledge and cultural representations of important social groupings. Coalitional interactions may be thought of as variably organized on the basis of *dominance orientation* (Sidanius & Pratto, 1999)—a concept that reflects the tendency to organize social responses on the basis of group distinctions. Although such variations have not been studied among the young, the work of Phinney and her colleagues (Phinney, Ferguson, & Tate, 1997) suggests that adolescents who are less focused on unique identification with their own group show more positive responses to out-group members.

Mating domain. Over the last 10 years, there has been a burgeoning interest in the different ways in which adults represent their close relationships with romantic partners. Such conceptions have been variously framed in terms of *attachment styles, attributional styles, relationship schemas,* or other terms that reflect the notion of organized knowledge structures (Berscheid, 1994).

The cognitive representation of romantic relationships has many parallels with the cognitive representation of attachment relationships; however, the two patterns are better thought of as analogous rather than continuous. Although there is substantial evidence for the continuity between adults' cognitive representation of their own early attachment history and the attachment style shown by their offspring (see, e.g., van IJzendoorn, 1995), there is less compelling evidence for the continuity between attachment patterns in infancy and attachment style with romantic partners (Berscheid, 1994). Indeed, leading adult attachment theorists do not argue for such continuity (see, e.g., Shaver & Brennan, 1992).

Romantic attachment styles (understood as stable knowledge structures) are based on security orientations of a specialized type. Rather than being rooted in the reliability of safety provisioning (as is true for working models of attachment to caregivers), models

of romantic relationships are based on perceived closeness, intimacy, and confidence in being loved and valued (see, e.g., N. L. Collins & Read, 1990; Hazan & Shaver, 1987). Adult attachment styles are closely related to general positivity of self-descriptions and social relationships as a whole (Baldwin, Fehr, Keedian, Seidel, & Thomson, 1993). As such, they focus on explicit expectancies regarding the likelihood and ways of accomplishing the basic goals of the mating domain. Overcoming problems associated with reliance on self-report, Simpson, Rholes, and Nelligan (1992) demonstrated that attachment styles predict the actual provision and solicitation of partner reassurance during times of stress.

In addition, adult attachment styles have been found to be predictive of conflict and sexual jealousy. For example, securely attached individuals are more likely to experience and express anger in response to jealousy provocations, whereas insecurely attached individuals are more likely to express their anger indirectly and to experience sadness (Sharpsteen & Kirkpatrick, 1997). Differences in the ways in which jealousy is expressed (but not differences in the experience of jealousy) have been found to serve as predictors of relational satisfaction (P. A. Andersen, Eloy, Guerrero, & Spitzberg, 1995). Thus, attachment styles not only serve as predictors of expectancies for romantic relations, they also serve as predictors of alternative (and differentially successful) ways of regulating relevant emotions.

The cognitive representation of romantic relationships has also been thought of in terms of stable belief patterns. Relationship beliefs have been found to influence the accessibility of different kinds of ideation concerning relationships. For example, Fletcher, Rosanowski, and Fitness (1994) found that those individuals who focused on relationship intimacy differed from those who focused on passion within their relationship. That is, individuals made faster judgments as to whether adjectives described their relationships (when constrained by the demands of a cognitive load) for schematically relevant adjectives; thus, "intimacy-schematic" individuals made faster ratings of an adjective such as *warm* than an adjective such as *exciting*.

As another approach, Fincham and Bradbury (1992) have conducted extensive research on the ways in which stable patterns of attributions predict behavior within marital interactions. Those partners who hold "conflict-promoting" attributions (e.g., attributing negative marital events as being due to a partner's negative intentions or selfish motivation) are more likely to experience relationship dissatisfaction and negative interaction outcomes (see, e.g., Fincham & Bradbury, 1992), including elevated risk for violence (Dutton, 1995). In short, this type of relationship cognition exceeds the range of adaptive flexibility and acts to produce harm to the relationship or individuals within it.

Reciprocity domain. Less attention has been given to variations in the cognitive representation of the reciprocity domain. As an exception, Rizzo and Corsaro (1988) were specifically concerned with the ways in which friendships (a prototypical example of reciprocal interactions) come to be organized cognitively. Somewhere between the ages of 4 and 6, children come to organize their friendships cognitively, that is, they develop stable knowledge structures about friendship. Once formed, these cognitive representations were found to influence the ways in which children managed their relationships with friends.

Hierarchical power domain. Considerable attention has been given to adults' cognitive representations of hierarchical power within caregiving relationships by Bugental and her colleagues (see, e.g., Bugental, 1992). Parents who see their relationship with children as power-balanced (symmetrical) are not easily disturbed by caregiving challenges. In contrast, parents who tend to see their relationships with children as power contests (in particular, when they themselves have a low perceived balance of power) are highly reactive to caregiving challenges—alternately making use of appeasing or aggressive tactics (Bugental, 1992). Children, in turn, respond to these inconsistent tactics with attentional disengagement (see, e.g., Bugental, Lyon, Lin, McGrath, & Bimbela, 1999).

Some limited attention has been given to variations in the ways in which children represent hierarchical relationships, that is, their relationships with parents (see, e.g., Bugental & Martorell, in press; Fincham, Beach, Arias, & Brody, 1998). Fincham, Beach, Arias, and Brody (1998) found that children's "conflict-promoting attributions" (e.g., their attributions of causality to parents for negative interactions) predicted parent–child conflict. Bugental and her colleagues found that children with low perceived power (relative to parents) showed high levels of verbal aggression with peers (Bugental & Martorell, in press) and attentional avoidance with potentially threatening adults (Cortez & Bugental, 1994).

Dodge and his colleagues (e.g., Dodge & Frame, 1982; Dodge, Pettit, McClaskey, & Brown, 1986) have given extensive consideration to children's chronic representation of peer relationships as hierarchical, that is, children's interpretive biases that easily lead them to see peer responses as competitive and hostile. These investigators have suggested that children's cognitive biases follow from their experiences with harsh parenting and, in turn, mediate their antisocial behavior (Dodge et al., 1990).

Summary. The cognitive representation of the domains of social life provides a flexible means of responding to ongoing social events on the basis of the individual's own history, in particular his or her earliest history. Within some range, such variations are adaptive. Outside that range, they may limit the possibility of accomplishing relevant domain goals.

The majority of research on relationship schemas has focused on attachment and romantic schemas. An emerging literature has developed to address the cognitive representation of power-based relationships (among both children and adults) and group relationships (among adults). The understanding of individual variations in the cognitive representation of reciprocal, equality-based relationships is most in need of further development.

Level 3: Cultural Flexibility in the Management of Domains

Finally, the ways in which the young come to acquire the algorithms of social life may involve reflective, aware appraisal processes—an option that appears to be available only to higher primates. Traditionally, interest in the preparation of the young for social life has focused on socialization processes. Consistent with phylogenetic differences in cognitive abilities, consideration of the role of intentional tuitional processes has focused on human processes. Human parents may be thought of as having the capability to reflect on and simulate alternative past, present, and future events in the service of achieving the goals of socialization. In addition, parents may guide the cognitive processes of the young

to facilitate their consideration of past experience and alternative pathways for the future. By the use of such induction tactics, parents may facilitate children's mental simulation of alternative explanations or responses to life events (Hoffman, 1970). Finally, parents may knowingly manage the extrafamilial environments experienced by the young and thus influence the ways in which they conceptualize and cope with the social world (Parke & Ladd, 1992). Children, in turn, increasingly participate in their own socialization as they show an increasing capacity to consider alternative explanations and responses to life events—as a combined function of experience and cognitive development (Bugental & Goodnow, 1998).

Sperber (1994), although arguing for the domain-specific nature of the mind, suggested that flexibility in the functioning of humans occurs as a result of the interconnected nature of cognitive domains. That is, humans are capable of deliberate domain shifting as a way of more completely considering their response options. Parents may reflect on the optional routes for accomplishing the same task within different domains (e.g., protecting the safety of older children by negotiating with them as equals or attempting to enforce authority-based mandates). In short, humans—with development and experience—have the increasing capacity to integrate and select their use of the algorithms of social life.

At the same time, management of the preparation of the young for social life may occur more easily when the methods caregivers use are consistent with the basic design of relevant domains. That is, it may be that the young are more likely to manifest easy acceptance and receptive compliance to social influences that use social algorithms from the evolutionary past. In contrast, the young may resist those influences that are inconsistent with such algorithms (despite their current utility).

Receptivity to domain-consistent influences. Under most circumstances, cultural norms operate in synchrony with the basic algorithms of social life (as pointed out by Kenrick & Simpson, 1997). Indeed, cultural rules regularly operate to enhance the functioning of such mechanisms. For example, basic notions of fairness and reciprocal obligation within interpersonal relationships are widely shared across cultures. As suggested by Turiel (1998), individuals within cultures develop multiple perspectives as a function of their own unique experiences, but the different domains of social thought are themselves widespread across cultures.

The theoretical notions presented by Emde et al. (1991) highlighted the receptivity of the young to socialization (and the developmental features of such receptivity). For example, the young are highly receptive to learning the do's and don'ts of family life. Emde and his colleagues have described young children as biologically prepared for human interaction in general and for socialization in particular; that is, children come into their social worlds with a high level of social fittedness. Throughout this article, I have noted the many ways in which children are prepared to respond selectively to social information. In the same way, caregiving adults are also prepared to be receptive to the kinds of social signals produced by the young and the perceptual features of the young. In explaining these processes, Krebs and Dawkins (1984) have proposed a coevolutionary process that involves both a "manipulator" and a "mind-reader" role for social signals, that is, social signals both motivate the actions of others and are used to predict the actions of others. The combined receptivity of the

young and their caregivers may be thought of as pointing to and defining the nature of effective socialization (see, e.g., Kochanska, 1997). That is, parents who are most effective in influencing their children make use of tactics to which children are highly receptive.

Consideration of the overall success of parents in preparing the young for the central features of social life far exceeds the scope of this article. It has sometimes been argued that the vast majority of parents succeed in at least minimally preparing the young for the kinds of experiences they will normatively encounter (Scarr, 1992). Differences in point of view emerge, however, when consideration is given to the optimal preparation of the young for social life (see, e.g., Baumrind, 1993).

Resistance to domain-inconsistent influences. Despite the general preparation of humans for caregiving experiences, current parenting and societal practices often run into conflict with adaptations from the past. When cultural rules run afoul of the basic algorithms of social life, resistance is often observed in response to the implicit "domain misfit." Resistance may take a number of forms. Resistance may involve explicit conflict between parents and children. It may also involve the implementation of informal accommodations in which there are unspoken but tacitly accepted violations of the formal rules.

A striking example of a misfit in the attachment domain involves the nighttime separation of infants and parents. Much to the distress of their parents, young children often respond with persistent crying to such separation. Such high intensity distress calls were adaptive in the evolutionary past in that night separation placed the young at risk for predation. Despite the current safety of children who experience separate sleeping arrangements, very young children respond to separation with compelling urgency. Separate home sleeping arrangements for infants and removal of infants to a separate room during the first year of life represent a relatively uncommon cultural practice universally (although common in the United States; Morelli, Rogoff, Oppenheim, & Goldsmith, 1992). At the same time, such methods do not seem to produce damage in today's world. However, the resistance of the young does mean that special efforts often need to be made to assist them (and their parents) in weathering the misfit between domain mechanisms and current needs.

