Attachment and Cooperation in Religious Groups: An Example of a Mechanism for Cultural Group Selection

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Bowlby proposed that "the psychological problem of ensuring persistent co-operative behaviour" in groups was solved by emotional valuation of the group leader, group policy, or the group itself derived from the infant-mother attachment relationship. He described how an emotionally valued relationship with a group leader, which is rooted in early attachments, can motivate an individual to cooperate for the benefit of the group. Bowlby's insights, studies of attachment relationships with a deity, and the application of multilevel and group selection to cooperation in religious groups together show how attachment to a deity (supernatural agent) could be a mechanism for intragroup cooperation, including the within-group cooperation required for group selection. As such, it links the attachment system, a pillar of human relationships and personality, to cooperation in groups. We also consider how the attachment system could be a basis for intragroup cooperation generally and compare this possibility to two other theories about human social cooperation, the "tribal social instincts" hypothesis and the evolution of "shared intentionality."

Religious groups have been very successful, appearing in human societies from ancient to modern times. One factor in the success of religious groups is cooperation within the group that benefits the group. The theme of cooperation in groups and group-beneficial behavior appears across a wide variety of discussions of the biological foundations of religion (Alcorta and Sosis 2005; Atran and Norenzayan 2004; Boyer 2001; Boyer and Bergstrom 2008; Bulbulia 2004; Haidt 2007; Hinde 1999; Irons 2001; Johnson and Bering 2006; Kirkpatrick 2005; Norenzayan and Shariff 2008; Rappaport 1999; Ruffle and Sosis 2006; Watanabe and Smuts 1999; Wilson 2002; Winkelman 2004). These include a range of views on whether group-beneficial behaviors could be adaptive and, if so, what kind of selection is at play, for example, individual or cultural group selection. All have an interest in a fundamental question: how does cooperation in religious groups arise?

This paper describes how the attachment system could provide a mechanism for cooperation in religious groups, a mechanism that could also function for group selection of religious groups. The attachment system is based on the early relationship between infant and mother (or similar caregiver) and the dynamics of this relationship throughout the life cycle (Bowlby 1969, 1982). Our proposal is derived from an early work by Bowlby on "the psychological problem of ensuring persistent co-operative behaviour" in groups (Bowlby 1946, 62). He described how an emotionally valued relationship between a member and a group leader, group, or group policy could engender cooperative behavior in the group. The capacity for emotional valuation was rooted in the earliest relationship, between child and mother. Here, Bowlby's discussion of how to ensure intragroup cooperation is extended to religious groups, with a focus on the role of the deity, one of the most salient phenomena in religions.

Bowlby's (1946) discussion of cooperation was directed toward an array of cultural institutions other than religion: nations, the Tennessee Valley Authority, the British army, bureaucracies, and so forth. Here, we extend his argument, exploring how the attachment system might function as a mechanism for intragroup cooperation or group selection generally. We comment briefly on related thoughts regarding infant-

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parent (nurturant) relationships or attachment (Boehm 1999*b*; Eibl-Eibesfeldt 1996), supernatural punishment (Johnson and Bering 2006),"tribal social instincts" (Richerson and Boyd 2001), and "shared intentionality" (Moll and Tomasello 2007). This broader perspective complements recent interpersonal studies on attachment, group processes, and leaders (Davidovitz et al. 2007; Marmarosh et al. 2006; Mayseless and Popper 2007; Mikulincer and Shaver 2007). An underlying theme is that the adult capacity to become emotionally involved with others, and therefore to want to cooperate with them, is the common developmental outcome of an innate capacity for attachment and the attachment process. This capacity can help engender cooperation that is beneficial for the group.

Evolution of Cooperation

Woven throughout discussions of cooperative behavior in religious groups is the larger question of how cooperation itself evolves (Johnson and Bering 2006; Wilson 2002). This question arises from the seminal problem of how cooperation between individuals, or altruism, could ever evolve when cooperation exacts a cost, or decreased fitness, to the self as it provides a benefit to an other. Research on this problem encompasses cooperation within species; cooperation between species; transitions to new levels of individuality, such as those from genes to chromosomes or from unicellular to multicellular organisms; and individual as well as group selection or multilevel selection (Hammerstein 2003; Lehmann and Keller 2006; Nowak 2006; Wilson and Wilson 2007). Nowak (2006) modeled the evolution of cooperation via five mechanisms: kin selection, direct reciprocity, indirect reciprocity, network reciprocity, and group selection. Nowak concluded: "we might add 'natural cooperation' as a third fundamental principle of evolution beside mutation and natural selection" (p. 1563). Group-selection models can be mathematically equivalent to models based on individual selection (Boyd 2006; Lehmann and Keller 2006; Nowak 2006). A review of group and multilevel selection, with discussion of models, has been provided by Wilson and Wilson (2007).

Humans exhibit exceptionally complex and inimitable cooperation in groups in comparison with other species, including other primates, for example, very large group size, specialized roles for individuals, and inclusion of non-kin (Bowles and Gintis 2003; Boyd et al. 2003; Fehr and Fischbacher 2003). Models of human cooperation frequently incorporate group selection because it has been very difficult to make models of complex human cooperation without group selection. Group selection is favored when there is an increase in between-group differences and a decrease in within-group differences. When this happens, behaviors that benefit the group can spread, even if they are costly for individuals (e.g., suicide), and thereby help groups to incorporate or dominate other groups (Boehm 1996, 1999*b*; Bowles and Gintis 2003; Hammerstein 2003; Richerson and Boyd 2005; Soltis, Boyd, and Richerson 1995; Turchin 2007). Both genetic and cultural group selection are possible (Wilson and Wilson 2007). Genetic and cultural selection can also function in an interactive, iterative, and mutually conditioning process akin to a feedback loop. This is gene-culture coevolution (Bowles, Choi, and Hopfensitz 2003; Bowles and Gintis 2003; Hammerstein 2003; Richerson and Boyd 2005).

