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Evolutionary Perspectives on Social Cognition

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INTRODUCTION

Social cognition evolved. This statement seems simple and uncontroversial enough. After all, social cognition is a product of biological structures (brain and body), and “nothing in biology makes sense except in the light of evolution” (Dobzhansky, 1964, p. 449). It was not until relatively recently, however, that an evolutionary perspective began to gain real traction within the field of social psychology. Over the past few decades, application of evolutionary theory to the understanding of psychological phenomena has taken off, emerging in a wide number of specialty and flagship journals (Webster, 2007). Database searches for terms like “evolution” show that in primary social psychological sources, even the 2000s represent a twofold increase in appearance over the 1990s. This Handbook is a good example – no previous incarnation of the *Handbook of Social Cognition* featured a chapter on evolutionary perspectives. Perhaps Kenrick, Schaller, and Simpson (2006, p. 2) summarized it best:

> Once upon a time, social cognition represented a relatively small and austere little niche in the study of social behavior. Today, it hardly makes sense to treat social cognition as a specialized domain of inquiry or to separate the study of social cognition from the study of psychology more broadly… .The same trajectory now characterizes the evolutionary perspective on social psychology.

The growth and acceptance of the evolutionary perspective on human sociality has not followed an easy progression. Early applications of sociobiology (the precursor of evolutionary psychology) to humans were met with strong resistance. Following the publication of his landmark *Sociobiology: The New Synthesis* (1975), of which only the final of 27 chapters was devoted to humans, the eminent biologist E. O. Wilson was harangued by scholars within and outside of his own department (in one example, Wilson had water poured on his head by a protestor during a conference) (Wilson, 1995). Even today, misunderstandings exist (e.g., Buller, 2005; but see Barrett, Frederick, Haselton, & Kurzban, 2006; Cosmides, Tooby, Fiddick, & Bryant, 2005; Kenrick, 1995). (For a review of the “standard” objections to evolutionary psychology, including issues of automaticity, learning, cultural variation, and interpretive errors such as the naturalistic fallacy and concerns about theoretical falsifiability, see Confer et al., 2010; Conway & Schaller, 2002; Kenrick, Ackerman, & Ledlow, 2003; Neuberg, Kenrick, & Schaller, 2010; Symons, 1992.) Thus, it may help to begin this chapter by establishing a general understanding of an evolutionary perspective within psychology. Following this, we highlight how this perspective carves social cognition at different conceptual joints than has traditionally been the case. Finally, we consider how a recent synthesis of evolutionary and developmental perspectives – scaffolding theory – can help to frame the emergence of linkages between specific social cognitive processes over the course of an individual's as well as a species' history.

An evolutionary perspective

At its core, an evolutionary perspective is a collection of specialized principles united by the common theme of adaptive design. How we think, feel, act, and exist is the result of selective forces that, over long periods of time, have shaped the body and mind to promote effective propagation of those same design features. To properly account for the outcomes of this process, an evolutionary perspective must be goal-based, engineering-focused, and interactionist in principle. As a *goal-based perspective*, the many mental adaptations studied by evolutionary researchers are initially considered to provide solutions to fine-grained, specific goals which themselves serve the "end" goal of differential reproduction. This goal framework reinforces the notion that cognition is for action (e.g., Morsella, Bargh, & Gollwitzer, 2008). Viewing the regularities and biases of social cognition as potential adaptations provides insight into why those features might exist as well as how to study them.

Typically, an evolutionary analysis also requires an *engineering focus*. For instance, Tooby and Cosmides (1992) detail five central components of such an analysis: investigators should identify an adaptive target (a proposed biologically successful outcome), background conditions (a description of the relevant ancestral environment in which the mental feature likely emerged), a design (a detailed depiction of the components and boundaries of the feature), a performance examination (how the feature acts in the world and the outcomes it produces), and a performance evaluation (an assessment of how well the design has met the adaptive target). This process can help to determine whether a particular mental construct is likely to be an adaptation. An engineering focus also highlights the historical constraints that restrict existing adaptations from achieving optimal functionality.

Finally, as is apparent from this analysis, an evolutionary perspective necessitates an *interactionist approach*. Selection acts on phenotypes (e.g., bodies, behaviors), which emerge as a result of gene–environment interactions. Although an evolutionary perspective is commonly misunderstood as advancing the idea of inevitable and immutable traits, evolutionary theories recognize the importance of *epigenetic* influences on development which occur after birth in response to the specific contingencies of one's environment (see Table 23.1). Epigenetic alterations are particularly important in the face of rapid environmental change; in some species they have been known to dramatically alter both the phenotype and the genotype within a single generation (Gottlieb, 1998; Weber & Depew, 2003). For all species, including humans, adaptations arose to solve problems within specific contexts, and therefore they are at least somewhat sensitive to intrapersonal, interpersonal, and cultural contexts. These contexts provide the critical information and affordances to which people respond (Gibson, 1979; McArthur & Baron, 1983). In sum, "nothing about humans could possibly be immune from developmental intervention" (Tooby & Cosmides, 1992, p. 80).

Unlike many psychological approaches, an evolutionary perspective connects humans to the rest of the biological world. Evolution affects all organisms. Indeed, hypotheses about humans are often drawn from observing the behavior of other species, and this comparative research has demonstrated both connections across species and the species-specific nature of human cognition and behavior relative to that of other animals. For instance, work on the social behavior of other primates has improved our understanding of human morality (de Waal, 2006) as well as shown the universality of biases and states such as loss aversion and cognitive dissonance (Chen, Lakshminaryanan, & Santos, 2006; Egan, Santos, & Bloom, 2007). With respect to loss aversion, a large amount of research suggests that people overweight losses relative to equivalent gains (e.g., Tversky & Kahneman, 1991), and thus prefer to avoid situations where losses could be incurred. Monkeys show the same tendencies. Given the choice between one piece of apple and two pieces of apple from which one piece was always removed prior to the transaction (making the expected value of each choice equal), capuchin monkeys strongly prefer the single apple offers (Chen et al., 2006). They dislike incurring the "loss," even though the end result is identical across choices. The presence of such sophisticated biases in "economic" reasoning within distantly related primates has shed new theoretical light on evolved unconscious cognitive and motivational processes in humans (Bargh & Morsella, 2008); as a consequence, these are now being looked for, and detected, in young children for the first time (see, e.g., Dunham, Baron, & Banaji, 2008).

Although an understanding of human as animal is true of certain other research approaches (e.g., using rats and pigeons as models for human behavior), and has historically been important within the broader field of psychology (Darwin, 1872; James, 1890/1950; McDougall, 1926), many researchers had moved away from this position before the advent of sociobiology and evolutionary psychology. For instance, Maslow

Table 23.1 Glossary of terms

Term	*Definition*	*Example*
Affordance	Informational relationship between individual and environment, specifically the utility offered by an external cue for a perceiver	A smiling person affords possible friendship; a growling lion affords potential injury
Costly signaling	Demonstrations (behavioral, physical) of fitness quality that occur at a cost and thus are relatively "honest" signals	Wearing expensive items shows the possession of and (likely) ability to acquire resources
Differential parental investment	Cost of producing and rearing offspring dictates mating-related selectivity	Women tend to be romantically choosier than men
Epigenetic factors	Influences on gene expression that occur without altering the genotype	Resource scarcity, toxin exposure, operational sex ratio
Genotype	Genetic makeup (specific alleles) of an individual	
Inclusive fitness	Combination of individual fitness with fitness produced by providing for genetic relatives	People often allocate support to relatives proportional to their relatedness
Loss aversion	Tendency to overweight and thus prefer avoiding losses relative to making equivalent gains	People may show twice as much negativity to a $5 price increase as they do happiness to a $5 price discount
Ontogeny	Developmental trajectory of organisms over the life span	
Phenotype	Observable characteristics of an individual, including (internal and external) morphology and behavior	Height, eye color, posture, language
Phylogeny	Evolutionary history of a species, especially in terms of ancestral relations to other species	
Scaffolding	Referring to connections between mental structures (concepts, goals) that emerge from ontogenetic or phylogenetic processes	Physical warmth (temperature) and social warmth (trust) are mentally associated
Sexual selection	Process focusing on traits that promote success at intrasexual competition and intersexual mate choice, often at a cost to survival-related fitness	Sexual dimorphisms, costly signaling