As an example of a domain misfit in the coalitional group domain, one may think of the fierce resistance of the young to another type of socialization attempt: resistance of adolescents to parental (or societal) efforts to interfere with their autonomy on issues they view as within their personal jurisdiction (see, e.g., Smetana & Asquith, 1994). Many of these shared generational conflicts revolve around choice of friends and reliance on peer group norms rather than adult norms. In the ancestral past, heightened involvement in coalitional processes in middle childhood and early adolescence may have regularly been useful in preparing the young for shared tribal involvement in resource acquisition and shared defense. However, in many contemporary settings, the coalitional activities of the young carry a high risk to the young themselves as well as to others (Moffitt, 1993). As a result, a social algorithm that was once adaptive may now be used in the service of such destructive occurrences as gang turf wars, school violence, organized vandalism against the symbols of out-groups, and so on. Community efforts to change such processes are typically unsuccessful (Sherman et al., 1998). Again, this does not suggest that

such efforts are either misdirected or futile, only that changes will not occur easily.

As an example of a misfit in the mating domain, one can think of the resistance to marriages when such mating is inconsistent with the basic algorithms of that domain. As noted earlier, humans (and many nonhumans) show an aversion to those that convey kin cues (typically marked by close association during the early years of life). As noted earlier, children reared together in a kibbutz environment virtually never marry (despite the positive reactions of their parents to such a possibility) (Shepher, 1983). In the same way, many types of arranged marriages essentially fail when those forced into a mating relationship have been closely associated in the early years of their life. For example, if a future bridegroom is brought into the family of a prospective bride when both are still young children, they are raised in an implicitly sibling relationship. Couples raised in this kin type of setting ultimately are more likely to divorce than are those in arranged marriages of other types (Wolf, 1995).

A final example of a domain misfit can be drawn from the history of efforts to overcome the organization of social life in a way that reflects group hierarchies. Across human ancestral history, more powerful groups have acted against the interests of less powerful groups (Sidanius & Pratto, 1999). The combined algorithms of the two domains act not only to influence the efforts of more dominant groups to retain their RHP but also to influence the response style of less dominant groups in ways that maintain their lower position. Despite decades of well-intentioned public policy efforts to create an equal playing field for different ethnic groups in the United States, the continued asymmetry across racial and ethnic groupings is profound (as documented by Sidanius & Pratto, 1999). Continuing inequities influence all aspects of the lives of developing children. Parents within subordinate social groups have repeatedly been found to be make use of more power-assertive tactics than do parents within advantaged groups. Child maltreatment and spousal violence is consistently higher in subordinate social groups. Children within subordinate families regularly have less adequate educational experiences and make less effective use of the experiences that are available. Such differences reflect not only the differential benefits accessible to those in more advantaged groups but also the self-debilitating responses of subordinate groups themselves. For example, the simple salience of a stigmatized group identity (e.g., a question asking for the individual's racial identity on a test form) can serve to impair performance on an intellectual task (Steele & Aronson, 1995). Efforts to correct for the effects of group dominance have had limited success. In contrast, relocation to a country that does not stigmatize a particular group leads to rapid equalization in the experiences and successes of the young. In short, the difficulties in reducing the debilitating effects of group stigma are profound but still possible.

Summary. Deliberate efforts to manage the experiences, behaviors, and values of the young operate within a wide range of flexibility. However, the ease with which such management can occur depends on the extent to which such efforts are consistent or inconsistent with the basic algorithms of social life. Many seemingly rational strategies for regulating social relationships may meet a wall of resistance when they are in some way inconsistent with domain algorithms. Socialization or community programs that recognize the basic algorithms of social life (and the optional ways in which those algorithms may be implemented) are more likely to be successful than those that are based on "rational," domain-insensitive principles.

Integration and Implications

Acquisition of the algorithms of social life has been described here as operating in specialized ways in five universally observed domains. The five domains are organized to solve problems in maintaining proximity within attachment relationships, maintaining the lines that divide social groupings, negotiating resources and control between individuals who differ in dominance and resources, maintaining equity within interactions based on reciprocity, and optimizing access to romantic partners.

Distinctive Design of Social Algorithms

It was suggested that humans are prepared for social life based on their shared evolutionary history. This history provides default capabilities that serve as a user's guide to the operation of domains. Attention focused here on the specific, separable aspects of domain algorithms. The attachment domain was described as providing the clearest example of an algorithm that is governed by tightly specified motives, timing, information search and retrieval, neurohormonal regulating processes, and behavioral regulators.

The strongest support for the differential organization of domains was found at the perceptual and computational levels. The sensitivities that are involved in attachment begin prenatally and are fully implemented by late infancy. Awareness of and response to social reciprocity begins in the first few months of life to form a central regulator of social life. Awareness and manifestation of dominance cues emerge in late infancy and assume particular importance with increased independence of the young. Awareness of grouping information follows a gradual course that begins at early ages but awaits higher levels of brain development before culturally constructed group preferences are shown. Finally, response to attractiveness (as a predictor of reproductive success) and kinship markers (as predictors of reproductive risk) are acquired in early childhood but serve to influence processes observed at much later ages.

Although domains appear to be regulated by particular combinations of neurohormones, no 1:1 relationship was found (or expected) between domains and hormones. Finally, there was some evidence to suggest the presence of distinctive emotions and social responses within different domains.

Variability in the Implementation of Domains

The algorithms of social life were also characterized as open to alternative means of implementation at three levels of organization. Although evolutionary history has provided the basic design of the algorithms of social life, there is also flexibility in the ways in which such algorithms may be implemented.

At a bioecological level, the same history that provided the basic designs also provided some range of response options that allow adaptive accommodation to recurrent changes within the environment. For example, hierarchical interactions may be less prominent in environments in which resources are easily accessible versus those in which resources are scarce. However, responses to environments that fall outside those that may be expected (on an

evolutionary basis) may produce adverse consequences for the developing child.

At a second level, it was suggested that organisms store information about their individual experiences in ways that reflect domain-specific organization. Such processes involve the combined operation of subcortical and higher cortical levels. Socialization at this level centers around the social affordances or kinds of information that are provided by others (in the process of managing their own interests rather than as specific tuitional efforts). Domain-based knowledge structures are created that integrate relevant perceptual cues, ideation and affect, physiological regulation, and behavioral routines. Once such structures are formed, they act automatically (and with little conscious awareness) to direct and motivate subsequent responses. Such structures act in a reasonably autonomous fashion to organize future response to domain-relevant cues. Suggestive support was found for the notion that domains are represented cognitively in distinctive ways. However, a primary limitation in testing notions of domain specificity at the level of cognitive representation is the relatively small body of research directed to this question. Although there is extensive information concerning the cognitive representation of attachment and romantic domains, as well as an emerging body of evidence on hierarchical and coalitional domains, little is known about individual differences in the cognitive representation of the reciprocity domain.

At a third level, humans also have the capacity to individually or jointly reflect on, plan, and implement the deliberate management of social life, including the preparation of the young for social life. Such processes may be thought of broadly in terms of socialization—a process that reflects the planned preparation of novices by experienced individuals or groups. It also involves the management of environments to optimize opportunities available to novices in their preparation for various aspects of social life. Although this level of domain implementation contains the highest levels of flexibility, such processes are also constrained by the basic design of domains. Thus, there is suggestive evidence that parental socialization and management activities are more easily implemented and maintained when they make use of strategies that are consistent with the basic design of domains. Further work is needed on the differential receptivity of the young to parental or cultural management as a function of the consistency or inconsistency of such efforts with the basic design features of social algorithms. By considering these issues, the creators of community-based prevention and intervention programs have the possibility of implemented them with greater success.

Conclusions

In this article, it has been suggested that the domains of social life are organized in systematically different ways. Domain instantiation and maintenance processes may be thought of as following basic social algorithms that nonetheless allow some range of flexible implementation. Such flexibility occurs at different levels. At the most basic biological level, humans (like other social animals) are prepared to respond differently within different ecologies. At a higher level, adaptive responses to life experiences are facilitated by the individual's acquisition of knowledge structures tailored to the individual's unique history within different social domains. At the highest level of flexibility, parents, peers, other societal representatives, and the young themselves have the capability of collaboratively managing their responses to the demands of social life—a process that occurs more easily when implemented in ways that are consistent with the basic algorithms that organize those domains.

References

Adamson, L. G., & Bakeman, R. (1991). The development of shared attention during infancy. *Annals of Child Development, 8,* 1–41.

Altmann, J. (1987). Life span aspects of reproductive and parental care in anthropoid primates. In J. B. Lancaster, J. Latmann, A. S. Rossi, & L. R. Sherrod (Eds.), *Parenting across the life span: Biosocial perspectives* (pp. 15–29). Hawthorne, NY: Aldine de Gruyter.

Andersen, P. A., Eloy, S. V., Guerrero, L. K., & Spitzberg, B. H. (1995). Romantic jealousy and relational satisfaction: A look at the impact of jealousy experience and frustration. *Communication Reports, 8,* 77–96.

Andersen, S. M., & Glasman, N. S. (1996). Responding to significant others when they are not there: Effects on interpersonal inference, motivation, and affect. In R. M. Sorrentino & E. T. Higgins (Eds.), *Handbook of motivation and cognition* (Vol. 3, pp. 262–321). New York: Guilford Press.

Asher, S. R., & Coie, J. D. (Eds.). (1990). *Peer rejection in childhood.* New York: Cambridge University Press.

Baldwin, M. W. (1992). Relational schemas and the processing of social information. *Psychological Bulletin, 112,* 461–484.

Baldwin, M. W., Fehr, B., Keedian, E., Seidel, M., & Thomson, D. W. (1993). An exploration of the relational schemata underlying attachment styles: Self-report and lexical decision approaches. *Personality and Social Psychology Bulletin, 19,* 746–754.

Bandura, A. (1977). *Social learning theory.* Englewood Cliffs, NJ: Prentice Hall.

Bargh, J. A., Chen, M., & Burrows, L. (1996). Automaticity of social behavior: Direct effects of trait construct and stereotype activation of action. *Journal of Personality and Social Psychology, 51,* 1173–1182.

Bargh, J. A., & Gollwitzer, P. M. (1994). Environmental control of goal-directed action: Automatic and strategic contingencies between situations and behavior. *Nebraska Symposium on Motivation, 41,* 71–124.

Barnett, O. W., Martinez, T. E., & Bluestein, B. W. (1995). Jealousy and romantic attachment on maritally violent and nonviolent men. *Journal of Interpersonal Violence, 10,* 473–486.

Baron-Cohen, S. (1995). *Mindblindness. An essay on autism and theory of mind.* Cambridge, MA: MIT Press.

Bartoshuk, L. M., & Beauchamp, G. K. (1994). Chemical senses. *Annual Review of Psychology, 45,* 419–449.

Baumeister, R. F., & Tice, D. M. (1990). Anxiety and social exclusion. *Journal of Social and Clinical Psychology, 9,* 165–195.

Baumrind, D. (1993). The average expectable environment is not good enough: A response to Scarr. *Child Development, 64,* 1299–1317.