An important model of cooperation that can involve cultural group selection and gene-culture coevolution is strong reciprocity (Bowles and Gintis 2003; Boyd et al. 2003; Fehr and Fischbacher 2003). Strong-reciprocity models include altruistic, or costly, punishment and reward as mechanisms to increase cooperation. Altruistic punishment is punishment that has a cost of decreased fitness for the punisher. Other factors that frequently appear in discussions about strong reciprocity, as well as other models of the evolution of cooperation, are repeated interactions or encounters and the social history, or "reputation," of individuals that helps predict whether an individual will cooperate.

Cooperation in Religious Groups

The prominent social nature of religion has stimulated inquiry into how cooperation is engendered in religious groups. These questions encompass proximate mechanisms by which cooperative behaviors are engendered and whether religion is adaptive.

Costly Signals of Commitment

Irons (2001), Sosis (2003), and Alcorta and Sosis (2005) described how "hard-to-fake" signs of commitment to a religion can lead to intragroup cooperation. Their work includes points that are common to many discussions about cooperation in religion. First, group life is beneficial, indeed adaptive. Sosis (1993) noted the kinds of benefits of group living: "In human history the adaptive advantage of group living was the benefits that individuals attained through intragroup cooperation such as cooperative hunting, food sharing, defense, and warfare" (p. 93). Another benefit of group living, not mentioned by Sosis, is "cooperative breeding," in which the prolonged helplessness of infants raises the cost of rearing children beyond what mothers alone could provide (Hrdy 2005). Second, there are ways in which intragroup cooperation can be fostered. Irons, Sosis, and Alcorta emphasize the importance of commitment to the group and signals of this commitment to enhance intragroup cooperation. Third, religion is a significant cultural means for facilitating intragroup cooperation. For example, "The most powerful cultural signals of commitment are religious ones" (Irons 2001, 293). That intragroup cooperation is beneficial (although with diverse views as to whether this is adaptive), that there are mechanisms that foster intragroup cooperation, and that religion is a significant source of these mechanisms are themes common to many discussions of cooperation in religious groups.

Commitment provides a basis for trusting in an individual's potential for cooperative behavior, and signals of commitment "advertise a willingness to cooperate" (Sosis 2003, 93). Knowing others' reputations and who will cooperate enhances the ability of individuals to encounter and interact with others who are willing to cooperate, thus furthering intragroup cooperation. Costly signals of commitment make it too costly for potential free-riders to establish a fake commitment to cooperate. Religions provide rich opportunities for costly signals of commitment by way of religious rituals (Alcorta and Sosis 2005; Irons 2001; Rappaport 1999; Watanabe and Smuts 1999).

Punishment

A different way to facilitate intragroup cooperation is punishment and reward, especially in transcendental amounts. Bulbulia (2004) used a model of the Prisoner's Dilemma game and explained how cooperation is promoted by a deity who is a "full-access strategic agent" (Boyer 2001, 159) and who has full information about the individual as well as the ability to provide infinite rewards and punishments. Defection (noncooperation) is not a good alternative for the religious individual who believes in a deity who always knows the truth about whether one is cooperating and who can supranaturally reward or punish in response. Defection by the individual on the next-to-last move, a rational choice if individuals know when the game is up, is also not possible, since a game with a supernatural agent is never over.

Johnson (2005) examined the 186 societies of the Standard Cross-Cultural Sample and observed that the presence of belief in supernatural punishment, measured as the presence of moralizing high gods, is associated with social cooperation. Bering (2002, 2006) has explicated some of the cognitive underpinnings of belief in supernatural punishment, focusing on how the capacity for belief in supernatural agency is derived from theory of mind. Theory of mind is the capacity to understand the other as an agent with a mind, intentions, beliefs, and goals. Bering (2006) has proposed an "existential theory of mind," as an exaptation of theory of mind, to explain how people attribute agency, intentionality, meaning, and purpose to natural events, that is, "that religious belief is an exaptation" (p. 143). Belief in supernatural agents can be adaptive because belief in supernatural agents who are omniscient, omnipotent, punishing, and so forth can modulate an individual's behavior toward social norms. Johnson and Bering (2006) have further linked supernatural punishment and cooperation in religious groups to the evolution of human cooperation, "suggest[ing] that religious beliefs, specifically the moralizing and sanctioning behavior they generate, may serve as a common origin for human cooperation" (p. 220).

Is Religion Adaptive?

There are different views on whether religion is (or some religions are) adaptive (Alcorta and Sosis 2005; Boyer and Bergstrom 2008; Norenzayan and Shariff 2008; Sanderson 2008*a*). Studies like those of Atran and Norenzayan (2004) view religion as a "by-product" of other adaptations (Boyer 2001; Kirkpatrick 2004, 2005). From this perspective, intragroup cooperation and the benefits observed for religious groups are the complex side effects of traits that evolved for other purposes.

Others have discussed how religion could be adaptive at the level of the individual or the group (Alcorta and Sosis 2005; Bering 2006; Bulbulia 2004; Johnson and Bering 2006; Norenzayan and Shariff 2008; Rappaport 1999; Wilson 2002). However, with respect to both punishment and costly signaling mechanisms, models implicate group selection (Boyd and Richerson 2002; Fehr and Fischbacher 2003; Gintis, Smith, and Bowles 2001; Wilson 2005). For example, Boyd and Richerson (2002) point out, "While punishment and reward can stabilize group beneficial norms, they can stabilize virtually any behavior. . . . Group beneficial equilibria will be common only if the process of equilibrium selection tends to pick out group beneficial equilibria" (p. 288). Something that can pick out group beneficial equilibria—"favor individually costly, group beneficial behaviors"—is cultural group selection (Boyd et al. 2003, 3534).