(1943, p. 392) claimed in his seminal work on motivation, "It is no more necessary to study animals before one can study man than it is to study mathematics before one can study geology or psychology or biology." Instead, an evolutionary perspective provides a meta-theory that helps to integrate research from a diverse range of fields that speak to social cognitive processes, from psychology to anthropology to economics.

ADAPTIVE SOCIAL COGNITION

Research using an evolutionary perspective has demonstrated how a wide span of social cognitive processes are tuned to produce functional solutions to adaptively important goals. Much of this research falls into two structural bins: lower-order perception effects and higher-order interpersonally relevant processing. Within these bins, many of the standard topics in social cognition – accuracy and bias, attention and memory, categorization, person perception, stereotypes, emotion, theory of mind, and so on – have been reframed in an evolutionary light. Such processes address goals at multiple levels of analysis (e.g., proximal, developmental), but the general focus of most evolutionary research has been on providing answers to the question of the ultimate function, or biological adaptiveness, of cognitive structures (Kenrick, Griskevicius, Neuberg, & Schaller, 2010; Tinbergen, 1963).

That is, what is this process good for? Why does it exist? How might it have aided a person over the course of evolutionary time? This latter question is critical, because although cognitive processes are likely to have been adaptive when they emerged in the ancestral past, it is also likely that relatively recent ecological and cultural changes have created environments in which some of these processes no longer maintain the same adaptive value. Thus, evolutionary researchers typically pursue questions of historical function, and of the related issue of historical contingency (i.e., Do features exist as they do simply because their evolution has been constrained by what previously existed?).

A focus on function does not imply that mental adaptations produce perfect outcomes. Changes in environments over time can lead to errors in information processing. People also make errors even in situations that match ancestrally relevant problems. Researchers have traditionally regarded such problems as the result of improperly applied heuristics or as motivated by a desire to enhance proximate feelings of self-esteem (e.g., Greenberg et al., 1993; Kahneman, Slovic, & Tversky, 1982; Miller & Ross, 1975). However, many error-generating cognitive biases are entirely consistent with, and in fact predicted by, an evolutionary approach. Factual accuracy is not necessarily the goal of natural selection. Instead, biases should arise wherever they promote more functional outcomes for basic adaptive problems. This notion is detailed by *error management theory* (EMT), which suggests that cognitive biases are often not flaws, but design features that improve responses under uncertainty (Haselton & Buss, 2000; Haselton & Nettle, 2006; see also Ackerman, Shapiro, & Maner, 2009; Gigerenzer & Goldstein, 1996; Goldstein & Gigerenzer, 2002; Nesse, 2005). EMT considers information processing as a signal detection problem, and points out that false-negative and false-positive judgments or decisions may actually aid people's fundamental goal pursuit. When judgments are uncertain, people may err on the side of overinclusiveness (a false-positive bias) or underinclusiveness (a false-negative bias). Though it may seem that both errors are substandard outcomes, uncertainty will inevitably produce errors, and thus it pays for people to exhibit the "correct" form of bias. EMT describes the evolutionary pressures that led to particular directions of bias as, on average, a function of minimizing the more adaptively costly errors.

For example, people may overweight public self-relevant information as in the case of the spotlight effect. In this effect, people presume their actions are more salient to others than is true (Gilovich, Medvec, & Savitsky, 2000; Savitsky, Epley, & Gilovich, 2001). Strictly speaking, such beliefs can be considered to be errors (e.g., involving anchoring and adjustment), but the *direction* of these errors suggests that they may also be adaptive solutions to uncertainty. Public self-relevant information is critically important to one's place in a social group, and thus giving this information more weight than it deserves may encourage people to maintain their social affiliations by adhering to group norms and self-censoring deviant behavior. In another example of error management, people tend to underweight signals of forgiveness after committing transgressions (Friesen, Fletcher, & Overall, 2005). Doing so may encourage stronger, and more effective, reconciliation attempts than would otherwise occur. In sum, oversensitivity to reputational information and undersensitivity to forgiveness information may help prevent consequences that could be deadly in ancestral environments, such as ostracism and aggression (Baumeister & Leary, 1995; Haselton & Nettle, 2006). Thus, social cognitive biases should be viewed in terms of their ultimate, adaptive effects, and not whether they represent logical or "accurate" ways of thinking.

Highlighting adaptive function in this way shifts the conceptual frame typically applied to social cognition. It suggests that classic formulations – those that organize the mind according to process or mental structure – might (unintentionally) present commonalities between processes or structures that evolved for quite distinct purposes. For example, understanding how emotion works in general is a worthwhile pursuit, but different emotions serve (and likely arose to serve) very different functions; thus, we might predict that particular emotions are somewhat different in both what they do *and* how they do it. The same may be true of most classic social cognitive constructions, including stereotypes, social comparisons, and so on (e.g., Todd, Hertwig, & Hoffrage, 2005). The mental gerrymandering in which we typically engage, although useful, may interfere with an understanding of the mind as a toolbox for solving specific types of problems. It is important to point out that answering questions of function has historically been integral to research on human cognition (e.g., James, 1890/1950). The modern advent of sociobiology and evolutionary psychology has given this problem-based approach the theoretical spotlight. To shine in this spotlight, then, we might first want to answer: What problems might cognitive processes have evolved to solve?

Fundamental social domains

There are innumerable goals that humans pursue on a day-to-day basis, yet the vast majority of these are representative of a set of fundamental social goals. In fact, these fundamental goals themselves filter down into one primary purpose – facilitating differential reproduction. Reproduction, and the reproductive fitness of offspring, is the final cause (in the Aristotelian sense) of social cognition. (Readers unfamiliar with this approach should note that this problem of differential reproduction, along with those discussed below, is ultimate in nature and not necessarily what a person would explicitly or even implicitly report.) Considering all aspects of social cognition as (potentially) feeding into this one primary purpose illuminates research questions that would otherwise go unasked, and reshapes our understanding of how and how well cognition works. Of course, there are many steps that people take to address this purpose. A number of researchers have attempted to organize these steps into functional domains of social life (e.g., Ackerman & Kenrick, 2008; Bugental, 2000; Buss, 1999; Fiske, 1992; Kenrick, Li, & Butner, 2003; Kenrick et al., 2010). Such organizations share a great deal of commonality (good for those theorists positing universal mechanisms), allowing us to consider social cognitive processing from the standpoint of relatively few adaptive functions. These domains include interpersonal aggression (enacting and reacting to physical threats), disease avoidance (protecting oneself from contagious agents), mating (selecting, attracting, and keeping romantic partners), status (power and prestige considerations), affiliation (managing social connections), and inclusive fitness (managing relationships with biologically related others). These fundamental domains, which we now review, incorporate most of the common problems a person might encounter in social situations.