Baumrind, D. (1996). The discipline controversy revisited. *Family Relations: Journal of Applied Family and Child Studies, 45,* 405–414.

Beebe, B., Alson, D., Jaffe, J., Feldstein, S., & Crowne, C. (1988). Vocal congruence in mother–infant play. *Journal of Psycholinguistic Research, 17,* 245–259.

Belsky, J. (1993). Etiology of child maltreatment: A developmental-ecological analysis. *Psychological Bulletin, 114,* 413–434.

Belsky, J., Steinberg, L., & Draper, P. (1991). Childhood experience, interpersonal development, and reproductive strategy: An evolutionary theory of socialization. *Child Development, 62,* 647–670.

Benenson, J. F. (1993). Greater preference among females than males for dyadic interaction in early childhood. *Child Development, 64,* 544–555.

Berndt, T. J., & Ladd, G. W. (1989). *Peer relationships in child development.* New York: Wiley.

Bernhardt, P. C., Dabbs, J. M., Jr., Fielden, J. A., & Lutter, C. D. (1998).

Testosterone changes during vicarious experiences of winning and losing among fans at sporting events. *Physiology and Behavior, 65,* 59–62.

Berscheid, E. (1994). Interpersonal relationships. *Annual Review of Psychology, 45,* 79–129.

Bettes, B. A. (1988). Maternal depression and motherese: Temporal and intonational features. *Child Development, 59,* 1089–1096.

Bigler, R. S., Jones, L. C., & Lobliner, D. B. (1997). Social categorization and the formation of intergroup attitudes in children. *Child Development, 58,* 530–543.

Biringen, Z., Emde, R. N., Campos, J. J., & Appelbaum, M. I. (1995). Affective reorganization in the infant, the mother, and the dyad: The role of upright locomotion and its timing. *Child Development, 66,* 499–514.

Blanchard, R. J., Hebert, M. M., Sakai, R. R., McKittrick, C., Yudko, E., McEwen, B. S., & Blanchard, D. C. (1998). Chronic social stress: Changes in behavioral and physiological indices of emotion. *Aggressive Behavior, 24,* 307–321.

Bowlby, J. (1969). *Attachment and loss: Vol. I. Attachment.* New York: Basic Books.

Bowlby, J. (1973). *Attachment and loss: Vol. II. Separation.* New York: Basic Books.

Bowlby, J. (1980). *Attachment and loss: Vol. III. Loss.* New York: Basic Books.

Breedlove, S. (1992). Sexual differentiation of the brain and behavior. In J. Becker, S. Breedlove, & D. Crews (Eds.), *Behavioral endocrinology* (pp. 39–68). Cambridge, MA: MIT Press.

Breland, K., & Breland, M. (1966). *Animal behavior.* New York: Macmillan.

Bremner, J. D., & Narayan, M. (1998). The effects of stress on memory and the hippocampus throughout the life cycle: Implications for childhood development and aging. *Development and Psychopathology, 10,* 871–885.

Bretherton, I. (1985). Attachment theory: Retrospect and prospect. *Monograph of the Society for Research on Child Development. 50* (1–2, Serial No. 209), 3–35.

Bretherton, I. (1990). Open communication and internal working models: Their role in the development of attachment relationships. In R. A. Thompson (Ed.), *Socioemotional development: Nebraska Symposium on Motivation, 1988* (pp. 57–113). Lincoln: University of Nebraska Press.

Brewer, M. B. (1994, June). *The social origins of human nature.* Keynote address presented at the Fourth Annual Society for Personality and Social Psychology Preconference, Washington, DC.

Brewer, M. B. (in press). Ingroup identification and intergroup conflict: When does ingroup love become outgroup hate? In R. Ashmore, L. Jussim, & D. Wilder (Eds.), *Social identity, intergroup conflict, and conflict reduction.* New York: Oxford University Press.

Brewer, M. B., & Gardner, W. (1996). Who is this "we"? Levels of collective identity and self representations. *Journal of Personality and Social Psychology, 71,* 83–93.

Brisson, N. J. (1983). Battering husbands: A survey of abusive men. *Victimology: An International Journal, 1,* 338–344.

Brody, G. H., Stoneman, Z., & MacKinnon, C. E. (1982). Role asymmetries in interactions among school-aged children, their younger siblings, and their friends. *Child Development, 53,* 1364–1370.

Bugental, D. B. (1992). Affective and cognitive processes within threat-oriented family systems. In I. E. Sigel, A. McGillicuddy-DeLisi, & J. Goodnow (Eds.), *Parental belief systems: The psychological consequences for children* (pp. 219–248). Hillsdale, NJ: Erlbaum.

Bugental, D. B. (1999, October). *Power-oriented cognitions as predictors of family violence.* Paper presented at the meeting of the Society for Experimental Social Psychology, St. Louis, MO.

Bugental, D. B., & Goodnow, J. G. (1998) Socialization processes. In N. Eisenberg (Vol. Ed.), *Handbook of child psychology: Vol. 3. Social, emotional, and personality development* (pp. 389–462). New York: Wiley.

Bugental, D. B., Lyon, J. E., Lin, E., McGrath, E. G., & Bimbela, A. (1999). Children "tune out" in response to the ambiguous communication style of powerless adults. *Child Development, 70,* 214–230.

Bugental, D. B., & Martorell, G. (in press). Perpetuation of powerlessness across relationships. *Journal of Family Psychology.*

Bukowski, W., & Hoza, B. (1989). Popularity and friendship: Issues in theory, measurement, and outcome. In T. J. Berndt & G. W. Ladd (Eds.), *Peer relationships in child development* (pp. 15–45). New York: Wiley.

Bukowski, W., Newcomb, A. F., & Hartup, W. W. (1996). *The company they keep: Friendship in childhood and adolescence.* New York: Cambridge University Press.

Buss, D. M. (1995). Psychological sex differences: Origins through sexual selection. *American Psychologist, 50,* 164–168.

Buss, D. M., Larsen, R. J., Westen, D., & Semmelroth, J. (1992). Sex differences in jealousy: Evolution, physiology, and psychology. *Psychological Science, 3,* 251–255.

Buss, D. M., & Schmitt, D. P. (1993). Sexual strategies theory: An evolutionary perspective on human mating. *Psychological Review, 100,* 204–232.

Cacioppo, J. T., & Tassinary, L. G. (1990), *Principles of psychophysiology: Physical, social, and inferential elements.* New York: Cambridge University Press.

Cairns, R. B., Gariepy, J.-L., & Hood, K. E. (1990). Development, microevolution, and social behavior. *Psychological Review, 97,* 49–65.

Caldwell, J. D. (1992). Central oxytocin and female sexual behavior. In C. A. Pedersen, J. D. Caldwell, G. R. Jirikowski, & T. R. Insel (Eds.), *Oxytocin in maternal, sexual, and social behaviors* (pp. 166–179). New York: Annals of the New York Academy of Sciences.

Caporael, L. R. (1997). The evolution of truly social cognition: The core configurations model. *Personality and Social Psychology Review, 1,* 276–298.

Caporael, L. R., & Baron, R. M. (1997) Groups as the mind's natural environment. In J. Simpson (Ed.), *Evolutionary social psychology* (pp. 317–344). Mahwah, NJ: Erlbaum.

Caporael, L. R., & Brewer, M. B. (1991). Reviving evolutionary psychology: Biology meets society. *Journal of Social Issues, 47,* 187–195.

Caporael, L. R., Dawes, R. M., Orbell, J. M., & Van de Kragt, A. J. (1989). Selfishness examined: Cooperation in the absence of egoistic incentives. *Behavioral and Brain Science, 12,* 683–739.

Caporael, L. R., Lukaszewski, M. P., & Culbertson, G. H. (1983). Secondary baby talk: Judgments by institutionalized elderly and their caregivers. *Journal of Personality and Social Psychology, 44,* 746–754.

Carlson, M., & Earls, F. (1993). Psychological and neuroendocrinological sequelae of early social deprivation in institutionalized children in Romania. In S. Carter, I. Leberhendler, & B. Kirkpatrick (Eds.), *The integrative neurobiology of affiliation* (pp. 419–428). New York: Academy of Sciences.

Cashdan, E. (1995). Hormones, sex, and status in women. *Hormones and Behavior, 29,* 354–366.

Cassidy, J. (1986). The ability to negotiate the environment: An aspect of infant competence as related to quality of attachment. *Child Development, 57,* 331–337.

Cassidy, J. (1994). Emotion regulation: Influences of attachment relationships. *Monographs of the Society for Research in Child Development, 59,* 228–283.

Cheney, D. L., & Seyfarth, R. M. (1985). Social and nonsocial knowledge in vervet monkeys. *Philosophical Transactions of the Royal Society of London, 308,* 187–201.

Chisholm, J. S. (1996). The evolutionary ecology of attachment organization. *Human Nature, 7,* 1–38.

Chomsky, N. (1988). *Language and problems of knowledge.* Cambridge, MA: MIT Press.

Clark, A. S., Wittwer, D. J., Abbott, D. E., & Schneider, M. L. (1994).

Long-term effects of prenatal stress on HPA axis activity in juvenile rhesus monkeys. *Developmental Psychobiology, 27,* 257–269.

Clark, M. S., Helgeson, V. S., Mickelson, K., & Pataki, S. (1994). Some cognitive structures and processes relevant to relationship functioning. In R. S. Wyer, Jr. (Ed.), *Handbook of social cognition* (pp. 189–238). Hillsdale, NJ: Erlbaum.

Clark, M. S., & Mills, J. (1979). Interpersonal attraction in exchange and communal relationships. *Journal of Personality and Social Psychology, 57,* 12–24.

Collins, N. L., & Read, S. J. (1990). Adult attachment, working models, and relationship quality in dating couples. *Journal of Personality and Social Psychology, 58,* 644–663.

Collins, W. A., & Russell, G. (1991). Mother–child and father–child relationships in middle childhood and adolescence: A developmental analysis. *Developmental Review, 11,* 99–136.

Cortez, V., & Bugental, D. B. (1994). Children's visual avoidance of threat: A strategy associated with low social control. *Merrill-Palmer Quarterly, 40,* 82–97.

Cosmides, L., & Tooby, J. (1989). Evolutionary psychology and the generation of culture: I. Theoretical considerations. *Ethology and Sociobiology, 10,* 29–49.

Cosmides, L., & Tooby, J. (1992). Cognitive adaptations for social exchange. In J. H. Barkow, L. Cosmides, & J. Tooby (Eds.), *The adapted mind: Evolutionary psychology and the generation of culture* (pp. 163–228). New York: Oxford University Press.

Dabbs, J. M. (1992). Testosterone measurements in social and clinical psychology. *Journal of Social and Clinical Psychology, 11,* 302–321.

Dabbs, J. M., (1997). Testosterone, smiling, and facial appearance. *Journal of Nonverbal Behavior, 21,* 45–55.

Daly, M., & Wilson, M. (1988). *Homicide.* New York: Aldine de Gruyter.

DeCasper, A. J., & Fifer, W. P. (1987). Of human bonding: Newborns prefer their mothers' voices. In J. Oates & S. Sheldon (Eds.), *Cognitive development in infancy* (pp. 111–118). Hove, England: Erlbaum.