Group selection is the specific target of inquiry of Wilson's study of religion. He hypothesized "that religions are largely (although by no means entirely) group-level adaptations . . . designed to provide a set of instructions for how to behave, to promote cooperation among group members, and to prevent passive freeloading and active exploitation within the group" (Wilson 2005, 385). The proposal is supported by a preliminary study of 35 religions and the adaptive function of religion, an earlier assessment of Christianity and some other religions, and models for the evolution of cooperation (Wilson 2002, 2005). As he summarizes, "Most religions in the sample have what Durkheim called secular utility. The practical benefits are inherently group- and other-oriented . . . religions demonstrate that the parameters of cultural evolution have themselves evolved to enhance between-group selection and restrict within-group selection" (Wilson 2005, 404–405; also see Haidt 2007). Boyd and Richerson (2006) also used Christianity as an example in their discussion of cultural group selection, highlighting the imitative spread of successful group-beneficial Christian behaviors.

God-People Relationships: A Proximate Mechanism for Group Selection

Wilson (2005) argued that religions' "otherworldly elements can be largely understood as proximate mechanisms that motivate adaptive behaviors" (p. 382). Proximate mechanisms are "the mechanisms that cause the trait to exist in actual organisms" (p. 392). These complement ultimate mechanisms, which explain "the environmental forces that favor the trait in terms of survival and reproduction" (p. 392). Among otherworldly elements, Wilson highlighted the deity and an

individual's relationship with the deity, the God-people relationship, as a basis for adaptive, prosocial behavior. For example, belief in supernatural forgiveness and punishment can promote prosocial behavior (Obeyesekere 1990; Spiro 1987; Wilson 2005).

God-people relationships have usually been the focus of a different and older line of inquiry in the psychology of religion. James's (1961 [1902]) working definition of religion was "*the feelings, acts, and experiences of individual men in their solitude, so far as they apprehend themselves to stand in relation to whatever they may consider the divine*" (p. 42, italics in original). His examples of the divine included the Abrahamic God, "unseen order" (p. 59), and the divine in religions of Asia. Freud was noted for his view that the God image in Judeo-Christianity was a father image (Rizzuto 1979). Deity images often include relationship characteristics (Granqvist and Dickie 2006; Hall et al. 1998; Kirkpatrick 2005; Obeyesekere 1990; Rizzuto 1979; Spiro 1987; Vergote and Tamayo 1981): maternal, paternal, loving, controlling, punishing, angry, helpful, and so forth. Finally, an attachment-theoretical perspective led to the proposal that some religious adherents have an attachment relationship with the deity (Kirkpatrick and Shaver 1990).

Attachment Theory

The originator of attachment theory was Bowlby (1969; also Ainsworth and Bowlby 1991). The attachment system is rooted in the infant's earliest nurturing relationships, usually the infant-mother dyad, but is active throughout the life cycle in a variety of child and adult relationships (Bowlby 1969, 1982; Cassidy and Shaver 1999; Chisholm 1999; Fonagy, Gergely, and Target 2007; Shaver and Mikulincer 2002). Attachment is a persistent, emotionally valued relationship characterized by proximity seeking (physical or symbolic closeness to the attachment figure), safe-haven and secure-base functions of the attachment figure, selectivity for a specific person or small number of specific persons, and separation anxiety or grieving after loss of the other. Proximity seeking is activated by circumstances of insecurity or distress, as the child turns to her attachment figure—the "stronger and/or wiser" (Bowlby 1988, 3) mother or other caregiver—for protection, security, relief, and comfort. The mother/caregiver is a safe haven where the infant can seek security and comfort, taking refuge from threats and distress, and a secure base from which to explore, secure in the expectation that mother will be available and protective if needed. Attachment is selective toward specific attachment figures; there is typically one primary attachment figure, usually the mother, but multiple attachments with a few additional persons are common, for example, the father, an older sibling, or other caregivers.

The three main types of attachments are secure, insecure-anxious, and insecure-avoidant. When the attachment system is activated by some kind of threat, "cognitive activation of internalized representations of attachment figures" (Shaver and Mikulincer 2002, 151) occurs and assessment of the "attachment figures' availability (either in the internal representational world or in the outside environment)" (p. 153) is made. For secure and insecure attachments, the assessment is of "perceived" availability or unavailability, respectively. Subsequently, securely attached individuals use behavioral, emotional, and cognitive strategies to get close to the attachment figure; insecurely attached individuals of the anxious type evidence hyperactivated attempts at closeness (e.g., clinging, demanding), while individuals with avoidant attachments evidence "deactivating strategies," such as physical and emotional distancing. Increased attachment security is correlated with a broad range of relational, emotional, cognitive, personality, and physical- and mental-health measures (Cassidy and Shaver 1999; Eisenberg 2002; Kirkpatrick 2005; Mikulincer and Shaver 2007; Shaver and Mikulincer 2002). Generally, secure attachments are correlated with higher and more positive levels of functioning.

Attachment includes the language of love (Zeki 2007). In effect, attachment theory is an evolutionary theory of the origin and nature of love: in secure attachments, love and joy upon closeness or reunion with the mother (attachment figure); when anxious, desire for the mother; and sadness, loss, and grieving when the mother is lost. Cognitive aspects include the "internal working model," a schema or script that encodes and organizes interpersonal information, and can be used for regulation of behavior (Bowlby 1969, 1982). Internal working models comprise representations of the self, the attachment figure, and patterns of relationship between them: behaviors, emotions, goals, and so forth (Baldwin et al. 1996; Cassidy and Shaver 1999; Mikulincer, Shaver, and Pereg 2003). Internal working models are modified throughout life in response to relational experiences.