Interpersonal aggression

The domain of interpersonal aggression refers to the ways in which people physically threaten and are threatened by others. Much of the social cognitive work in this domain has investigated responses to direct or indirect threat cues. Perhaps the most commonly studied direct threat cue is the angry expression. A large literature suggests that people are especially attuned to the presence of angry individuals, and respond by devoting a high degree of cognitive resources to these individuals. This is true from a very early age, as infants rapidly visually discriminate anger and respond with functionally appropriate negative behaviors (e.g., Serrano, Iglesias, & Loeches, 1995). As adults, people also find it difficult to disengage their visual attention from angry faces, and they exhibit enhanced memory for such faces (e.g., Ackerman, Shapiro, Becker, Neuberg, & Kenrick, 2011; Fox et al., 2000; Jackson, Wu, Linden, & Raymond, 2009; Öhman, Flykt, & Esteves, 2001). These patterns are especially strong in high-anxiety individuals or individuals primed with other cues to threat (e.g., Fox, Russo, Bowles, & Dutton, 2001), suggesting that the goal to avoid harm sensitizes (and perhaps oversensitizes) people to potential dangers. Interestingly, identification of anger is quicker when it appears on male faces than on female faces (Becker, Kenrick, Neuberg, Blackwell, & Smith, 2007). This effect appears to be due to the evolution of the physical structure of male and female faces, and not existing gender stereotypes. Specialized attunement to male anger may be quite functional, as men are more likely to inflict physical damage on others (Vivian & Langhinrichsen-Rohling, 1994), and more likely to engage in extreme aggressive thinking (e.g., homicidal fantasies) (Buss, 2005; Kenrick & Sheets, 1993).

Indirect safety threats can take many forms, but evolutionary accounts have largely focused on group membership as a cue to the presence or absence of potential threat. Humans are naturally group-forming creatures (Baumeister & Leary, 1995; Caporael, 1997), and the group boundaries we create afford other people relevance for our fundamental goals. That is, the interpersonal interactions that mattered most to individuals' evolutionary outcomes (e.g., mate selection, reciprocal exchange, negotiation of status hierarchies) historically occurred within coalitional groups. This is still largely true today (Fiske, 1992). We are also more interdependent and empathetic with these "in-group" members. Indeed, when faced with safety threats, in-group members band together, increasing the likelihood of in-group prosocial behavior (e.g., Griskevicius et al., 2006; Van Vugt, De Cremer, & Janssen, 2007). Because of the outcomes these close ties allow, in-group interactions necessitate more complex inferences than interactions with out-group members.

Whereas in-group members afford us a variety of potential benefits, over evolutionary time, out-group members have typically not. As a result, out-group membership serves as an easy cue to potential threat (this is true even if the base rate of threats is higher within in-groups). Consistent with this idea, people heuristically associate many out-group members with harm (e.g., Becker et al., 2010; Cottrell & Neuberg, 2005; Eberhardt, Goff, Purdie, & Davies, 2004; Faulkner, Schaller, Park, & Duncan, 2004; Navarrete et al., 2009; Trawalter, Todd, Baird, & Richeson, 2008). People also more readily perceive intentions of threat in out-group members (Maner et al., 2005), especially when primed by cues to danger such as ambient darkness (Schaller, Park, & Mueller, 2003). Out-group members may also frequently be the targets of cognitions that facilitate aggression, such as dehumanization (e.g., Bandura, Underwood, & Fromson, 1975; Harris & Fiske, 2006).

Out-group membership often has been operationalized in terms of racial differences (in fact, race is not itself a "natural" category, but a proxy for group membership; Kurzban, Tooby, & Cosmides, 2001), but can be indicated by religious, cultural, gender, and many other individual differences as well. Combinations of group cues also may produce particular functional relevancies (e.g., Black men are more associated with physical threat than Black women; Navarrete, McDonald, Molina, & Sidanius, 2010). Indirect threat cues become especially powerful in their effects on cognition when accompanied by direct threat cues. For instance, subliminally priming images of guns and knives leads White perceivers to visually attend more to Black men (Eberhardt et al., 2004). Angry expressions can amplify memory for Black men, even countering cognitive processing deficits typically found for out-group members (Ackerman et al., 2006; also see Becker et al., 2010). At an evaluative level, although people's judgments of stimuli typically contrast away from extreme examples (Schwarz & Bless, 1992), White individuals viewing angry Black men assimilate the perceived threat to other, non-angry Black faces (Shapiro, Ackerman, Neuberg, Maner, Becker, & Kenrick, 2009). Such findings highlight the functional tuning of a number of cognitive processes – by devoting more resources to the processing of potential safety threats, people are likely better able to track and respond to (and less likely to miss) these dangers.

Disease avoidance

Interpersonal aggression is not the only safety-related danger associated with social interaction. People are also carriers of contagious diseases. This is not simply due to the advent of large, modern societies. Disease-causing organisms have been a recurrent problem throughout human evolutionary history (Gangestad & Buss, 1993; Low, 1990). People, therefore, likely acquired specific cognitive strategies for managing disease-relevant cues (Gangestad, Haselton, & Buss, 2006; Kurzban & Leary, 2001; Park, Faulkner, & Schaller, 2003; Zebrowitz & Collins, 1997). Although these strategies should produce somewhat similar responses to those in the physical safety domain, there are important differences. For example, the emotion of disgust functions in the service of disease avoidance (Tybur, Lieberman, & Griskevicius, 2009), and is seen in reaction to targets associated with disease, whereas anger is generally not (Cottrell & Neuberg, 2005). The relatively indirect and invisible nature of disease transmission suggests that people may be especially likely to over-perceive or over-react to a wide variety of cues (Haselton & Nettle, 2006; Kurzban & Leary, 2001; Li, Ackerman, White, Neuberg, & Kenrick, 2011; Tybur, Bryan, Magnan, & Caldwell Hooper, 2011). That is, although people may have developed some lay theory of contagion (probably mediated by physical contact), the uncertain and constantly changing nature of disease threats would promote heuristic avoidance responses to many cues that are actually not indicative of contagion.

Indeed, people associate a large number of physical and behavioral abnormalities with disease (e.g., Park, Schaller, & Crandall, 2007; Schaller, Park, & Faulkner, 2003; Zebrowitz, Fellous, Mignault, & Andreoletti, 2003). For example, people attend to but show decreased preference for others with unusual facial features such as birthmarks, scars, and other asymmetries (e.g., Ackerman et al., 2009; Grammer & Thornhill, 1994; Kurzban & Leary, 2001). (Such asymmetries may in fact be indicative of early-life exposure to disease agents [Thornhill & Gangestad, 1993].) When primed with other cues to disease, people also become more suspicious of out-group members (who may be carriers of diseases to which perceivers have not developed immunity), infer less extraversion and openness in themselves (which can inhibit interpersonal contact), and behaviorally avoid others (e.g., Heinemann, Pellander, Vogelbusch, & Wojtek, 1981; Houston & Bull, 1994; Mortensen, Becker, Ackerman, Neuberg, & Kenrick, 2010). A number of other yet-untested formulations of classic social cognitive constructs may emerge from a motivation to avoid disease.

Mating

A large portion of research taking an evolutionary approach has focused, to some degree, on the topic of mating. It is clear why – differential reproduction represents the primary end of the evolutionary game. However, mating processes are also linked by Darwin's other major theory, sexual selection. Sexual selection suggests that heritable traits that promote competitive success for mates will be selected, even if they negatively affect survival (Darwin, 1871). Thus, people may take risks, spend themselves into the poorhouse, or even kill each other as a function of (ultimate, unconscious) reproductive pressures (e.g., Daly & Wilson, 1983, 1988; Miller, 1998, 2000).