DeCasper, A. J., & Spence, M. J. (1991). Auditory mediated behavior during the perinatal period. In M. J. S. Weiss & P. R. Zelazo (Eds.), *Newborn attentional biological contrasts and the influence of experience* (pp. 142–176). Norwood, NJ: Ablex.

de Waal, F. (1989). *Peacemaking among primates.* Cambridge, MA: Harvard University Press.

de Waal, F. B. M. (1992). The chimpanzee's sense of social regularity and its relation to the human sense of justice. In R. D. Masters & M. Gruter (Eds.), *The sense of justice: Biological foundation to law* (pp. 241–255). Newbury Park, CA: Sage.

de Waal, F. B. M., & Luttrell, L. M. (1988). Mechanisms of social reciprocity in three primate species: Symmetrical relationship characteristics or cognition? *Ethology and Sociobiology, 9,* 101–118.

Dix, T. (1992). Parenting on behalf of the child: Empathic goals in the regulation of responsive parenting. In I. E. Sigel, A. V. McGillicuddy-DeLisi, & J. J. Goodnow (Eds.), *Parental belief systems: The psychological consequences for children* (2nd ed., pp. 319–346). Hillsdale, NJ: Erlbaum.

Dodge, K. A., Bates, J. E., & Pettit, G. S. (1990, December 21). Mechanisms in the cycle of violence. *Science, 250,* 1678–1683.

Dodge, K. A., & Frame, C. L. (1982). Social cognitive biases and deficits in aggressive boys. *Child Development, 53,* 620–635.

Dodge, K. A., Pettit, G. S., McClaskey, C. L., & Brown, M. M. (1986). Social competence in children. *Monographs of the Society for Research in Child Development, 51*(2, Serial No. 213), 1–85.

Doyle, A. B., & Aboud, F. B. (1995). A longitudinal study of White children's racial prejudice as a social–cognitive development. *Merrill-Palmer Quarterly, 41,* 209–228.

Draper, P., & Harpending, H. (1982). Father absence and reproductive strategy: An evolutionary perspective. *Journal of Anthropological Research, 38,* 255–273.

Dugatkin, L. A., Alfieri, M. S., & Moore, A. J. (1994). Can dominance hierarchies be replicated? Form–re-form experiments using the cockroach (*Nauphoeta cinerea*). *Ethology, 97,* 94–112.

Dunham, P., Dunham, F., Tran, S., & Akhtar, N. (1991), The nonreciprocating robot: Effects on verbal discourse, social play, and social referencing at two years of age, *Child Development, 62,* 1489–1502.

Dunn, J. (1993). *Young children's close relationships: Beyond attachment.* Newbury Park, CA: Sage.

Dunn, J., & Brown, J. (1991). Becoming American or English? Talking about the social world in England and the United States. In M. H. Bornstein (Ed.), *Cultural approaches to parenting: Crosscurrents in contemporary psychology* (pp. 155–172). Hillsdale, NJ: Erlbaum.

Dutton, D. G. (1995). Intimate abusiveness. *Clinical Psychology: Science and Practice, 2,* 207–224.

Eckerman, C. O., Davis, C., & Didow, S. M. (1989). Toddlers' emerging ways of achieving social coordinations with a peer. *Child Development, 60,* 440–453.

Eckerman, C. O., & Stein, M. R. (1990). How imitation begets imitation and toddlers' generation of games. *Developmental Psychology, 26,* 370–378.

Eisenberg, N., & Fabes, R. A. (1998). Prosocial behavior. In N. Eisenberg (Vol. Ed.), *Handbook of child psychology: Vol. 3. Social, emotional, and personality development* (pp. 701–778). New York: Wiley.

Eisenberg, N., & Miller, P. (1990). The development of prosocial behavior versus nonprosocial behavior in children. In M. Lewis & S. M. Miller (Eds.), *Handbook of developmental psychopathology* (pp. 181–188). New York: Plenum.

Eisenberg, N., & Mussen, P. H. (1989). *The roots of prosocial behavior in children.* New York: Cambridge University Press.

Ellis, L. (1993). Defining social stratification in human and nonhuman animals. In L. Ellis (Ed.), *Social stratification and socioeconomic inequality* (pp. 15–35). Westport, CT: Praeger/Greenwood.

Ellsworth, P. C. (1994). Sense, culture, and sensibility. In S. Kitayama & H. R. Markus (Eds.), *Emotion and culture: Empirical studies of mutual influence* (pp. 23–50). Washington, DC: American Psychological Association.

Emde, R. N., Biringen, Z., Clyman, R. B., & Oppenheim, D. (1991). The moral self of infancy: Affective core and procedural knowledge. *Developmental Review, 11,* 251–270.

Evans, D. W., Leckman, J. F., Carter, A., Reznick, J. S., Henshaw, D., King, R. A., & Pauls, D. (1997). Ritual, habit, and perfectionism: The prevalence and development of compulsive-like behavior in normal young children. *Child Development, 68,* 58–68.

Evans, W. P., Fitzgerald, C., Weigel, D., & Chvilichek, S. (1999). Are rural gang members similar to their urban peers? Implications for rural communities. *Youth and Society, 30,* 267–282.

Fabes, R. A., Eisenberg, N., Smith, M. C., & Murphy, B. C. (1996). Getting angry at peers: Associations with liking of the provocateur. *Child Development, 67,* 942–956.

Fagan, J. F., & Singer, L. T. (1979). The role of simple feature differences in infants' recognition of faces. *Infant Behavior & Development, 2,* 39–45.

Fairbanks, L. A. (1993). What is a good mother? Adaptive variation in maternal behavior in primates. *Current Directions in Psychological Science. 2,* 179–183.

Fehr, B. (1996). *Friendship processes.* Thousand Oaks, CA: Sage.

Feingold, A. (1990). Gender differences in effects of physical attractiveness on romantic attraction: A comparison across five research paradigms. *Journal of Personality and Social Psychology, 59,* 981–993.

Feneron, R., & Jaisson, P. (1995). Ontogeny of nestmate brood recognition in a primitive ant, *Ectatomma tubercalutum* Olivier (Ponerinae). *Animal Behavior, 50,* 9–14.

Fernald, A. (1993). Approval and disapproval: Infant responsiveness to

vocal affect in familiar and unfamiliar languages. *Child Development, 64*, 657–674.

Fernald, A., Taeschner, T., Dunn, J., Papousek, M., DeBoyson-Bardles, B., & Fukui, J. (1989). A cross-language study of prosodic modifications in mothers' and fathers' speech to preverbal infants. *Journal of Child Language, 16*, 477–501.

Fiddick, L. (1998). *The deal and the danger: An evolutionary analysis of deontic reasoning.* Unpublished doctoral dissertation, University of California, Santa Barbara.

Field, T. M., Cohen, D., Garcia, R., & Greenberg, R. (1984). Mother–stranger face discrimination by the newborn. *Infant Behavior and Development, 7*, 19–25.

Field, T. M., Healy, B., Goldstein, S., & Guthertz, M. (1990). Behavior-state matching and synchrony in mother–infant interactions of nondepressed versus depressed dyads. *Developmental Psychology, 26*, 7–14.

Fincham, F. D., Beach, S. R. H., Arias, I., & Brody, G. H. (1998). Children's attributions in the family: The Children's Relationship Attribution Measure. *Journal of Family Psychology, 12*, 481–493.

Fincham, F. D., & Bradbury, T. N. (1992). Assessing attributions in marriage: The Relationship Attribution Measure. *Journal of Personality and Social Psychology, 62*, 457–468.

Fisher, H. E. (1998) Lust, attraction, and attachment in mammalian reproduction. *Human Nature, 9*, 23–52.

Fiske, A. P. (1992). The four elementary forms of sociality: Framework for a unified theory of social relations. *Psychological Review, 99*, 689–723.

Fiske, A. P. (1993). Social errors in four cultures: Evidence about the elementary forms of social relations. *Journal of Cross-Cultural Psychology, 24*, 67–94.

Fiske, A. P., Haslam, N., & Fiske, S. T. (1991). Confusing one person with another: What errors reveal about the elementary forms of social relations. *Journal of Personality and Social Psychology, 60*, 656–674.

Fiske, S. T., (1993). Controlling other people: The impact of power on stereotyping. *American Psychologist, 48*, 621–628.

Fiske, S. T., & Pavelchak, M. A. (1986). Category-based versus piecemeal-based responses. Developments in schema-triggered affect. In R. M. Sorrentino & E. T. Higgins (Eds.), *Handbook of motivation and cognition: Foundations of social behavior* (pp. 167–203). New York: Guilford Press.

Fletcher, G. J. O., Rosanowski, J., & Fitness, J. (1994). Automatic processing in intimate relationships: The role of relationship beliefs. *Journal of Personality and Social Psychology, 67*, 888–897.

Flinn, M. V., Quinlan, R. J., Decker, S. A., Turner, M. T., & England, B. G. (1996). Male–female differences in effects of parental absence on glucocorticoid stress response. *Human Nature, 7*, 125–162.

Florian, V., & Mikulincer, M. (1998). Terror management in childhood: Does death conceptualization moderate the effects of mortality salience on acceptance of different others? *Personality and Social Psychology Bulletin, 24*, 1104–1112.

Fodor, J. (1983). *The modularity of mind: An essay on faculty psychology.* Cambridge, MA: MIT Press.

Fogel, A. (1993). Parent–infant games as dynamic social systems. In K. McDonald (Ed.), *Parent–child play: Descriptions and implications* (pp. 43–69). Albany: State University of New York.

Francis, D., Kiorio, J., LaPlante, P., Weaver, S., Seckl, J. R., & Meany, M. J. (1996). The role of early environmental events in regulating neuroendocrine development: Moms, pups, stress and glucocorticoid receptors. In C. F. Ferris & T. Grisso (Eds.), *Understanding aggressive behavior in children* (pp. 318–328). New York: New York Academy of Sciences.

Freedman, D. B. (1964). Smiling in blind infants and the issue of innate vs. acquired. *Journal of Child Psychology and Psychiatry, 5*, 171–184.

Fuligni, A. J., & Eccles, J. S. (1993). Perceived parent–child relationships and early adolescents' orientation toward peers. *Developmental Psychology, 29*, 622–632.

Funk, M. S. (1996). Development of object permanence in the New Zealand parakeet *(Cyanoramphus auricaps)*. *Animal Learning and Behavior, 24*, 375–383.

Furman, W., & Robbins, P. (1985). What's the point? Issues in the selection of treatment objectives. In K. H. Rubin & J. E. Ledingham (Eds.), *Children's peer relations: Issues in assessment and intervention* (pp. 41–54). New York: Springer-Verlag.

Gallistel, C. R. (1989). Animal cognition: The representation of space, time and number. *Annual Review of Psychology, 40*, 155–189.

Garcia, J., & Koelling, R. A. (1996). Relation of cue to consequences in avoidance learning. In L. D. Houck & L. C. Drickamer (Eds.), *Foundations of animal behavior: Classic papers with commentary* (pp. 374–375). Chicago: University of Chicago Press.

Ginsberg, S. D., Hof, P. R., McKinney, W. T., & Morrison, J. H. (1993). Quantitative analysis of tuberoinfundibular tyrosine hydroxylase- and corticotropin-releasing factors–Immunoreactive neurons in monkeys raised with differential rearing conditions. *Experimental Neurology, 120*, 95–105.