Adult attachments include romantic relationships (pair-bonding) and relationship with a psychotherapist (Cassidy and Shaver 1999; Holmes 2002). Recent studies have begun to explore attachment to leaders (Davidovitz et al. 2007; Mayseless and Popper 2007). Attachment to a group is also being studied, and both group and dyadic-relationship attachment style can affect group processes, including "group cohesion": "commitment, cooperation, coordination, and consensus" (Rom and Mikulincer 2003, 1226; see also Marmarosh et al. 2006; Mayseless and Popper 2007; Mikulincer and Shaver 2007; Smith, Murphy, and Coats 1999).

Finally, there can also be an attachment relationship with a deity (Kirkpatrick and Shaver 1990; Kirkpatrick 2005). The image of the deity as a loving, caring, beneficent, strong, and wise maternal or paternal figure is that of an ideal attachment figure. Individuals can love the deity, as portrayed in the Bible's Song of Songs, Shankaracharya's song to the Divine Mother in Hinduism, or Kabir's poetry in Islam. Note that although deities are noncorporeal (usually; some humans are held to be divine by followers), so too are attachment figures most of the time: a representation in a neurocognitive internal working model of an attachment schema.

Of the many facets of attachment, we now highlight two: theory of mind and cooperation. Both benefit from an evolutionary perspective.

Evolution and Mother-Infant Cooperation

Bowlby's (1969) view was that the adaptive function of attachment was protection of the helpless infant from predators. (He also coined the phrase "environment of evolutionary adaptedness.") The following is an updated view. The roots of the attachment process go back 350 million years to the neurobiology of reptilian thermoregulation, pain avoidance, and "place attachment" (territoriality: recognizing and wanting to return to and protect home; Panksepp 1998). Reptilian "proto-attachment" then diverged toward imprinting in birds and attachment in mammals. Gubernick (1981) showed that attachment of broadly the human sort (gradual development over months and use of the mother/caregiver as safe haven and secure base) is concentrated in mammals who faced the simultaneous adaptive problems of providing adequate investment to slow-developing infants with limited mobility and doing so in complex, intense, variable, and sometimes dangerous social contexts like those of many nonhuman primates. Gubernick thus broadened Bowlby's view that the original adaptive function of attachment was predator protection, arguing instead that it was driven by selection on infants to elicit all sorts of investment (not just protection from predators) from anyone who would respond and on mothers for their capacity to recognize and motivation to invest in their own offspring. Thus, the essential adaptive function of human attachment was *mother-infant cooperation*, as a "resource elicitation system" for infants and a "maternal investment system" for mothers: even as the infant elicits investment, the mother's capacity to recognize and motivation to invest in her offspring grows.

Theory of Mind

The capacity of the infant to elicit more investment requires better "reading" of the mother's intentions through more nuanced "readings" of their own feelings of security, contingent on maternal behavior (see below), to the point of distinguishing between the mother's ability and willingness to invest, in order to adjust their elicitations accordingly (Chisholm 1996). Behne et al. (2005) have now shown that infants as young as 9–12 months can do this. Without the capacity to distinguish between the mother's ability and willingness to invest, maternal "reprimands" (punishment) would be counterproductive, inducing confusion and thus insecurity and thereby reducing any "unsecured commitment" to cooperate that the infant might have had. Together, the infant's innate desire to be held in "good esteem" by her mother and her ability to "read" her mother's intentions mean that she is predisposed to "forgive" her mother's punishment ("defection"). In this way, just as punishment and forgiveness are implicated in the evolution of cooperation (e.g., the tit-for-tat strategy in iterated Prisoner's Dilemma games [Axelrod 1981; Frank 2002]), they also help mother-infant cooperation to develop in secure attachments.

The ability to read the mother's intentions is part of theory of mind. Fonagy and others (Fonagy, Gergely, and Target 2007; Fonagy and Target 1997; Main 1991) proposed an attachment model of the development of theory of mind in which mothers/caregivers "scaffold" their children's theory-of-mind skills by "behaving towards the child in such a way that leads him or her to postulate that their own behavior may best be understood through the assumption that they have ideas and beliefs, feelings and wishes which determine their actions and the reactions of others to them" (Fonagy, Redfern, and Charman 1997, 52). They argued that children's ability to make this assumption comes from their innate ability to detect contingencies—the objective conditional probabilities connecting events or actions in time, space, or sensory intensity—in this case the contingency between the child's feeling state and her mother's/caregiver's behavior (Gergely and Watson 1999; Watson 2001). Sufficiently sensitive and responsive parenting, the hallmark of secure attachment, involves frequent "mirroring" of children's behavior and emotional states back to them (see Gallese, Eagle, and Migone 2007 regarding mirror neuron system involvement in mirroring and theory of mind), creating an objective conditional probability that they can perceive. Parental mirroring modulates the child's arousal, thereby reducing negative affect, and at the same time provides her with environmental "scaffolding" for learning that she is an intentional agent. The child thus learns to "learn through" the mother/caregiver, setting the stage for "learning through" others as she grows.

Studies of theory of mind in nonhuman species show that, although some aspects of theory of mind can be found in other species, humans have unmatched abilities (Call and Tomasello 2008; Premack 2007). These unmatched theory-of-mind abilities underlie our unmatched capacity for interpersonal, social cognition (e.g., empathy, altruism, deception, morality, pedagogy; Fonagy, Gergely, and Target 2007; Gallese, Eagle, and Migone 2007; Premack 2007), including complex social cooperation in groups. Thus, individuals in other species cooperate with each other, but we do so in more complex ways, and our capacity to do this depends in large measure on theory of mind and its roots in the nature of human mother-infant attachment.