Within the broad domain of mating, several unique types of problems exist (Miller & Todd, 1998). People must select, attract, and retain romantic partners. Selection, as with all forms of judgment and decision making, involves evaluation of relevant criteria and determination that those criteria pass some threshold of acceptability. There is broad agreement about the criteria that are important for "good" mating decisions (e.g., most people want romantic partners who are kind, trustworthy, intelligent, and likable), but much research has also examined sex differences in the qualities people desire in mates (Buss, 1989; Li, Bailey, Kenrick, & Linsenmeier, 2002; Schmitt, 2005). This work has consistently shown that women tend to prefer status and resource-acquisition potential in potential mates more than men do, whereas men tend to prefer indicators of physical attractiveness and fecundity more than women do (e.g., Buss, 1989; Buss & Barnes, 1986; Buunk, Dijkstra, Fetchenhauer, & Kenrick, 2002; Li et al., 2002). Generally, women are more selective than men in the qualities they judge to be romantically acceptable (Buss & Schmitt, 1993; Kenrick, Sadalla, Groth, & Trost, 1990). This discrepancy is explained by the principle of parental investment, which stresses that in any sexual species marked by differential investment in offspring, the sex that invests more will be choosier in selecting mates (Trivers, 1972). In people, women spend more physiological resources to produce eggs than men do to produce sperm and women spend more time rearing children; thus, women are romantically choosier. Of course, degree of choosiness also depends on the type of relationship, or mating strategy, people pursue (Gangestad & Simpson, 2000). When looking for long-term, committed partners, men and women often look for similar qualities, though when looking for short-term partners (a situation that exaggerates the costs of choosing poorly) women tend to be somewhat pickier than men (Buss & Schmitt, 1993; Clark & Hatfield, 1989; Kenrick et al., 1990; Li & Kenrick, 2006).

The ways in which people attract and retain romantic partners extend these patterns of evaluation. Because parental investment leads women to be choosier than men, women often play the role of selector and men often play the role of selectee (Miller, 1998). In terms of mate quality (reproductive potential), everyone is not created equal, and thus men typically compete to be selected (Buss, 1988; Geary, Vigil, & Byrd-Craven, 2004). This competition can be direct, through combat or ritualized events, but it commonly takes the form of *costly signaling*. Such signals require significant investment and are designed (at a functional level) to demonstrate the quality of a particular man over and above that of other men. Think peacock tails (although in men we see other forms of conspicuous consumption, such as sports cars and picking up the check at meals.) When presented with mating-relevant cues, men exhibit increased attention to attractive women as well as correspondingly riskier judgments, less conformity, more creativity, and a variety of other cognitive changes that act as costly signals (e.g., Griskevicius, Cialdini, & Kenrick, 2006; Griskevicius et al., 2007; Maner et al., 2003; Miller, 2000; Van den Bergh, Dewitte, & Warlop, 2008). In some instances, men may be motivated to pursue more rapid romantic commitment (Ackerman, Griskevicius, & Li, 2011), and they may even begin to think cooperatively in order to overcome the romantic thresholds that women (utilizing their own forms of cooperation as a method of quality control) set (Ackerman & Kenrick, 2009).

Once a romantic couple forms, people's cognition shifts to a mate-retention mindset. This produces increased attentional focus on desirable members of the same sex (to ward off potential interlopers), paired with a reduction in attraction to the opposite sex (to reduce the potential of straying). A host of additional defensive strategies also come on-line (e.g., Buss & Shackelford, 1997; Campbell & Ellis, 2005; Maner, Gailliot, Rouby, & Miller, 2007; Maner, Rouby, Gonzaga, 2008; Shackelford, Goetz, & Buss, 2005; Simpson, Gangestad, & Lerma, 1990). These kinds of empirical findings highlight the importance of romantic concerns at an ultimate, if not a proximate level, and indicate that many outcomes beyond simple direct mating decisions are influenced by mating-related cognition.

Status

The drive for power and prestige within social groups is a hallmark of all societies (Barkow, 1989; Brown, 1991; Eibl-Eibesfeldt, 1989). The motivation to acquire status likely stems from the natural tendency for human groups to form dominance hierarchies (indeed, this is true of all group-living primates), and for higher-ranking members of those hierarchies to prosper (for a more detailed review of status-based processes, see Fiske, 2010). In fact, attaining status can result in greater interpersonal influence (Miller, Collins, & Brief, 1995), material resources (Cummins, 1998), and self-esteem (Tesser, 1988), as well as decreases in stress-related health problems (Adler, Epel, Castellazzo, & Ickovics, 2000; Cummins, 2008). Objective status is thus certainly valuable, but even perceiving relatively high levels of status can produce many of these benefits independent of actual status (Cummins, 2008).

It is no surprise, then, that people possess a number of cognitive adaptations that facilitate status seeking. For example, many of the positive illusions people exhibit, from unrealistic optimism to a heightened sense of personal control, likely function by encouraging successful actions, promoting the signaling of high-quality traits, and buffering against failures (Campbell, 1986; Haselton & Nettle, 2006; Weinstein, 1980). These illusions act as forms of self- and other-deception that can aid people faced with status challenges (Cummins, 2008; von Hippel & Trivers, 2011). Competing motivations to maintain group membership may help to constrain unrealistic status perceptions within groups, however (Anderson, Srivastava, Beer, Spataro, & Chatman, 2006). Other cognitions motivated by status seeking include legitimizing perceptions of rigid social structures (Sidanius & Pratto, 2001), the desire for leadership (Van Vugt, Hogan, & Kaiser, 2008), and preferences for the use of particular social exchange rules (Ackerman & Kenrick, 2008; Fiske, 1992). Interestingly, the manner in which our minds are shaped by status ambitions may depend on the stability of one's status position. We might expect that status attainment is associated with competitive thoughts, and indeed, people who acquire high status act competitively (or selfishly) when status hierarchies are unstable. However, when one's position is relatively safe, high-status individuals instead behave more cooperatively, focusing on group goals (Maner & Mead, 2010).

Although women gain a number of social and material benefits by elevating their power and prestige, men gain a unique benefit from rising in the status hierarchy – an increase in mating attractiveness. As mentioned earlier, status confers romantic desirability on men to a much stronger degree than it does on women (Baize & Schroeder, 1995; Buss, 1989; Li et al., 2002). Thus, the advertisement of status by men is largely a function of sexual selection pressures. Men therefore are more attuned than women to potential losses of status (Daly & Wilson, 1988; Gutierres, Kenrick, & Partch, 1999). This cross-domain benefit of status suggests that status cognitions overlap with mating cognitions, at least for men. For example, men who perceive a higher proportion of males relative to females in their environment (a cue to mating competition) respond by mentally discounting the future and accepting more risk in their decisions (a status-relevant outcome) (Griskevicius, Tybur, Ackerman, Delton, & Robertson, in press). The same is not true for women. We might expect similar forms of overlap in other situations that cue mating and status.