Gralinski, H. J., & Kopp, C. B. (1993). Everyday rules for behavior: Mothers' requests to young children. *Developmental Psychology, 29*, 573–584.

Granger, D., Weisz, J., & Kauneckis, D. (1994). Neuroendocrine reactivity, internalizing behavior problems, and control-related cognitions in clinic-referred children and adolescents. *Journal of Abnormal Psychology, 103*, 267–276.

Graziano, W. G., Jensen-Campbell, L. A., Todd, M., & Finch, J. E. (1997). Interpersonal attraction from an evolutionary psychology perspective: Women's reactions to dominant and prosocial men. In J. Simpson (Ed.), *Evolutionary social psychology* (pp. 141–167). Mahwah, NJ: Erlbaum.

Greenberg, J., Pyszczynski, T., Solomon, S., Rosenblatt, A., Veeder, M., Kirkland, S., & Lyon, D. (1990). Evidence for terror management theory II: The effects of mortality salience on reactions to those who threaten or bolster the cultural worldview. *Journal of Personality and Social Psychology, 58*, 308–318.

Grotevant, H. D. (1998). Adolescent development in family contexts. In N. Eisenberg (Vol. Ed.), *Handbook of child psychology: Vol. 3. Social, emotional, and personality development* (pp. 1097–1149). New York: Wiley.

Grusec, J. E. (1991). Socializing concern for others in the home. *Developmental Psychology, 27*, 338–342.

Grusec, J. E., & Goodnow, J. J. (1994). Impact of parental discipline methods on the child's internalization of values: A reconceptualization of current points of view. *Developmental Psychology, 30*, 4–19.

Grusec, J. E., & Mammone, N. (1995). Features and sources of parents' attributions about themselves and their children. In N. Eisenberg (Ed.), *Review of personality and social psychology: Vol. 15. Social development* (pp. 49–73). Thousand Oaks, CA: Sage.

Gunnar, M. R. (in press). Quality of early care and buffering of neuroendocrine stress reactions: Potential effects of the developing human brain. *Preventative Medicine.*

Gunnar, M., Brodersen, L., Krueger, K., & Rigatuso, J. (1996). Dampening of behavioral and adrenocortical reactivity during early infancy: Normative change and individual differences. *Child Development, 67*, 877–889.

Gunnar, M. R., Schuder, M., Morison, S. J., Ames, E. W., & Fisher, L. (1999, April). *Stress hormone levels in adopted Romanian children: Associations with long-term institutionalization and cognitive impairment.* Paper presented at the Meeting of the Society for Research in Child Development. Albuquerque, NM.

Gustafson, G. E., Green, J. A., & Cleland, J. W. (1994). Robustness of individual identity in the cries of human infants. *Developmental Psychobiology, 27*, 1–9.

Harcourt, A. H., & de Waal, F. B. M. (1992). *Coalitions and alliance in humans and other animals.* New York: Oxford University Press.

Harlow, H. F. (1971). *Learning to love*. San Francisco: Albion.

Harris, J. R. (1995). Where is the child's environment? A group socialization theory of development. *Psychological Review, 102*, 458–489.

Harrison, A. W., Wilson, M. N., Pine, C. J., Chan, S. Q., & Buriel, R. (1990). Family ecologies of ethnic minority children. *Child Development, 61*, 347–362.

Hart, J., Gunnar, M., & Cicchetti, D. (1996). Altered neuroendocrine activity in maltreated children related to symptoms of depression. *Development and Psychopathology, 8*, 201–214.

Hastings, P. D., & Grusec, J. E. (1998) Parenting goals as organizers of responses to parent–child disagreement. *Developmental Psychology, 34*, 465–479.

Hatfield, E., & Rapson, R. L. (1996). *Love and sex: Cross-cultural perspectives*. Boston: Allyn & Bacon.

Hatfield, E., & Sprecher, S. (1995). Men's and women's preferences in marital partners in the United States, Russia, and Japan. *Journal of Cross-Cultural Psychology, 26*, 728–750.

Hazan, C., & Shaver, P. (1987). Romantic love conceptualized as an attachment process. *Journal of Personality and Social Psychology, 52*, 511–524.

Hepper, P. B., Scott, D., & Shahidullah, S. (1993). Newborn and fetal response to maternal voice. *Journal of Reproductive and Infant Psychology, 11*, 147–153.

Herman, B. H., & Panksepp, J. (1981, March 6). Ascending endorphin inhibition of distress vocalization. *Science, 211*, 1060–1062.

Hess, R. D. (1970). Social class and ethnic influences upon socialization. In P. H. Mussen (Ed.), *Carmichael's manual of child psychology* (Vol. 2, pp. 457–557). New York: Wiley.

Higley, J. D., Hopkins, W. D., Thompson, W. W., Byrne, E. A., Hirsch, R. M., & Suomi, S. J. (1992). Peers as primary attachment sources in yearling rhesus monkeys (*Macaca mulatta*). *Developmental Psychology, 20*, 1163–1171.

Hirschfeld, L. A. (1996). *Race in the making: Cognition, culture, and the child's construction of human kinds*. Cambridge, MA: MIT Press.

Hirschfeld, L. A., & Gelman, S. A. (1994). Toward a topography of mind: An introduction to domain specificity. In L. A. Hirschfeld & S. A. Gelman (Eds.), *Mapping the mind* (pp. 3–36). Cambridge, England: Cambridge University Press.

Hofer, M. A. (1987). Early social relationships: A psychobiologist's view. *Child Development, 58*, 633–647.

Hoffman, M. (1970). Moral development. In P. H. Mussen (Ed.), *Carmichael's manual of child psychology* (Vol. 2, pp. 261–359). New York: Wiley.

Hoffman, M. L. (1981). Is altruism part of human nature? *Journal of Personality and Social Psychology, 40*, 121–137.

Holden, G. M., & Miller, P. C. (1999). Enduring and different: A meta-analysis of the similarity in parents' child rearing. *Psychological Bulletin, 125*, 223–254.

Hubbard, F. O. A., & van IJzendoorn, M. H. (1991). Maternal unresponsiveness and infant crying across the first 9 months: A naturalistic longitudinal study. *Infant Behavior and Development, 14*, 229–312.

Inoff-Germain, G., Arnold, G. S., Nottelmann, E. D., Susman, E. J., Cutler, G. B., & Chrousos, G. P. (1988). Relations between hormone levels and observational measures of aggressive behavior of young adolescents in family interactions. *Developmental Psychology, 24*, 129–139.

Izard, C. E., Haynes, O. M., Chisholm, G., & Baak, K. (1991). Emotional determinants of infant–mother attachment. *Child Development, 62*, 906–917.

Jackendoff, R. (1992). *Language of the mind: Essays on mental representation*. Cambridge, MA: MIT Press.

Johnson, M. H. (1990). Cortical maturation and perceptual development. In H. Block & B. Bertenthal (Eds.), *Sensory-motor organization and development in infancy and early childhood* (pp. 145–162). Dordrecht, The Netherlands: Kluwer Academic.

Johnson, M. H. (1992). Imprinting and the development of face recognition: From chick to man. *Current Directions in Psychological Science, 1*, 52–55.

Johnson, M. H., Dziurawiec, S., Ellis, H. D., & Morton, S. (1991). Newborns' preferential tracking of face-like stimuli and its subsequent decline. *Cognition, 40*, 1–21.

Kalick, S. M., Zebrowitz, L. A., Langlois, J. H., & Johnson, R. M. (1998). Does human facial attractiveness honestly advertise health? Longitudinal data on an evolutionary question. *Psychological Science, 9*, 8–13.

Kaplan, J. R., Manuck, S. B., Fontenot, M. B., Muldoon, M. F., Shively, C. A., & Mann, J. J. (1997). The cholesterol–serotonin hypothesis: Interrelationships among dietary lipids, central serotonergic activity, and social behavior in monkeys. In M. Hillbrand & R. T. Spitz (Eds.), *Lipids, health, and behavior* (pp. 139–165). Washington, DC: American Psychological Association.

Keil, F. C. (1998). Cognitive science and the origins of thought and knowledge. In R. M. Lerner (Vol. Ed.), *Handbook of child psychology: Vol. 1. Theoretical models of human development* (pp. 341–413). New York: Wiley.

Kelley, H. H. (1979). *Personal relationships: Their structures and processes*. Hillsdale, NJ: Erlbaum.

Kelley, H. H. (1983). Love and commitment. In H. H. Kelley, E. Berscheid, A. Christensen, J. H. Harvey, T. L. Huston, G. Levinger, E. McClintock, L. A. Peplau, & D. R. Peterson (1983), *Close relationships* (pp. 265–314). New York: Freeman.

Kelley, H. H. (1984). The theoretical description of interdependence by means of transition lists. *Journal of Personality and Social Psychology, 47*, 956–982.

Kelley, H. H., Berscheid, E., Christensen, A., Harvey, J. H., Huston, T. L., Levinger, G., McClintock, E., Peplau, L. A., & Peterson, D. R. (1983). *Close relationships*. New York: Freeman.

Kelley, H. H., & Thibaut, J. W. (1978). *Interpersonal relations: A theory of interdependence*. New York: Wiley.

Kelly, M. K., Power, T. G., & Wimbush, D. D. (1992). Determinants of disciplinary practices in low-income Black mothers. *Child Development, 63*, 573–582.

Kenrick, D. T., & Simpson, J. A. (1997). In J. A. Simpson & D. T. Kenrick (Eds.), *Evolutionary social psychology* (pp. 1–20). Mahwah, NJ: Erlbaum.

Kenrick, D. T., & Trost, M. R. (1997). Evolutionary approaches to relationships. In S. Duck (Ed.), *Handbook of personal relationships: Theory, research, and interventions* (pp. 151–177). Chichester, England: Wiley.

Kiesler, S., Sproull, L., & Waters, K. (1996). A prisoner's dilemma experiment on cooperation with people and human-like computers. *Journal of Personality and Social Psychology, 70*, 47–65.

Knight, G. P., & Chao, C.-C. (1991). Cooperative, competitive, and individualistic social values among 8- to 12-year-old siblings, friends, and acquaintances. *Personality and Social Psychology Bulletin, 17*, 201–211.

Knutson, B., & Panksepp, J. (1997). Effects of serotonin depletion on the play of juvenile rats. In C. S. Carter, I. I. Lederhendler, & B. Kirkpatrick (Eds.), *The integrative neurobiology of affiliation* (pp. 475–477). New York: Annals of the New York Academy of Sciences.

Knutson, B., Panksepp, J., & Pruitt, D. (1996). Effects of fluoxetine on the play of juvenile rats. *Aggressive Behavior, 22*, 297–307.

Knutson, B., Wolkowitz, O. M., Cole, S. W., Chan, T., Moore, E. A., Johnson, R. C., Teppstra, J., Turner, R. A., & Reus, V. I. (1998). Selective alterations of personality and social behavior by serotonergic intervention. *American Journal of Psychiatry, 155*, 373–379.

Kochanska, G. (1997). Mutually responsive orientation between mothers and their young children: Implications for early socialization. *Child Development, 68*, 94–112.