Cooperation, Compliance, and Socialization

Cooperative interactions in childhood include synchrony of child-parent behaviors (Feldman 2007). Cooperation or compliance by the child with the mother's/caregiver's wishes is effected by way of a large range of maternal interventions, from reward to punishment (Gralinski and Kopp 1993; Kochanska and Aksan 1995; Kochanska et al. 2004), for example, "social exchange," "guidance; gentle control," "negative con-

trol . . . threats, harsh physical interventions, negatives, or direct commands or prohibitions" [punishments], and "time out" ["defection"] (Kochanska and Aksan 1995, 243).

Ultimately, these early experiences will help shape the individual's degree of harmony, or compliance, in the realm of adult relationships, social rules, norms, and morality (Cassidy and Shaver 1999; Chisholm 1999; Davidson and Harrington 2002; Eisenberg 2002; Granqvist and Hagekull 1999; Kochanska 2002; Kochanska et al. 2004). Generally, securely attached persons will evince more harmonious and effective levels of socialization in both dyads and groups. Poignant examples of how infant-mother attachment affects socialization can also be seen in other species, such as rhesus monkeys (Seay, Alexander, and Harlow 1964) and geese (Fischer-Mamblona 2000).

Bowlby on "Persistent Co-Operative Behaviour"

Although Bowlby is associated with attachment between child and mother and other attachment figures, he also once focused on "the psychological problem of ensuring persistent co-operative behaviour" in groups (Bowlby 1946, 62). Cooperative behavior can be categorized as either "willing cooperation" or "co-operation which is obtained by the use of threats" (p. 63). Bowlby described the libidinization (emotional valuation) of the "leader and the policy which he advocates" (p. 63) or of "long term ends, social leaders, and the group itself" (p. 65) as a means of achieving willing cooperation. Of these, the easiest path is

> libidinization of leaders. . . . One reason for the libidinization of a leader and not of a policy is that it is both emotionally and intellectually much easier. In the first place, a plan may be very difficult to apprehend. Further . . . the capacity to libidinize originates in infancy in the child's feelings for his mother; persons are, therefore, the earliest objects of libidinization. (P. 64)

The libidinization of the leader can lead to willing cooperative behavior in the same way that "the normal child is much influenced by being held in good esteem by the people he values, and responds in typical ways to encouragement or reprimand" (p. 65). Bowlby also addressed the fact that cooperative behaviors that are good for the group may be detrimental to the individual. Writing shortly after the end of World War II, he referred to behavior in armies, for example:

> Those private aims of the individual which would be inimical to it are outweighed and obliterated by the libidinization both of the group aim and of the leader who represents it. Moreover, the co-operating group itself comes to be emotionally valued. Although awareness of personal advantage enters into these libidinizations, it is noteworthy that very strong altruistic sentiments are also enlisted. (Pp. 64–65)

In observing that libidinization of the leader (as well as the policy and the group) can facilitate behavior that is good for the group even if it exacts a cost to the individual, Bowlby's work also ties together emotionally valued relationships with the facilitation of altruistic behavior, a matter of fundamental significance for cooperative behavior. In summary, Bowlby's work describes how a central, emotionally valued relationship with a group leader or policy or the group itself could function as a mechanism for intragroup cooperation.

Attachment to the Deity and Cooperation

Bowlby (1946) described how a relationship with a group leader, rooted in infant-mother attachment, could function as a mechanism for intragroup cooperation. On the basis of two assessments—that the "God-people relationship" is a proximate mechanism for group selection in religious groups (Wilson 2002) and that people can have an attachment relationship with a deity (Kirkpatrick and Shaver 1990)—we substitute a deity for Bowlby's group leader and obtain an emotionally valued attachment to the deity as a mechanism for intragroup cooperation and cultural group selection in religious groups.

This proposal leads to two main hypotheses: for some, although not necessarily all, religious groups, (i) individuals belonging to the group have an attachment relationship with a deity (supernatural agent) and (ii) an individual's attachment to a deity mediates group-beneficial cooperation. The first hypothesis predicts, for an individual with an attachment relationship with a deity, that the deity is represented with features of an attachment figure, especially as an ideal attachment figure, and that the relationship meets the criteria for an attachment. The second hypothesis predicts an association between attachment to a deity and group-beneficial cooperation. This association includes predictions that seeking proximity to the deity promotes proximity to the group, that the group will have a selective relationship with one or a few deities, that cooperating with the deity's wishes is a mechanism for generating group-beneficial cooperative behaviors, that benefits of individual attachments to a deity will benefit the group, and that attachment security with respect to the deity can modulate in-group-out-group competition.

Studies to test these hypotheses would include ethnographic cases and studies of large cross-cultural databases and histories. They would also include neurocognitive studies to observe how activation of the attachment system modulates social behavior (altruistic, selfish, etc.), emotion, intentions, and activation of brain regions subserving attachment and social and moral cognition. Here, we begin with some general evidence in support of the hypotheses.

Attachment to the Deity

The first hypothesis is that individuals have an attachment relationship with the deity. Many studies have described representations of a deity (or deity substitute) that are consistent with an attachment figure, for example, strong, wise, protective, supportive, loving, maternal, paternal. Attachment-related representations include Buddhist, Hindu, and Judeo-Christian representations (Davidson and Harrington 2002; Granqvist, Ljungdahl, and Dickie 2007; Hall et al. 1998; Kirkpatrick 2005; Kirkpatrick and Shaver 1990; Obeyesekere 1990; Rizzuto 1979; Spiro 1987; Vergote and Tamayo 1981). Both secure and insecure attachment styles have been portrayed (e.g., Popp et al. 2003). An example of a representation of an ideal, secure attachment figure is "the idea of God is the idea of an absolutely adequate attachment figure. . . . God is thought of as a protective parent who is always reliable and always available to its children when they are in need (Kaufman 1981, 67; see Kirkpatrick and Shaver 1990, 318).