Affiliation

People everywhere desire to form social groups (Baumeister & Leary, 1995; Caporael, 1997; Leary & Cox, 2007). In-group relationships afford a number of benefits – safety, romance, direction in uncertain situations – and thus people attempt to manage those social connections using a variety of rules, incentives, and cognitive biases. Perhaps the best-known decision rule that helps to maintain effective group functioning is reciprocal altruism (Axelrod & Hamilton, 1981; Trivers, 1971). From an evolutionary perspective, cooperation between unrelated individuals is a puzzle (Why help others if it doesn't help my own genes?), but reciprocal altruism ensures that many interactions will involve relatively equal exchanges (Clark, Mills, & Powell, 1986; Fiske, 1992; see also Cosmides & Tooby, 1992). Indeed, many in-group relationships are reciprocal in nature (Ackerman & Kenrick, 2008; van Lange, 1999; Van Vugt & van Lange, 2006). The notion that people (and many other animals; Trivers, 1971) are inclined towards exchanges that are often time delayed and content varying requires the use of particular social cognitive abilities. People must remember their interaction partners, and they must be able to calculate the abstract value of exchange goods and services. Additionally, people need to be on the lookout for free riders – those trying to cheat the system by drawing physical or social resources without adequate repayment (Price, Cosmides, & Tooby, 2002; Yamagishi, 1986). Although social norms help to reduce cheating behavior, people have evolved specialized mechanisms for detecting cheaters in social exchanges (e.g., Cosmides, 1989) and for responding negatively to exchange violations (e.g., Fehr & Gächter, 2002).

The fundamental nature of the goal for social connection is acutely made by research on threats to one's place in a group – the problem of social exclusion. Forms of exclusion (rejection, ostracism, being ignored) are hugely impactful on individuals, producing an array of negative consequences on judgment, self-control, emotion, and mental health (Baumeister & Leary, 1995; Williams, 2007a, 2007b). For example, after being excluded, people feel pain (Eisenberger, Lieberman, & Williams, 2003), exhibit deficits in intelligent thought and the ability to self-regulate appropriately (Baumeister & DeWall, 2005), and experience aspects of emotional numbness (DeWall, Baumeister, & Masicampo, 2009). When given the opportunity, people also display a compensatory motivation to make connections with new and old interaction partners. For instance, excluded people conform more to others' opinions (Williams, Cheung, & Choi, 2000), form more positive impressions of and desires to interact with new people (Maner, DeWall, Baumeister, & Schaller, 2007), and spend money in the service of identifying with others (Mead, Baumeister, Stillman, Rawn, & Vohs, 2011). These patterns make functional sense. Over evolutionary time, exclusion would have been tantamount to a death sentence, and thus people should possess mechanisms that are especially sensitive to exclusion. Thus, people are attuned to cues of potential rejection, like averted gaze (Wirth, Sacco, Hugenberg, & Williams, 2010), and they may also over-respond by anthropomorphizing animals and objects after exclusion (Epley, Waytz, & Cacioppo, 2007). One important cognitive mechanism that helps to regulate social connections is self-esteem. Instead of representing a domain-general evaluative mechanism as it has traditionally been considered, it may be that self-esteem evolved as an indicator of one's level of acceptance in social groups (Leary, Tambor, Terdal, & Downs, 1995; also see Kirkpatrick, & Ellis, 2001).

Inclusive fitness

The domain of inclusive fitness refers to the manner in which people manage relationships with biologically related others. Biological kinship involves a different type of interpersonal tie, characterized by unique psychological mechanisms, than the typical affiliative relationship (Park & Ackerman, 2011). Overlapping genetic structure can itself create an incentive to interact prosocially, if genes for altruism are shared between kin. Thus, the typical (cooperative) decision rule active among related individuals is a function of the cost to oneself relative to the benefit to the other, multiplied by the probability that the relevant gene is shared (Hamilton, 1964). Higher degrees of relatedness often lead to higher degrees of help, in terms of social support (Kivett, 1985), physical safety (Daly & Wilson, 1998), economic inheritance (Smith, Kish, & Crawford, 1987), and even willingness to rush into a burning building to save someone (Burnstein, Crandall, & Kitayama, 1994). However, a high degree of relatedness also often leads to lowered sexual attraction in order to minimize genetic problems with incest (Ackerman, Kenrick, & Schaller, 2007; Fessler & Navarrete, 2004).

These forms of processing do not necessitate many of the cognitive requirements of strategies like reciprocal altruism, but they do require a means of distinguishing kin from non-kin, and closer kin from less close kin. In humans, perceived similarity, familiarity (especially co-residence during childhood), and maternal perinatal association (seeing one's mother caring for an infant from birth) all may act as signals of relatedness (DeBruine, 2005; Lieberman, Tooby, & Cosmides, 2007; Park, Schaller, & Van Vugt, 2008). When such cues are present, people may be over-inclusive, mentally representing unrelated others using kin-based psychological mechanisms (Park & Ackerman, 2011; Shepher, 1971; Westermarck, 1921). This can support outcomes such as surrogate parenting by unrelated individuals (stepparents, friends, elders, etc.), a behavior that, interestingly, has historically been performed more often by women than men. Kinship over-inclusion is also a likely contributor to "implicit egotism" effects in which liking of and identification with others (as well as with occupations and places to live) is often based merely on superficial similarities such as sharing initials or birthdays (Cohen, Garcia, Apfel, & Master, 2006; Jones, Pelham, Carvallo, & Mirenberg, 2004).

An interesting extension of inclusive fitness involves parent–offspring conflict (Godfray, 1995; Trivers, 1974). Functional, gene-level goals sometimes differ for children and parents, producing tensions over issues of resource investment (e.g., how much and for how long children should be supported), prosocial vs egotistic behavior, and even the decisions children make as adults. For instance, parents often attempt to exert direct or indirect influence over the romantic choices their children make, and these attempts typically stress a different set of mate qualities than children prefer (Buunk, Park, & Dubbs, 2008; Dubbs & Buunk, 2010). In sum, inclusive fitness as a domain of inquiry represents an important, but understudied, window into social cognition.

Domain-specific and domain-flexible cognitive processing

An evolutionary perspective suggests specific ways in which information relevant to functional problems, such as those that arise within fundamental domains, is likely to be processed. Solutions to a given problem are thought to entail the use of distinct, or modular, computational mechanisms that are relatively independent of those used to address other functional problems (Barrett & Kurzban, 2006; Kurzban & Aktipis, 2007; Santos, Hauser, & Spelke, 2002; Sherry & Schacter, 1987; Sperber, 2001; Tooby & Cosmides, 1992). For instance, people use different decision rules and memory procedures to manage language learning, food aversion, facial memory, and spatial location. This modularity involves specificity of processing (e.g., which inputs relate to which functions) but it does not necessarily imply fixed at birth or completely encapsulated responses. Organisms typically possess a number of open-ended mental programs that draw on environmental information to shape those mechanisms' development (Mayr, 1976), or "fill the tank" (consider that cars, which are specialized to accept gasoline as input, can also run on vegetable oil). This information is often fitted to species-specific ecological tasks. For example, rats, which have poor vision and rely on taste and smell to find food at night, easily condition aversions to novel tastes but not to novel visual stimuli (Garcia &

Koelling, 1966). Although commonly misunderstood as "less evolved" than closed programs (which are fixed), open programs are clearly adaptive. Creatures would simply not last long if they were unable to respond to the changing requirements of dynamic environments. People may have an even greater degree of flexibility than many animals in the kinds of information that they apply to particular functional problems, but some degree of processing specificity still exists. We rarely see people trying to make friends with shrubbery or compete for status with sandwiches.