Konner, M. (1982). Biological aspects of the mother–infant bond. In R.

Emde & R. H Harmon (Eds.), *The development of attachment and affiliative systems* (pp. 137-160). New York: Plenum.

Kotelchuk, M., Zelazo, P. R., Kagan, J., & Spelke, E. (1975) Infant reactions to prenatal separations when left with familiar and unfamiliar adults. *Journal of Genetic Psychology, 126,* 255-262.

Kraemer, G. W., Ebert, M. H., Schmidt, D. E., & McKinney, W. T. (1991). Strangers in a strange land: A psychobiological study of infant monkeys before and after separation from real or inanimate mothers. *Child Development, 62,* 548-566.

Krebs, J. R., & Dawkins, R. (1984). Animal signals: Mind-reading and manipulation. In J. R. Krebs & N. B. Davies (Eds.), *Behavioral ecology: An evolutionary approach* (pp. 380-402). Oxford, England: Basil Blackwell.

Kuczynski, L., & Kochanska, G. (1990). Development of children's non-compliance strategies from toddlerhood to age 5. *Developmental Psychology, 26,* 398-408.

Kuczynski, L., Kochanska, G., Radke-Yarrow, M., & Girnius-Brown, O. (1987). A developmental interpretation of young children's noncompliance. *Developmental Psychology, 23,* 799-806.

Kudo, S.-I., & Ishibashi, E. (1996). Maternal defence of a leaf beetle is not effective against parasitoids but is against pedestrian predators. *Ethology, 102,* 560-567.

Kupersmidt, J. B., DeRosier, M. E., & Patterson, C. P. (1995). Similarity as the basis for children's friendships: The role of sociometric status and withdrawn behavior, academic achievement and demographic characteristics. *Journal of Social and Personal Relationships, 12,* 439-452.

Ladd, G. W., Kochenderfer, B. J., & Coleman, C. C. (1997). Classroom peer acceptance, friendship, and victimization: Distinct relational systems that contribute uniquely to children's school adjustment. *Child Development, 68,* 1181-1197.

La Freniere, P., & Charlesworth, W. R. (1983). Dominance, attention, and affiliation in a preschool group: A nine-month longitudinal study. *Ethology and Sociobiology, 4,* 55-67.

Langlois, J. H., Roggman, L. A., Casey, R. J., Ritter, J. M., Rieser-Danner, L. A., & Jenkins, V. Y. (1987). Infant preferences for attractive faces: Rudiments of a stereotype? *Developmental Psychology, 23,* 363-369.

Langlois, J. H., & Styczynski, L. E. (1979). The effects of physical attractiveness on the behavioral attributions and peer preferences of acquainted children. *International Journal of Behavioral Development, 2,* 325-341.

Larzelere, R. E. (1996a). A review of the outcomes of parental use of nonabusive or customary physical punishment. *Pediatrics, 98,* 824-828.

Larzelere, R. E. (1996b, February). *A review of the outcomes of nonabusive or customary physical punishment.* Paper presented at the Conference on the Short and Long Term Consequences of Corporal Punishment, American Academy of Pediatrics, Elk Grove Village, IL.

Laupa, M., & Turiel, E. (1995). Social domain theory. In W. M. Kurtines & J. L. Gewirtz (Eds.), *Moral development: An introduction* (pp. 455-474). Boston: Allyn & Bacon.

Laursen, B., & Bukowski, W. M. (1997). A developmental guide to the organisation of close relationships. *International Journal of Behavioral Development, 21,* 747-770.

Laursen, B., Hartup, W. W., & Koplas, A. L. (1996). Towards understanding peer conflict. *Merrill-Palmer Quarterly, 42,* 76-102.

Lester, B. M., Hoffman, J., & Brazelton, T. B. (1985). The rhythmic structure of mother–infant interaction in term and preterm infants. *Child Development, 56,* 15-27.

LeVine, R. A. (1990). Infant environments in psychoanalysis: A cross-cultural view. In R. Stigler, R. Shweder, & G. Herdt (Eds.), *Cultural psychology: Essays on comparative human development* (pp. 454-476). New York: Cambridge University Press.

LeVine, R. A., & Campbell, D. T. (1971). *Ethnocentrism: Theories of conflict, ethnic attitudes, and group behavior.* New York: Wiley.

LeVine, R., & LeVine, S. E. (1988). Parental strategies among the Gusii of

Kenya. In R. A. LeFien, P. M. Miller, & M. M. West (Eds.), *Parental behavior in diverse societies* (pp. 27-35). San Francisco: Jossey-Bass.

Lewis, M., & Ramsay, D. S. (1995). Developmental change in infants' responses to stress. *Child Development, 66,* 657-670.

Liebowitz, M. R. (1983). *The chemistry of love.* Boston: Little, Brown.

Lin, E. (1998). *The signal value of children's voices and its effect on adults' physiological and emotional responses.* Unpublished doctoral dissertation, University of California, Santa Barbara.

Lyon, J. E., & Bugental, D. B. (1994, October). *Relational power schemas: Effects on safer sex.* Paper presented at the meeting of the Society of Experimental Social Psychology, Lake Tahoe, CA.

Lyons-Ruth, K., Alpern, L., & Repacholi, B. (1993). Disorganized infant attachment classification and maternal psychosocial problems as predictors of hostile–aggressive behavior in the preschool classroom. *Child Development, 64,* 572-585.

Maccoby, E. E. (1988). Gender as a social category. *Developmental Psychology, 24,* 755-765.

MacDonald, K. B. (1992). Warmth as a developmental construct: An evolutionary position. *Child Development, 63,* 753-773.

Main, M. (1990). Cross-cultural studies of attachment organization: Recent studies, changing methodologies, and the concept of conditional strategies. *Human Development, 33,* 48-61.

Malt, B. C. (1995). Category coherence in cross-cultural perspective. *Cognitive Psychology, 29,* 85-148.

Markman, E. M. (1992). Constraints on word learning: Speculations about their nature, origins, and domain specificity. In M. R. Gunnar & M. Maratsos (Eds.), *Minnesota Symposia on Child Psychology: Vol. 25. Modularity and constraints in language and cognition.* (pp. 59-102). Hillsdale, NJ: Erlbaum.

Mazur, A., & Booth, A. (1996). Testosterone and dominance in men. *Behavioral and Brain Sciences, 21,* 353-391.

Mazur, A., Halpern, C., & Udry, J. R. (1994). Dominant looking male teenagers copulate earlier. *Ethology and Sociobiology, 15,* 87-94.

McCullough, M. R., Rachal, K. C., Sandage, S. J., Worthington, E. L., Jr., Brown, S. W., & Hight, T. L. (1998). Interpersonal forgiveness in close relationships: II. Theoretical elaboration and measurement. *Journal of Personality and Social Psychology, 75,* 1586-1603.

McEwen, B. S. (1998). Protective and damaging effects of stress mediators. *New England Journal of Medicine, 338,* 171-179.

McGregor, H. A., Lieberman, J. D., Greenberg, J., Solomon, S., Arndt, J., Simon, L., & Pyszczynski, T. (1998). Terror management and aggression: Evidence that mortality salience motivates aggression against worldview-threatening others. *Journal of Personality and Social Psychology, 74,* 590-605.

Mehlman, J. D., Higley, J. D., Faucher, I., Lilly, A. A., Taub, D. M., Vickers, J., Suomi, S. J., & Linnoila, M. (1995). Correlation of CSF 5-HIAA concentration with sociality and the timing of emigration in free-ranging primates. *American Journal of Psychiatry, 152,* 907-913.

Miczek, K. A., & Tornatzky, W. (1996). Ethnopharmacology of aggression: Impact on autonomic and mesocorticolimbic activity. In C. F. Ferris & T. Grisso (Eds.), *Understanding aggressive behavior in children* (pp. 60-77). New York: New York Academy of Sciences.

Mischel, W., & Shoda, Y. (1995). A cognitive-affective-system theory of personality: Reconceptualizing situations, dispositions, dynamics, and invariance in personality structure. *Psychological Review, 102,* 246-268.

Moffitt, T. E. (1993). Adolescence-limited and life-course-persistent antisocial behavior: A developmental taxonomy. *Psychological Bulletin, 100,* 674-701.

Mooring, M. S., & Hart, B. L. (1997). Reciprocal allogrooming in wild impala lambs. *Ethology, 103,* 665-680.

Morelli, G. A., Rogoff, B., Oppenheim, D., & Goldsmith, D. (1992). Cultural variation in infants' sleeping arrangements. *Developmental Psychology, 28,* 604-613.

Morris, W. (Ed.). (1969). *The American heritage dictionary of the English language*. Palo Alto, CA: Houghton Mifflin.

Morton, J., & Johnson, M. H. (1991). CONSPEC and CONLERN: A two-process theory of infant face recognition. *Psychological Review, 98*, 164–181.

Mosquera, P. M. R., Manstead, A. S. R., & Fischer, A. H. (in press). The role of honor-related values in the elicitation, experience, and communication of pride, shame, and anger: Spain and the Netherlands compared. *Personality and Social Psychology Bulletin*.

Muroyama, Y. (1991). Mutual reciprocity of grooming in female Japanese macaques *(Macaca fuscata)*. *Behaviour, 119*, 161–170.

Murphy, G. L., & Medin, D. L. (1985). The role of theories in conceptual coherence. *Psychological Review, 92*, 289–316.

Murstein, B. I. (1972). Physical attractiveness and marital choice. *Journal of Personality and Social Psychology, 22*, 8–12.

Nelson, E., & Panksepp, J. (1996). Oxytocin mediates acquisition of maternally associated odor preferences in preweanling rat pups. *Behavioral Neuroscience, 110*, 583–592.

Nucci, L. (1985). Social conflict and the development of children's moral and conventional concepts. *New Directions in Child Development, 29*, 55–70.

Nucci, L., & Smetana, J. G. (1996). Mothers' concept of young children's areas of personal freedom. *Child Development, 67*, 1870–1886.

Ockleford, E. M., Vince, M. A., Layton, C., & Reader, M. E. (1988). Responses of neonates to parents' and others' voices. *Early Human Development, 18*, 27–36.

Ogbu, J. U. (1985). A cultural ecology of competence among inner-city Blacks. In M. P. Spencer, G. K. Brookins, & W. R. Allen (Eds.), *The social and affective development of Black children* (pp. 45–66). Hillsdale, NJ: Erlbaum.

Ono, T. (1996). An experimental study of victim derogation: The case of victims of ijime. *Japanese Journal of Experimental Social Psychology, 36*, 230–239.

Ostwald, P. F. (1963). *Soundmaking: The acoustic communication of emotion*. Springfield, IL: Charles C Thomas.

Palacios, J. (1990). Parents' ideas about the development and education of their children: Answers to some questions. *International Journal of Behavioral Development, 13*, 137–155.

Panksepp, J. (1993). Rough and tumble play: A fundamental brain process. In K. McDonald (Ed.), *Parent–child play: Descriptions and implications* (pp. 147–184). New York: State University of New York Press.

Panksepp, J., & Miller, A. (1996). Emotions and the aging brain: Regrets and remedies. In C. Magai & S. H. McFadden (Eds.), *Handbook of emotion, adult development, and aging* (pp. 3–26). New York: Academic Press.