Other studies have measured attachment in individuals' relationships with a deity (Beck and McDonald 2004; Birgegard and Granqvist 2004; Granqvist, Ljungdahl, and Dickie 2007; Kirkpatrick and Shaver 1992; Kirkpatrick, Shillito, and Kellas 1999; Rowatt and Kirkpatrick 2002). One study indicated that around 70% of adult subjects evinced secure attachments and 30% insecure (23% anxious and 7% avoidant) attachments to God (Kirkpatrick and Shaver 1992). An individual's attachment to the deity more often corresponds with the individual's style of attachment to parents or romantic partners, although the association is complex and may be mediated by socialization mechanisms. Thus, some individuals "compensate" for a history of insecure maternal attachment by way of a secure attachment to God as an ideal attachment figure.

Subliminal presentation of themes of abandonment by God or mother has been used to activate the attachment system. Subliminal activation modulated the individual's sense "of turning to and maintaining contact with God and religion to obtain/maintain a sense of felt security" and showed that "God functions as an attachment-like figure" (Birgegard and Granqvist 2004, 1125, 1133).

Group-Beneficial Cooperation

The second hypothesis predicts an association between attachment to a deity and group-beneficial cooperation. This hypothesis shifts the focus from the individual, as in studies described above, to the group and predictions about group-beneficial behaviors that are mediated by an attachment to a deity.

Proximity Seeking. Proximity-seeking behavior—the desire to be close to God—is expected to promote proximity to the group. Closeness to the group increases the probability that members will encounter and interact with each other, increasing opportunities for imitation and within-group cooperation. Religions support many means for the purpose of bringing the individual closer to the deity (Kirkpatrick 2005) that necessarily entail more closeness to the group: sacred places such as temples, specialized persons to give initiations establishing a relationship with a deity, community rituals, and sacred accoutrements.

Further, Boehm (1996) has described how group emergency decision making is an important adaptive cooperative behavior. One of the most salient features of the attachment system is that it is activated by threats to the individual's security. This attachment mechanism predicts that threat activation should lead to proximity-seeking behavior that promotes contact with the group. This was observed immediately after September 11, 2001, as an increase in U.S. church attendance (Altemeyer 2004). Fundamentalism, with a goal of religious survival in a world perceived as threatening, may also be a highly significant example of threat-activated proximity seeking (Marty and Appleby 1993).

Selectivity. A selective relationship with or commitment to a single deity or subset of deities characterizes many religious groups, notably, on a globe with multitudes of deities, the Abrahamic monotheisms: Judaism, Christianity, and Islam. If relationship with the deity is based on attachment, it would be natural for individuals in the group to have one primary attachment-figure deity. The normal capacity for multiple attachments would also support attachment to a small subset of deities (or deity substitutes), such as God, Jesus, and Mary (mother of Jesus) for some Christians. Although other mechanisms could also be involved in group identity around specific deities, attachment is a useful mechanism by which commitment to (emotional valuation of) only one or a few supernatural agents specific to the group could be obtained.

Doing What the Deity Wants. Because we are predisposed to cooperate with attachment figures, cooperation with the group can be facilitated by expression of the group's needs—prosocial, moral, group-beneficial norms—as the wishes of an attachment-figure deity. Thus, it is predicted that group-beneficial behaviors such as moral behavior will be promoted by the deity as, for example, some idiographic and context-sensitive variation of "What God wants you to do is . . . ." The morality and norm-promoting roles of religions are well known (Barkan 2006; Davidson and Harrington 2002; Haidt 2007; Hood, Hill, and Williamson 2005; Wilson 2002). The role of a deity in promoting moral norms was highlighted by Wilson (2002). The best-known example in Western culture is God as the source for the Ten Commandments.

Punishment has a role in infant-mother/caregiver interactions to obtain the child's cooperation. If attachment to a deity mediates group-beneficial behavior, punishment by the deity is predicted to have an important role in obtaining group-beneficial cooperation. Indeed, supernatural punishment is a critical factor for intragroup cooperation observed in many

religions (Johnson 2005; Johnson and Bering 2006; Wilson 2002). Note that individuals can have attachments, albeit insecure, to caregivers who are extremely hurtful and abusive, as seen for human (Bowlby 1984) and nonhuman primates (Seay, Alexander, and Harlow 1964). Thus, deity representations that are extremely punitive and hurtful could nonetheless be consistent with attachment mechanisms (Kirkpatrick 2005; Popp et al. 2003). Forgiveness also has a role in infant-mother attachment and would be expected to play a role in modulating group cooperation. The importance of forgiveness for group-beneficial cooperation in religion, including mediation by the deity, has been emphasized by Wilson (2005).

Secure Attachments. Benefits from secure attachments include more positive views of self and others; optimism and confidence; strategies to obtain support from others; regulation of affect and emotional expression; romantic relationships; coping with mortality salience; problem solving; performance on theory-of-mind tests; receptivity to new information or threatening views; empathic, compassionate, and altruistic tendencies; less bias toward outsiders; and coping with being a prisoner of war (Chisholm 1999; Eisenberg 2002; Kirkpatrick 2005; Shaver and Mikulincer 2002; Solomon et al. 1998; Van IJzendoorn and Sagi 1999). Decreased attachment anxiety or avoidance in attachment to groups or in close relationships is associated with better functioning in groups (Marmarosh et al. 2006; Rom and Mikulincer 2003; Smith, Murphy, and Coats 1999).