Despite the general lack of one-upmanship between person and lunch, a significant amount of flexibility exists in how domain-relevant information is processed and applied. Cognitive systems may be designed to manage novelty (Flinn, 2006; Gangestad et al., 2006; Miller, 2000) or cast a wide net in terms of which stimuli are perceived as relevant (Bargh, Green, & Fitzsimons, 2008; Haselton & Nettle, 2006), and the biases these systems produce can appear to apply beyond the problems for which they evolved. Consider two examples. From an evolutionary perspective, a mating motivation is designed to promote the search for suitable romantic partners, which, for humans, includes only other humans. However, the decision rules that direct evaluation of suitable mating characteristics may affect a broader set of evaluations. One such characteristic is peak life stage (broadly, time of maximal fecundity). Studies show that an active mating goal causes preferential attunement to targets representing a peak stage of development, such as women in early adulthood but not as toddlers or older adults (Huang & Bargh, 2008). Demonstrating the wide net this motivation may cast, mating-primed peak preference also occurs for other living targets, including bananas and flowers, but not for inorganic objects such as cars.

Another example of flexible processing involves the manner in which people think about their friends. Friendship is a functionally different form of relationship than is biological kinship in that we are not genetically related to our friends. Yet, friends experience many kinship-relevant psychological cues such as prosociality, attitudinal similarity, and self–other overlap (e.g., Park & Schaller, 2005; Park et al., 2008). For a number of reasons, women may experience many of these cues more strongly than men, which may increase the probability that women sometimes view friends as akin to family members (Ackerman et al., 2007). Indeed, women's responses to friends on two important kinship indicators (disgust in response to sexual activity and nepotistic benevolence) suggest that they may process friends using the same mechanisms as those used to process kin (Ackerman et al., 2007; Park & Ackerman, 2011). Consistent with this, in their work on "befriending" in response to stress, Taylor and colleagues suggest that friendship processes "may have piggybacked onto the attachment-caregiving system" employed in kinship interactions (Taylor et al., 2000, p. 412).

These two examples, peak attunement and friendship processing, demonstrate that the inputs considered relevant for a particular cognitive system may extend beyond the domain for which that system evolved. Along similar conceptual lines, emerging work in the fields of social cognition and neuroscience suggests that open-ended systems might allow for cognitive connections to emerge between seemingly different domains of processing. In the next section, we review the ideas underlying this research and suggest that the cross-modular development of the mind can be explained by one particular perspective – scaffolding theory.

A SCAFFOLDED MIND

An understanding of the human social world requires, and historically has required, great cognitive flexibility. How might people manage the novel information to which they are continually exposed? One possibility is by "fitting" this new information to existing knowledge structures. This process of conceptual integration is the hallmark of *scaffolding* (Williams, Huang, & Bargh, 2009). In architecture, scaffolding refers to supporting physical structures used to shape and construct buildings (we might also think of physical foundations as being a form of scaffolding). This imagery can also be applied to mental structures. In the mind, scaffolding refers to the utilization of primitive (foundational, pre-existing) concepts as the basis for the development of derived (later) conceptual knowledge. This process may be one of active construction, as when parents provide contextual support for language learning (Cazden, 1983; Wood, Bruner, & Ross, 1976), but the focus of much recent work, and our review here, is on the passive, unintentional co-opting of primitive mental structures. In particular, existing work suggests that a key source for primitive concepts involves knowledge of the physical world (Shepard, 1984, 2001; Tooby & Cosmides, 1992), whereas a key source for derived concepts involves more abstract knowledge, including our understanding of the social world. It is clear why – people, and other organisms, must interact with the physical world before they are able to make use of social information. This is of course an overgeneralization, but it remains essentially true. Newborns encounter a host of physical, sensory inputs before developing the mental capacities to understand complex social interactions (Mandler, 1992).

Scaffolding is an experiential process, but its roots extend into the natural history of humans and biological organisms more generally. In fact, our use of the terms *primitive* and *derived* is itself co-opted from the literature on anatomical evolution. In this literature, a derived feature is a physical structure (e.g., a wing) that is adapted from a pre-existing structure (e.g., an arm). As Mayr (1960, p. 377) pointed out, "The emergence of new structures is normally due to the acquisition of a new function by an existing structure . . . the resulting 'new' structure is merely a modification of a preceding structure." The evolutionary development of mental structures likely proceeded in a similar fashion (Bargh & Morsella, 2008; Buss, Haselton, Shackelford, Bleske, & Wakefield, 1998; Kenrick et al., 2010; Panksepp, 2004). More recent mental systems – designed to manage new, recurrent and species-specific needs – were not fashioned out of whole cloth, but built in part from existing materials. These pre-existing structures therefore would have established the groundwork (by analogy, a schema) for the processing of information in novel domains, and likewise set constraints on how the derived structure could function (of course, some modification would necessarily occur in order for the new cognitive system to be adaptive; Wakefield, 1999). Psychologically, then, information processing within a derived domain should retain many of the hallmarks of information processing within the relevant primitive domain. This process of recruiting previously evolved mental systems can be referred to as *phylogenetic scaffolding* (Williams et al., 2009).

Phylogenetic scaffolding is likely widespread throughout the human mind. Over evolutionary time, all organisms have faced certain basic, critical goals – for example, finding and processing food, avoiding predation or environmental damage, and reproduction. As species evolved, some developed more complex social (and psychological) systems. These systems required new ways of managing information, but they also relied on many of the same information-processing mechanisms. The social world is largely physical, after all. Thus, when people deal with interpersonal and intrapersonal psychological issues – e.g., How do I know if she is a good person? How do I know if I'm a good person? – how these issues are addressed is in part influenced by mechanisms that existed previously. This influence could occur simply through constraint of how derived mental mechanisms function (e.g., use of only certain inputs), through recruitment of pre-existing neural regions, or some other process (Anderson, 2007a, 2010). Such questions remain to be answered, but we expect that no one answer is universally true.

In comparison to phylogenetic scaffolding, the application of (primitive) concepts that are experienced over the course of human development to later-experienced information (derived concepts) is referred to as *ontogenetic scaffolding* (Williams et al., 2009). Through ontogenetic scaffolding, basic sensorimotor experiences encountered over the course of development serve as a foundation for understanding later, more abstract concepts. Much of the work supporting the idea of ontogenetic scaffolding, and our focus here, again involves the passive process of utilizing early physical knowledge in the service of later abstract knowledge. This form of scaffolding may recruit phylogenetic linkages, and it may also involve relatively domain-general physical concepts (e.g., sensations) that support integration of higher-level concepts (e.g., beliefs, impressions).

How ontogeneic scaffolding might work is a hotly contested question at present (see Anderson, 2010; Barsalou, 1999; Boroditsky & Ramscar, 2002; Hurley, 2008; Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005). Generally, research has tended to support the idea that abstract mental tasks recruit brain regions associated with sensorimotor functioning (e.g., thinking about verbs/actions activates motor control areas and thinking about nouns/objects activates vision areas; Damasio & Tranel, 1993). The same is likely true for higher-order cognition, as we describe below.

At least two models strongly make the case for sensorimotor processing serving as the primitive feature on which abstract (and social) processing is scaffolded. One of these, the "neural exploitation hypothesis," suggests that because cognition is for action, thinking about things (simulation) requires activation of action-related brain regions (Gallese, 2008; Gallese & Lakoff, 2005). This occurs because, just as the premotor system functions to control and structure perception and action patterns, the premotor system (becomes decoupled from these procedures and then) is used to control and structure later-arising social cognitive procedures (Gallese, 2008). As Anderson (2010) describes it, people develop schemas through experiences with objects and events that guide actions related to those objects and events. The components of these schemas are used to construct concepts that have some (broadly defined) functional relation to elements of the prior experiences. A second model, the "shared circuits model," provides a more complex, hierarchical construction of feedback loops that are predicated on sensorimotor processes and facilitate social cognitive processing (e.g., mindreading) (for details, see Hurley, 2008). Additional possible models exist, however. For instance, certain emerging theories in neuroscience highlight the re-use of previously existing neural structures, and some of these go beyond the re-use of sensorimotor mechanisms (e.g., Anderson, 2007b, 2010; Dehaene & Cohen 2007).