Panksepp, J., Nelson, E., & Bekkedal, M. (1997). Brain systems for the mediation of social separation-distress and social-reward. *Annals of the New York Academy of Sciences, 807*, 78–100.

Panksepp, J., Siviy, S. M., & Normansell, L. A. (1985). Brain opioids and social emotions. In M. Reite & T. Field (Eds.), *The psychobiology of attachment and separation* (pp. 3–49). Orlando, FL: Academic Press.

Papousek, M., & Papousek, H. (1989). Forms and functions of vocal matching in interactions between mothers and their precanonical infants. *First Language, 26*, 137–157.

Papousek, M., & Papousek, H. (1990). Excessive infant crying and intuitive parental care: Buffering support and its failures in parent–infant interaction. *Early Child Development and Care, 65*, 117–126.

Papousek, P. (1995). Origins of reciprocity and mutuality in prelinguistic parent–child "dialogues." In I. Markova, C. F. Graumann, & K. Foppa (Eds.), *Mutualities in dialogue* (pp. 58–81). Cambridge, England: Cambridge University Press.

Parke, R. D., & Buriel, R. (1998). Socialization in the family. In N. Eisenberg (Vol. Ed.), *Handbook of child psychology: Vol. 3. Social,*

emotional, and personality development (pp. 463–562). New York: Wiley.

Parke, R. D., & Ladd, G. W. (Eds.). (1992), *Family–peer relationships: Models of linkage*. Hillsdale, NJ: Erlbaum

Parker, G. A., & Rubenstein, D. I. (1981). Role assessment, reserve strategy, and acquisition of information in asymmetric animal conflicts. *Animal Behavior, 29*, 221–240.

Parpal, M., & Maccoby, E. E. (1985). Maternal responsiveness and subsequent child compliance. *Child Development, 56*, 1326–1334.

Parrott, W. G., & Gleitman, H. (1989). Infants' expectations in play: The joy of peek-a-boo. *Cognition and Emotion, 3*, 291–311.

Pedersen, C. A., Caldwell, J. D., Jirikowski, G. F., & Insel, T. R. (1992). *Oxytocin in maternal, sexual, and social behavior*. New York: New York Academy of Sciences.

Pelligrini, A. D., & Smith, P. K. (1998). Physical activity play: The nature and function of a neglected aspect of play. *Child Development, 69*, 577–598.

Penton-Voak, J. S., Perrett, D. I., Castles, D. L., Kobayashi, T., Burt, D. M., Murray, L. K., & Minamisawa, R. (1999, June 24). Menstrual cycle alters face preference. *Nature, 24*, 741–742.

Perrett, D. I., Lee, K. J., Penton-Voak, K., Rowland, D., Yoshikawa, S., Burt, D. M., Henzi, S. P., Castles, D. L., & Akamatsu, S. (1998, August 27). Effects of sexual dimorphism on facial attractiveness. *Nature, 394*, 884–887.

Perrigo, G., Bryant, W. C., & vom Saal, F. S. (1990). A unique neural timing system prevents male mice from harming the offspring. *Animal Behaviour, 39*, 535–539.

Perry, B. D. (1994). Neurobiological sequelae of childhood trauma: PTSD in children. In M. M. Murburg (Ed.), *Catecholamine function in posttraumatic stress disorder: Emerging concepts* (pp. 233–255). Washington, DC: American Psychiatric Press.

Perusse, D. (1993). Cultural and reproductive success in industrial societies: Testing the relationship at the proximate and ultimate levels. *Behavioral and Brain Sciences, 16*, 267–322.

Phinney, J. S., Cantu, C. L., & Kurtz, D. A. (1997). Ethnic and American identity as predictors of self-esteem among African-Amerian, Latino, and White adolescents. *Journal of Youth and Adolescence, 26*, 165–185.

Phinney, J. S., Ferguson, D. L., & Tate, J. D. (1997). Intergroup attitudes among ethnic minority adolescents: A causal model. *Child Development, 68*, 955–969.

Piaget, J. (1948). *The moral judgment of the child*. Glencoe, IL: Free Press.

Pipp, S., & Harmon, R. J. (1987). Attachment as regulation: A commentary. *Child Development, 58*, 648–652.

Popik, P., & van Ree, J. M. (1991). Oxytocin, but not vasopressin, facilitates social recognition following injection into the medial preoptic area of the rat brain. *European Journal of Pharmacology, 1*, 555–560.

Power, T. G., Hildebrandt, K. A., & Fitzgerald, H. E. (1982). Adults' responses to infants varying in facial expressions and perceived attractiveness. *Infant Behavior and Development, 5*, 33–44.

Premack, D., & Premack, A. J. (1994). Moral belief: Form versus content. In L. A. Hirschfeld & S. A. Gelman (Eds.), *Mapping the mind: Domain specificity in cognition and culture* (pp. 149–168). Cambridge, England: Cambridge University Press.

Price, J., Sloman, L., Gardner, R., Gilbert, P., & Rohde, P. (1994). The social competition hypothesis of depression. *British Journal of Psychiatry, 164*, 309–315.

Putnam, F., & Trickett, P. (1997). Psychobiological effects of sexual abuse. In R. Yehuda & A. McFarlane (Eds.), *Psychobiology of posttraumatic stress disorder* (pp. 150–159). New York: New York Academy of Sciences.

Rabiner, D. L., Keane, S. P., & MacKinnon-Lewis, C. (1993). Children's beliefs about familiar and unfamiliar peers in relation to their sociometric status. *Developmental Psychology, 29*, 236–243.

Rholes, W. S., Newman, L. S., & Ruble, D. N. (1988). Understanding self

and other: Developmental and motivational aspects of perceiving persons in terms of invariant dispositions. In E. T. Higgins & R. M. Sorrentino (Eds.), *Handbook of motivation and cognition: Foundations of social behavior* (pp. 369–407). New York: Guilford Press.

Rizzo, T. A., & Corsaro, W. (1988). Toward a better understanding of Vygotsky's process of internalization: Its role in the development of the concept of friendship. *Developmental Review, 8*, 219–237.

Robarchek, C. A., & Robarchek, C. J. (1998). Reciprocities and realities: World views, peacefulness, and violence among Semai and Waorani. *Aggressive Behavior, 24*, 123–133.

Robertson, I. C. (1993). Nest intrusions, infanticide, and parental care in the burying beetle, *Nicrophorous orbicollis* (Coleoptera; Silphidae). *Journal of Zoology, 231*, 583–593.

Rogoff, B., Mistry, J., Goncu, A., & Mosier, C. (1993). Guided participation in cultural activity by toddlers and caregivers. *Monographs of the Society of Research in Child Development, 58*(8, Serial No. 236), v–179.

Rosch, E., & Mervis, C. B. (1975). Family resemblances: Studies in the internal structure of categories. *Cognitive Psychology, 7*, 573–605.

Rots, N. Y., Workerl, J. O., Sutanto, W., Cools, A. R., Levine, S., de Kloet, E. R., & Oitzl, M. S. (1995). Maternal deprivation results in an enhanced pituitary–adrenal activity and an enhanced dopamine susceptibility at adulthood. *Society for Neuroscience Abstracts, 21*, 524.

Rowell, T. E., Wilson, C., & Cords, M. (1991). Reciprocity and partner preference in grooming of female blue monkeys. *International Journal of Primatology, 12*, 319–336.

Sapolsky, R. M. (1991). Testicular function, social rank, and personality among wild baboons. *Psychoneuroendocrinology, 16*, 281–293.

Scarr, S. (1992). Developmental theories for the 1990s: Development and individual differences. *Child Development, 63*, 1–19.

Schaal, B. (1988). Olfaction in infants and children: Developmental and functional perspectives. *Chemical Senses, 13*, 145–190.

Schaal, B., Tremblay, R. E., Soussignan, R., & Susman, E. J. (1996). Male testosterone linked to high social dominance but low physical aggression in early adolescence. *Journal of the American Academy of Child and Adolescent Psychiatry, 35*, 1322–1330.

Schino, G., & Troisi, A. (1992). Opiate receptor blockade in juvenile macaques: Effect on affiliative interactions with their mothers and group companions. *Brain Research, 576*, 125–130.

Schneider, M. L. (1992). The effects of mild stress during pregnancy on birthweight and neuromotor maturation in Rhesus monkey infants (*Macca mulatta*). *Infant Behavior and Development, 15*, 389–403.

Segal, N. L. (1984). Cooperation, competition, and altruism within twin sets: A reappraisal. *Ethology and Sociobiology, 5*, 163–177.

Seligman, M. E. (1970). On the generality of the laws of learning. *Psychological Review, 77*, 406–418.

Sharpsteen, D. J., & Kirkpatrick, L. A. (1997). Romantic jealousy and adult romantic attachment. *Journal of Personality and Social Psychology, 72*, 627–640.

Shaver, P. R., & Brennan, K. A. (1992). Attachment styles and the "Big Five" personality traits: Their connections with each other and with romantic relationship outcomes. *Personality and Social Psychology Bulletin, 18*, 536–545.

Shaver, P. R., & Hazan, C. (1993). Adult romantic attachment: Theory and evidence. In D. Perlman & W. Jones (Eds.), *Advances in personal relationships* (Vol. 4, pp. 29–70). London: Jessica Kingsley.

Shepher, J. (1983). *Incest: A biosocial approach.* New York: Academic Press.

Sherif, M., Harvey, O. J., White, B. J., Hood, W. R., & Sherif, C. (1954). *Experimental study of positive and negative intergroup attitudes between experimentally produced groups: Robbers' Cave experiment.* Norman: University of Oklahoma.

Sherman, L. W., Gottfredson, D., MacKenzie, D., Eck, J., Reuter, P., & Bushway, S. (1998). *Preventing crime: What works, what doesn't, what's promising? A report to the United States Congress prepared for*

the National Institute of Justice. Washington, DC: U.S. Department of Justice, Office of Justice Programs, National Institute of Justice.

Sidanius, J., & Pratto, J. (1999). *Social dominance: An intergroup theory of social hierarchy and oppression.* New York: Cambridge University Press.

Siegel, S. J., Ginsberg, S. D., Hof, P. R., Foote, S. L., Young, W. G., Kraemer, G. W., MacKinney, W. T., & Morison, J. H. (1993). Effects of social deprivation in prepubescent rhesus monkeys: Immunohistochemical analysis of the neurofilament protein triplet in the hippocampal formation. *Brain Research, 619*, 299–305.

Silk, J. B. (1992). The patterning of intervention among male bonnet macaques: Reciprocity, revenge, and loyalty. *Current Anthropology, 33*, 318–324.

Simon, H. A. (1962). An information processing theory of intellectual development. *Monographs of the Society for Research in Child Development, 27*, 150–162.

Simpson, J. A., Gangestad, S. W., & Nations, C. (1996). Sociosexuality and relationship initiation: An ethological perspective of nonverbal behavior. In G. J. O. Fletcher & J. Fitness (Eds.), *Knowledge structures in close relationships: A social psychological approach* (pp. 121–146). Mahwah, NJ: Erlbaum.

Simpson, J. A., Rholes, W. S., & Nelligan, J. S. (1992). Support seeking and support giving within couples in an anxiety-provoking situation: The role of attachment styles. *Journal of Personality and Social Psychology, 62*, 434–446.