Persons who report secure attachments to God show increased physical and mental health in comparison with persons reporting insecure attachments, similar to a large body of findings for other kinds of secure attachments (Kirkpatrick 2005; Kirkpatrick and Shaver 1992; Kirkpatrick, Shillito, and Kellas 1999; Rowatt and Kirkpatrick 2002). Many other studies support a role for internalized religious belief, devotion, or religiosity in increased health, altruism, and decreased antisocial behavior (Hackney and Sanders 2003; Koenig et al. 2007; McCullough and Willoughby 2009; Sanderson 2008*a*; Vilchinsky and Kravetz 2005). Overall, secure attachments and factors related to secure attachment to a deity, such as religiosity, are predicted to lead to benefits for the individual that also are beneficial for a group.

Viewing attachment from an evolutionary perspective puts the focus squarely on reproductive fitness. Researchers have described the potential adaptive value of both secure and insecure attachments, arguing that different "patterns of attachment represent nascent facultative reproductive strategies that evolved to promote reproductive fitness in particular ecological niches" (Belsky 1999, 150; also Chisholm 1999; Chisholm et al. 2005). Secure attachments may signal to the child that the environment is safe and supportive and may promote development of reproductive behavior that is shifted toward later reproduction and fewer offspring, in whom relatively greater parental investment can be made, while insecure attachments can signal unsupportive, uncertain environments and promote behavior shifted toward earlier reproduction and more offspring. Thus, secure attachments to the deity are expected to promote the reproductive fitness of religious adherents and relative fitness of their group by fostering a "long-term reproductive strategy." There is much evidence of how religiosity is associated with increased value placed on family, marriage, and less risky behaviors (Kirkpatrick 2005; Sanderson 2008*a*; Weeden, Cohen, and Kenrick 2008). For example, data from the General Social Survey revealed that religiosity is associated with a lower-than-average number of premarital sexual partners (Barkan 2006).

It is also possible to "prime, or make temporarily more accessible, cognitive representations of significant relationships" (Baldwin et al. 1996, 103). For cognitive representations of secure attachments, this approach, which enhances the sense of "felt security," is "secure base priming" (Mikulincer and Shaver 2001, 97). Secure-base priming has been effected, subliminally or not, by using persons' names, words or images associated with security, or a story with a script of a secure attachment. After secure-base priming, individuals tend to behave as predicted for people who have a secure attachment style, and this behavior promotes similar benefits (Mikulincer and Shaver 2001; Mikulincer et al. 2001; Shaver and Mikulincer 2002). Deity representations, internal or external, as positively responsive, protective, loving, available, forgiving, and helpful are types of representations of secure attachments that prime the secure base and promote benefits of secure attachments.

Effects from priming the secure base have been observed in individuals with both secure and insecure attachment styles, and this effect has not depended on use of an individual's own attachment figure (Mikulincer and Shaver 2001; Mikulincer et al. 2001). For example, "temporary activation of the sense of attachment security leads even chronically insecure persons to react to others' needs similarly to persons who have a more secure attachment style" (Mikulincer et al. 2001, 1222). Thus, secure-base priming via positive, loving representations of the deity provides a mechanism for distributing, or "sharing," the benefits of secure attachments to individuals who do not have secure attachments to the deity or secure attachment styles. This resource sharing also has the unusual feature that it is not costly because it does not decrease the sharer's allotment.

Insecure Attachments. Individuals can have insecure-anxious or insecure-avoidant attachments to the deity, although the frequency of the latter is low and individuals with such attachments would be expected to avoid the deity (Beck and McDonald 2004; Kirkpatrick 2005) and likely the group as well. Insecure-anxious attachments are characterized by hyperactivation of the attachment system. "Hyperactivation is indicated by recurrent attempts to minimize distance from attachment figures and elicit their support and love through clinging and controlling responses. It is also indicated by hypervigilant, anxious attentional focus on attachment figures and relationship[s]" (Shaver and Mikulincer 2002, 141). By

extension, anxious attachments to a deity could result in clinging behaviors and more attention to the deity than might have been elicited from positive, secure attachments. Anxious attachments may also result in increased negativity toward out-groups, further discussed below. With respect to attachment to a group, although anxiety in group attachments is associated with decreased functioning in groups, it is also associated with "subordinating personal wishes and goals in favor of the group" (Smith, Murphy, and Coats 1999, 98; also Marmarosh et al. 2006; Rom and Mikulincer 2003). Subordination/submission to the group decreases within-group differences, enhancing intragroup cooperation, and is an example of a group-beneficial behavior.

Insecure attachments were traditionally considered maladaptive, especially in the interpersonal field, because of negative themes in interpersonal schema, emotions, and behaviors. However, the consensus now is that insecure attachments belong to a repertoire of adaptive attachment styles that reflect environments of evolutionary adaptedness that were often marked by great uncertainty, harshness, and deprivation (see CA+ online supplement A). Insecure attachments can effect a shift away from long-term reproductive strategies as well as toward less positive behaviors (more short-term thinking, impulsiveness, aggression, noncooperation) that may be adaptive in unsupportive and insecure environments (Belsky 1999; Chisholm 1999; Hinde 1982; Main 1981). Mikulincer and Shaver (2007) have also suggested that in some circumstances individuals with insecure attachments might have specific beneficial roles in group function, for example, as "threat detectors" (p. 239). Thus, inclusion of individuals with insecure anxious attachments to a deity (or insecure attachment styles) could benefit the group while still helping to increase within-group homogeneity in insecure environments.