In the following empirical review, we focus on the contribution of sensorimotor processing to more abstract social processing. This conceptualization of scaffolding suggests the primacy of physical processing over social processing, which we believe characterizes much of the recent embodied cognition work and is generally consistent with evolutionary history (others have seen things differently; e.g., Ostrom, 1984). This should not be taken to mean that social cognition is in any way less important than non-social cognition. Humans are fundamentally a social species, perhaps more so than any other. This fact may argue that people necessarily possess a high degree of specialized, un-scaffolded mental structures for processing the social world; however, it could likewise suggest that a means of facilitating social cognition (through scaffolding) might be an especially important adaptation for humans.

Our claim is not that physical processing can account for the sophisticated nature of *all* human social processing; rather, scaffolding advances our understanding of the development and consequences of this conceptual integration when it does occur. A scaffolding approach also may be uniquely powerful in helping to explain the role of incidental influences on both social judgments and decisions, as well as on goal pursuit. Moreover, it can provide a framework with which to predict domains where these connections are likely to occur. Below, we concentrate on research that employs priming methods to demonstrate such physical and social associations. Because links between primitive and derived structures are often retained, priming methods can be especially useful in revealing these underlying structural connections (Bargh & Chartrand, 2000).

Scaffolded concepts

Work in the realm of embodied social cognition is quite varied, but a representative sample has focused on the manner through which tactile sensory experiences make associated concepts more mentally accessible. Consider the tactile dimension of warmth–coldness, a fundamental object property (Lederman & Klatzky, 1987) and also a fundamental component of interpersonal evaluation (Asch, 1946; Fiske, Cuddy, & Glick, 2007). The conceptual understanding of interpersonal warmth (i.e., trust, helpfulness) may be scaffolded on the sensation of physical warmth because early-life experiences with physical warmth were often manifested during times of care and trust, such as infant–mother contact (Bowlby, 1969; Harlow, 1958). If so, later contact with warm objects should conceptually prime trust and helpfulness. Indeed, in one study, people who briefly held a cup of hot coffee were more likely to rate another person as socially warm than were people who held a cup of iced coffee (Williams & Bargh, 2008). In a second study from this paper, briefly touching a heated therapeutic pad (as opposed to a cold therapeutic pad) increased the likelihood that participants would choose to give a gift to their friends rather than take it for themselves. It also appears that similar neural regions are involved in processing physical and social warmth (Meyer-Lindenberg, 2008). For instance, during an economic trust ("dictator") game, touching a warm product increased people's willingness to sacrifice their own immediate gains for potential future shared profits with a partner, and this increase was mediated by activation in insula (Kang, Williams, Clark, Gray, & Bargh, 2011). Indeed, the same specific region of insula became activated following physical cold temperature sensation as well as after betrayals of trust (i.e., social coldness) in the economics game (Kang et al., 2011, Study 2).

In addition to temperature, there are three other fundamental object-related properties about which people acquire knowledge – weight, texture, and hardness (Lederman & Klatzky, 1987). Evidence suggests that unique abstract concepts are scaffolded onto these properties as well. Physical weight (heaviness) appears to be associated with importance and seriousness, physical texture (roughness) with difficulty and argumentativeness, and physical hardness with evaluative rigidity. In several studies, people holding heavy clipboards judged job candidates as being more seriously interested in the position, viewed currency as having more value, and engaged in more cognitive elaboration during preference formation tasks (Ackerman, Nocera, & Bargh, 2010; Jostmann, Lakens, & Schubert, 2009). In other studies, touching rough puzzles made social interactions seem less coordinated and effortless, whereas touching hard objects (and even sitting in hard chairs) led people to view others as both more stable and strict, and themselves to engage in more rigid negotiations (Ackerman et al., 2010). Such findings demonstrate how tactile sensorimotor experiences may serve as the conceptual foundation for (facilitating understanding of) derived, abstract knowledge. We have suggested a speculative reason why aspects of social warmth would be commonly tied to physical warmth (cueing infant–caretaker closeness), and the same may be true for other tactile forms of scaffolding (e.g., important things generally are physically heavier, the friction caused by physical roughness makes movement more difficult, hard things are inherently rigid). However, important questions remain as to whether these, and other, scaffolded links are themselves adaptive.

Scaffolded goal pursuit

Much of the research into scaffolded cognition has focused on conceptual linkages. Emerging research, though, suggests that scaffolding may also be implicated in goal-related processes (Williams et al., 2009). A goal is a mental representation of a desired end state, including the means through which to attain that end state (Aarts & Dijksterhuis, 2000; Bargh, 1990; Kruglanski et al., 2002). Mental representations of goals are distinguishable from concepts through their abilities to turn on, persist in activation through a delay, and deactivate following achievement of the end state (Fishbach & Ferguson, 2007). Through scaffolding, one goal may act as a primitive and one as a derived goal such that the activation, operation, and completion of one goal may influence pursuit of the other goal (Williams et al., 2009). Thus, pursuit of one goal may inform progress of the other, linked goal.

Some basic evidence supports the association of physical and social goal processing. For instance, Zhong and Leonardelli (2008) show that participants who recall being socially excluded (an experimental manipulation that threatens affiliation goals; Park & Maner, 2009) rate the ambient temperature of their room as colder compared to participants who do not recall being socially excluded. Both neural regions and genes that process social affiliation threats also appear to overlap with those that process physical pain (Eisenberger, Lieberman, & Williams, 2003; Way, Taylor, & Eisenberger, 2009). For example, social rejection can trigger feelings of physical numbness (DeWall & Baumeister, 2006), which has been identified as a defensive mechanism in the human body to minimize distress from physical injury. If we presume that goal processes which serve social rejection concerns are scaffolded on goal systems that respond to physical pain (see also MacDonald & Leary, 2005), management of pain goals also may interfere with management of rejection goals.

Consistent with this possibility, ingesting a physical painkiller (Tylenol [acetaminophen]) can decrease both affective and neural reactions to social rejection (DeWall et al., 2010). In another set of studies, socially excluded individuals were found to have an increased need for affiliation, but this need disappeared (i.e., was apparently satisfied) if they had briefly held something warm following the exclusion experience (Bargh & Shalev, in press). Furthermore, even simulating physically safe experiences can interrupt people's goal-driven responses to social rejection, specifically by reducing experienced negative affect as well as intentions to behave prosocially (Huang, Ackerman, & Bargh, 2011).