Smetana, J. B. (1996). Adolescent–parent conflict: Implications for adaptive and maladaptive development. In D. Cicchetti & S. L. Toth (Eds.), *Adolescence: Opportunities and challenges. Rochester Symposium on Developmental Psychopathology* (Vol. 7, pp. 1–46). Rochester, NY: University of Rochester Press.

Smetana, J. B. (1997). Parenting and the development of social knowledge reconceptualized: A social domain analysis. In J. E. Grusec & L. Kuczynski (Eds.), *Parenting and children's internalization of values* (pp. 162–192). New York: Wiley.

Smetana, J. B., & Asquith, P. (1994). Adolescents' and parents' conceptions of parental authority and personal autonomy. *Child Development, 65*, 1147–1162.

Sperber, D. (1994). The modularity of thought and the epidemiology of representations. In L. A. Hirschfeld & S. A. Gelman (Eds.), *Mapping the mind* (pp. 39–67). Cambridge, England: Cambridge University Press.

Sprecher, S. (1998). Social exchange theories and sexuality. *Journal of Sex Research, 35*, 32–43.

Sprecher, S., & Duck, S. (1994). Sweet talk: The importance of perceived communication for romantic and friendship attraction experienced during a get-acquainted date. *Personality and Social Psychology Bulletin, 20*, 391–400.

Sprecher, S., Sullivan, Q., & Hatfield, E. (1994). Mate selection preferences: Gender differences examined in a national sample. *Journal of Personality and Social Psychology, 66*, 1074–1080.

Sroufe, L. A., Bennett, C., Englund, M., Urban, J., & Shulman, S. (1993). The significance of gender boundaries in preadolescence: Contemporary correlates and antecedents of boundary violation and maintenance. *Child Development, 64*, 455–466.

Stack, D. M., & Muir, D. W. (1992). Adult tactile stimulation during face-to-face interactions modulates five-month-olds' affect and attention. *Child Development, 63*, 1509–1525.

Stauder, J. E., Molenaar, P. C., & Van der Molen, M. W. (1993). Scalp topography of event-related brain potentials and cognitive transition during childhood. *Child Development, 64*, 769–788.

Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identity and performance. *American Psychologist, 52*, 613–629.

Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African Americans. *Journal of Personality and Social Psychology, 69*, 797–811.

Steinberg, L., & Silverberg, S. B. (1986). The vicissitudes of autonomy in early adolescence. *Child Development, 57*, 841–851.

Stipek, D., Weiner, B., & Li, X. (1989). Testing some attribution–emotion relations in the People's Republic of China. *Journal of Personality and Social Psychology, 56*, 109–116.

Straus, M. A., & Gelles, R. J. (1988). How violent are American families? Estimates from the National Family Violence Resurvey. In G. T. Hotaling, D. Finkelhor, J. T. Kirkpatrick, & M. A. Straus (Eds.), *Family abuse and its consequences: New directions in research* (pp. 14–36). Newbury Park, CA: Sage.

Strayer, F. F., & Trudel, M. (1984). Developmental changes in the nature and function of social dominance among young children. *Ethology and Sociobiology, 5*, 279–295.

Suchecki, D., Mozaffrian, D., Gross, G., Rosenfeld, P., & Levine, S. (1993). Effects of maternal deprivation on the ACTH stress response in the infant rat. *Neuroendocrinology, 57*, 204–212.

Sugarman, D. R. (1983). The development of children's physical and social causal explanations. *Dissertation Abstracts International, 44*, 363.

Surra, C. A., & Longstreth, M. (1990). Similarity of outcomes, interdependence, and conflict in dating relationships. *Journal of Personality and Social Psychology, 59*, 501–516.

Susman, E. J., Inoff-Germain, G., Nottelman, E. D., Loriaux, L., Cotler, G. B., Jr., & Chrousos, G. P. (1987). Hormones, emotional dispositions, and aggressive attributes in adolescents. *Child Development, 58*, 1114–1134.

Susman, E. J., Worrall, B. K., Murowchick, E., Frobose, D. A., & Schwab, J. E. (1996). Experience and neuroendocrine parameters of development: Aggressive behavior and competencies. In D. M. Stoff & R. B. Cairns (Eds.), *Aggression and violence: Genetic, neurobiological and biosocial perspectives* (pp. 267–289). Mahwah, NJ: Erlbaum.

Sutton, J., & Smith, P. K. (1999). Bullying as a group process: An adaptation of the participant role approach. *Aggressive Behavior, 25*, 97–111.

Symons, D. (1978). *Play and aggression: A study of rhesus monkeys*. New York: Columbia University Press.

Tajfel, H. (1982). Social psychology of intergroup relations. *Annual Review of Psychology, 33*, 1–39.

Teicher, M., Ito, Y., Gloid, C., Andersen, S., Dumont, N., & Ackerman, E. (1997) Preliminary evidence for abnormal cortical development in physically and sexually abused children using EEG coherence and MRI. In R. Yehuda & A. McFarlane (Eds.), *Psychobiology of posttraumatic stress disorder* (pp. 160–175). New York: New York Academy of Sciences.

Thorne, B., & Luria, Z. (1986). Sexuality and gender in children's daily worlds. *Social Problems, 33*, 176–190.

Thornhill, R., & Gangestad, S. W. (1993). Human facial beauty: Averageness, symmetry, and parasite resistance. *Human Nature, 4*, 237–269.

Tooby, J. (1982). Pathogens, polymorphism and the evolution of sex. *Journal of Theoretical Biology, 97*, 557–576.

Tooby, J., & Cosmides, L. (1996). Friendship and the banker's paradox: Other pathways to the evolution of adaptations for altruism. *Proceedings of the British Academy, 88*, 119–143.

Tooby, J., & DeVore, I. (1987). The reconstruction of hominid behavioral evolution through strategic modeling. In W. G. Kinzey (Ed.), *The evolution of human behavior: Primate models* (pp. 183–237). New York: State University of New York Press.

Trevarthen, C. (1988). Universal co-operative motives: How infants begin to know the language and culture of their parents. In G. Jahoda & I. M. Lewis (Eds.), *Acquiring culture: Cross-cultural studies in child development* (pp. 37–90). London: Croom Helm.

Trickett, P. K., & Putnam, F. W. (1993). Impact of child sexual abuse on females: Toward a developmental, psychobiological integration. *Psychological Science, 4*, 81–87.

Trivers, R. (1974). Parent–offspring conflict. *American Zoologist, 14*, 249–264.

Tronick, E. Z. (1989). Emotions and emotional communication in infants. *American Psychologist, 44*, 112–119.

Turiel, E. (1998). The development of morality. In N. Eisenberg (Vol. Ed.), *Handbook of child psychology: Vol. 3. Social, emotional, and personality development* (pp. 863–932). New York: Wiley.

Turiel, E., & Davidson, P. (1986). Heterogeneity, inconsistency, and synchrony in the development of cognitive structures. In I. Levin (Ed.), *Stage and structure: Reopening the debate* (pp. 106–143). Norwood, NJ: Ablex.

Udry, J. R., & Talbert, L. M. (1988). Sex hormone effects on personality and puberty. *Journal of Personality and Social Psychology, 54*, 291–295.

Vallee, M., Mayo, W., Dellu, F., & Le Moal, M. (1997). Prenatal stress induces high anxiety and postnatal handling induces low anxiety in adult offspring: Correlation with stress-induced corticosterone secretion. *Journal of Neuroscience, 17*, 2626–2636.

Van Hasselt, V. B., Morrison, R. L., Bellack, A. S., & Hersen, M. (Eds.). (1988). Overview. In V. B. Van Hasselt, R. L. Morrison, A. S. Bellack, & M. Hersen (Eds.), *Handbook of family violence* (pp. 3–8). New York: Plenum.

van IJzendoorn, M. H. (1995). Adult attachment representations, parental responsiveness, and infant attachment: A meta-analysis of the predictive validity of the Adult Attachment Interview. *Psychological Bulletin, 117*, 387–403.

Wadhwa, P. D., Dunkel-Schetter, C., Chicz-Demet, A., Porto, M., & Sandman, C. A. (1996). Prenatal psychosocial factors and the neuroendocrine axis in human pregnancy. *Psychosomatic Medicine, 58*, 432–446.

Wainryb, C., & Turiel, E. (1994). Dominance, stratification, and concepts of personal entitlements in cultural context. *Child Development, 65*, 1701–1722.

Walker, P. L. (in press). Is the battered-child syndrome a modern phenomenon? *Proceedings of the European Meeting of the Paleopathology Association*.

Washburn, R. W. (1929). A study of the smiling and laughing of infants in the first year of life. *Genetic Psychology Monographs, 6*, 403–537.

Wehner, R., & Srinivasan, M. V. (1981). Searching behavior of desert ants, genus *Cataglyphis* (Formicidaw, Hymenoptera). *Journal of Comparative Physiology, 142*, 315–338.

Wekerle, C., & Wolfe, D. A. (1999). Dating violence in mid-adolescence: Theory, significance, and emerging prevention initiatives. *Clinical Psychology Review, 19*, 435–456.

Westermarck, E. (1922). *The history of human marriage*. New York: Allerton.

White, J. W., & Koss, M. P. (1991). Courtship violence: Incidence in a national sample of higher education students. *Violence and Victims, 6*, 247–256.

Wilkinson, G. (1988). Reciprocal altruism in bats and other mammals. *Ethology and Sociobiology, 9*, 85–100.

Wilson, M., & Daly, M. (1994). The psychology of parenting in evolutionary perspective and the case of human filicide. In S. Parmigiani & F. S. von Saal (Eds.), *Infanticide and parental care* (pp. 73–134). London: Academic Publishers.

Wolf, A. P. (1995). *Sexual attraction and childhood association: A Chinese brief for Edward Westermarck*. Stanford, CA: Stanford University Press.

Yau, J., & Smetana, J. G. (1996). Adolescent–parent conflict among Chinese adolescents in Hong Kong. *Child Development, 67*, 1262–1275.

Yee, M. D., & Brown, R. (1992). Self-evaluations and intergroup attitudes in children aged three to nine. *Child Development, 63*, 619–629.

Youniss, J. (1980). *Parents and peers in social development*. Chicago: University of Chicago Press.

Youniss, J. (1986). Development in reciprocity through friendship. In C.

Zahn-Waxler, E. Cummings, & R. Iannottee (Eds.), *Altruism and aggression* (pp. 88–106). New York: Cambridge University Press.

Zahn-Waxler, C., Robinson, J. I., & Emde, R. N. (1992). The development of empathy in twins. *Developmental Psychology, 28,* 1038–1047.

Zebrowitz, L. A., Brownlow, S., & Olson, K. (1992). Baby talk to the babyfaced. *Journal of Nonverbal Behavior, 16,* 143–158.

Zebrowitz, L. A., Kendall-Tackett, K. A., & Fafel, J. (1991). The influence of children's facial maturity on parental expectations and punishments. *Journal of Experimental Child Psychology, 52,* 221–238.

Zlochower, A. J., & Cohn, J. F. (1996). Vocal timing in face-to-face interaction of clinically depressed and nondepressed mothers and their 4-month-old infants. *Infant Behavior and Development, 19,* 371–374.