Another example of goal scaffolding involves the processing of physical and moral contagion. Concerns about physical contagion stem from the fundamental desire to avoid disease transmission. The desired end state of contagion goals involves avoiding physical impurities (social indicators of which are discussed above), and the means through which to attain this state include specific avoidance behaviors and emotions such as disgust (Rozin & Fallon, 1987; Rozin, Millman, & Nemeroff, 1986). Interestingly, concerns about *moral* contagion involve similar outcomes (avoiding moral impurities) attained by similar means (avoidant actions, felt disgust) (Haidt, 2007; Rozin et al., 1999). Consider the moral euphemisms of a "dirty player" who cheats at a game or of "washing away one's sins." Again, we should expect that scaffolding will set the stage for goal-related actions at one level to interfere with goal pursuit at another level. Typically, people judge unethical acts quite negatively. Deliberating on such acts can elicit a desire for physical cleanliness, and engaging in physical cleaning actions can make moral offenses appear less wrong and actually interrupt the goal to restore one's own moral purity (Schnall, Benton, & Harvey, 2009; Zhong & Liljenquist, 2006). The nature of this physical and moral scaffolding may even be specific to the motor modality involved. Verbal offenses trigger a desire to clean the mouth but not the hands, and written offenses trigger a desire to clean the hands but not the mouth (Lee & Schwarz, 2010). It is not yet known whether actual interruptions of social goal pursuits by physical means are modality-specific in this way.

FUTURE DIRECTIONS

Scaffolding

A number of open questions remain regarding a scaffolded view of the human mind. For instance, to what extent are metaphoric priming effects dissociable from pure semantic priming effects? Semantic priming can account for many metaphoric priming effects through the hypothesized process of ontogenetic scaffolding, such that the original physical concept (e.g., hardness) acquires additional, analogous meanings over the course of one's experiences. The process would be similar to that of stereotype formation and eventual automatization. As stereotypes form, the original group-differentiating information (e.g., skin color, gender, age) becomes associated over time with additional group-related content (e.g., stereotypic group qualities gleaned passively from the media, parents, peers, other cultural sources). With sufficient use of the stereotype representation, the new meanings eventually become co-activated with the old in an all-or-none fashion (Devine, 1989; Hayes-Roth, 1977). In this way, the (more concrete) features that activated the original concept (e.g., physical hardness) now also activate the accrued (more abstract) features as well (e.g., decreased willingness to compromise).

There is no reason why embodied grounding or metaphoric priming effects must all have the same underlying cause. There may well be multiple causes: semantic priming may be responsible for some types of connections, possibly hard/soft or rough/smooth, but not be as necessary in the production of others, such as warm/cold, which are supported by specific anatomical connections (Kang et al., 2011). It is here that developmental research on infants and toddlers (pre-verbal children), as well as on non-human primates, would be especially useful in distinguishing between possible innate, early-experience, and semantic priming accounts of physical-to-psychological influences (see Dunham et al., 2008). If these physical influences on social judgments and behavior are found in children who have not yet developed complex semantic knowledge, or in other primates, this would favor an innate or scaffolding account over a semantic priming interpretation. We consider such developmental-comparative approaches as critical for future investigations of the scaffolded human mind.

Reconceptualizing social cognition

The domain-oriented approach espoused by evolutionary perspectives represents a shift from traditional phenomenon- or process-oriented approaches to social cognition. Cognitive structures previously examined in terms of process (i.e., how they work) may be fruitfully re-examined in terms of function (i.e., why they work). One prime candidate for functional reappraisal is the self-construct. The self, and various processes related to the self (e.g., self-esteem, self-enhancement, self-control, self-consistency), are standard topics within social cognition (e.g., Bandura, 1989; Brewer, 1991; Kihlstrom & Klein, 1994). Such aspects of the self-concept are typically considered quite broadly in their function, even when the self is divided into multiple component structures such as good selves, bad selves, ought selves, and ideal selves (Markus & Nurius, 1986).

Yet, from an evolutionary perspective, component selves cannot be generally good or bad, but only good or bad *for some purpose*. The notion of a coherent, singular self makes even less sense (Bargh & Huang, 2009; Kurzban & Aktipis, 2007). Different aspects of the self likely arose for different purposes, and at different times. Indeed, this evolutionarily derived, function-driven perspective has been applied to multiple aspects of mental life that have traditionally been considered under the aegis of the self, including self-representations (Kurzban & Aktipis, 2007), beliefs (von Hippel & Trivers, 2011), motivations (Bargh & Huang, 2009; Tetlock, 2002), and phenomenal states associated with consciousness (Morsella, 2005). Similar conclusions might be drawn about other traditional concepts, such as contrast and assimilation effects (Shapiro et al., 2009). Across various functional domains, these phenomena may exhibit important differences of process and outcome, suggesting that we may wish to view the mind first in terms of function and only then in terms of process.

Reconsidering how the conceptual joints of social cognitive research are carved offers other intriguing implications. The very term *unconscious* has been used in social cognition, and cognitive science more generally, primarily to refer to effects that occur when a person is unaware of the presence of a stimulus, thus operationalizing "unconscious" processes in terms of what the mind can do with subliminally presented stimuli (e.g., Dehaene, Changeux, Naccache, Sackur, & Sergent, 2006; Loftus & Klinger, 1992). That same term, however, has long been used in evolutionary theory to refer to the *unintended* aspects of a process, which were assumed to involve supraliminal, not subliminal stimuli. Darwin (1859) used the term "unconscious" (Freud was only 3 at the time) when describing how farmers and stockbreeders produced larger ears of corn and fatter sheep by implicitly following the laws of natural selection. Moreover, Dawkins (1976) wrote of nature as the "blind watchmaker, the unconscious watchmaker," stressing that there was no intentional guiding hand in producing complex, evolved designs (see also Bargh & Morsella, 2008; Buss et al., 1998; Dennett, 1991, 1995). Limiting (theoretically) the powers of unconscious influence to how the mind can handle subliminally presented stimuli is a conceptual mistake, as it confuses the operational definition of an unconscious process with the actual scope or domain of its operation (Bargh, 1992; Morsella & Bargh, in press). It also puts a conceptual roadblock in the way of appreciating the role of the unconscious over evolutionary time periods, because it is difficult to understand why such a supposedly sophisticated system would be adapted merely to process rarely-if-ever occurring subliminal-strength stimuli. After all, natural selection shaped the human unconscious over the eons through experience with normal, supraliminal stimuli, not subliminal stimuli.

CONCLUSION

Recent decades have seen a rapid expansion in interest in applying an evolutionary perspective to questions of social cognition. We expect that this trend will continue. Evolutionary approaches are especially interesting to people wishing to connect human cognition with the rest of the biological world, and they help answer the call for "bigger picture" theorizing in the field of psychology (e.g., Bargh, 2006; Conway & Schaller, 2002; Kruglanski, 2001). Any number of novel hypotheses may be spawned by explicitly considering social cognition in terms of adaptive problems rather than traditional constructs. After all, "Is it not reasonable to anticipate that our understanding of the human mind would be aided greatly by knowing the purpose for which it was designed?" (Williams, 1966, p. 16). However, we do not expect evolutionary psychology to become an encapsulated research area within psychology more generally. It is simply a metatheoretical approach to situating psychological effects and to hypothesis generation, and as such, must be integrated with other metatheoretical approaches to explain social cognitive (and other) phenomena at multiple levels of analysis. This process is now well underway (e.g., Gangestad et al., 2006; Kenrick et al., 2010; Low, 1998; Norenzayan, Schaller, & Heine, 2006).

The notion of scaffolding, along with other models of mental derivation, may facilitate the understanding of higher-order cognitive processes across these multiple analytical levels. We hope that these models will help to integrate evolutionary theorizing with the increasingly expanding field of embodied cognition. The accuracy of such models remains to be determined, of course, but it is inescapable that how we think about ourselves and others is in large part a product of our species' evolutionary history. This recognition should bring a sense of satisfaction to all psychologists desirous of connecting their work to the other natural sciences. But it should also excite those who appreciate the new light that an evolutionary perspective can shed on the fundamental questions of social cognition.

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