In-Group-Out-Group Dynamics. The attachment system modulates in-group-out-group bias. Negative responses toward out-group members decrease after secure-base priming: "secure base priming virtually eliminated any differential evaluation of in-group and out-group targets" (Mikulincer and Shaver 2001, 110). Alternatively, increased anxiety in attachment relationships is associated with increased negativity toward out-groups. These results reveal modulation of intergroup bias via the attachment system. Thus, the attachment system is predicted to be a mechanism by which levels of hostility in religious groups could be adjusted. This could be mediated by representations of the deity, verbal or visual, that range from very positive to very negative in many religions. For example, in an interpersonal study of God representations in the Torah of the Hebrew Bible and the New Testament (instruments for the cultural transmission of Judaism and Christianity), a large range of positive and negative representations were observed, including negative bias toward outsiders in both texts (Popp et al. 2003, 2004). Increase in intergroup bias promotes between-group differences, a condition that favors group selection. An extreme example is war (paraphrasing Richerson and Boyd 2001; Bowles 2006).

Factors for Group Selection. Encounters between and imitation of group members, commitment to the group, morality, norm enforcement, punishment (strong reciprocity), and resource sharing promote intragroup cooperation and suppression of within-group differences (Boehm 1996, 1999*b*; Bowles and Gintis 2003; Richerson and Boyd 2001; Wilson 2002, 2005). Between-group differences can be increased by way of "benign forms" (Wilson 2005, 398) of competitive advantages, such as those that arise from secure attachments or other group-beneficial characteristics of cooperation. On the other hand, modulation of the attachment system that fosters hostility toward out-groups would also increase between-group differences. Thus, there are many consequences of our attachment mechanism that favor group selection.

Examples: Navajo and Shinto Religions

To further illustrate this mechanism, we provide examples from the Navajo and Shinto religions. These examples qualitatively illustrate a few ways in which the deity (supernatural agent) could appear as an attachment figure and a mechanism for group-beneficial cooperation. Although evidence from large databases of religions will be required for validation studies, these brief examples are provided to help bring the mechanism alive and further indicate the kinds of observations that can be made.

Asdzáán Nádleehé

Witherspoon (1975, 1977) has described a paradigmatic mother in Navajo philosophy, Asdzáán Nádleehé ("Changing Woman"), whose relationship to her children (the Navajo) "provides the major conceptual framework for the Navajo cultural definition of motherhood" (Witherspoon 1975, 15). Asdzáán Nádleehé is "incapable of doing harm to anyone. She is only capable of blessing, aiding, and sustaining; and, as such, is the very essence of benevolence" (Witherspoon 1977, 36). She is "the very essence and personification of regeneration, rejuvenation, renewal, and dynamic beauty, . . . the Supreme Mother of the Navajos and . . . the most blessed, the most benevolent of all the Holy People" (p. 201). She also has "god-like powers" (McNeley 1981, 2). Because of her, the mother-child bond "is considered to be the ideal pattern or code for all social interaction" (Witherspoon 1975, 85). Thus, Asdzáán Nádleehé has the appearance of an ideal attachment figure and can provide benefits of attachment security to the Navajo. Because her ideal maternal relationships are a model for both mother-child relationships and all social interactions, they promote secure attachments and prosocial, cooperative behaviors within the Navajo community.

The Japanese Emperor

During the late 1800s, Japan was modernizing and under stress from rapid change. Bellah (2003) has described how one response to the social stress was to promote Japanese society as a family headed by the Japanese emperor: "The nation is a hierarchically organized kinship group with the emperor as its head" (p. 177). The story of the Japanese emperor is that he is descended from the Shinto sun goddess Amaterasu-o-mikami. Moreover, "the Japanese emperor, based on the model of the divine ancestress Amaterasu, has been more of a mother figure than a father figure. Like the mother in the Japanese family, he has been emotionally central even when actually powerless, exercising a powerful motivational attraction even when giving no effective command" (p. 179). He has been "a focus of emotional attachment" (p. 183). The emotionally valued relationship with the emperor as a mother figure was used as a mechanism for change in Japanese society, because "all kinds of aggressive and innovative behavior could be legitimated if it were for the sake of the emperor" (p. 180). It also supported self-sacrifice during war, for "dying for the emperor involves not just an abstract moral duty but a warm personal relation" (p. 181). After World War II, retaining the emperor to help promote the well-being of Japanese society during the reconstruction period was a priority for MacArthur. Thus, the emperor has features of a divine, maternal attachment figure and has been an object of emotional attachment for many Japanese. This relationship has been used to promote intragroup cooperation and between-group competition during the prewar, wartime, and postwar periods, from which the Japanese have emerged as a successful group.

These examples also illustrate how this attachment mechanism can play a role in polytheism, a religious type that might not appear at first glance to be consistent with attachment's selectivity. Shinto is polytheistic and has numerous kami/deities, yet a "divine-human" (Bellah 2003, 185) emperor is an attachment figure "modeled" after one kami, Amaterasu. In this regard, also note that evidence on the emergence of monotheism from polytheisms in the ancient Near East describes intermediate stages such as "'affective monotheism' to characterize devotional attachment of a pious individual to a particular deity both in the ancient near East and Israel" (Gnuse 1997, 137). In the end, it would not be surprising if this attachment mechanism were active in some polytheisms: we encounter many humans during our first (and other) years, but we attach to only one, two, or a few persons.

Discussion

Bowlby (1946) proposed solutions to "the psychological problem of ensuring persistent co-operative behaviour" based on an emotional valuation of a group leader, group policy, or the group itself that is rooted in the infant-mother attachment relationship. Our proposal is a straightforward application of this mechanism, with the deity as group leader. Drawing on Bowlby's insights, this paper describes how the attachment system and an attachment to the deity could be a mechanism for intragroup cooperation, including within-group cooperation required for group selection. The mechanism is consistent with Wilson's (2002) conclusion that the God-people relationship is a proximate mechanism for group-adaptive behavior in religion: attachment to the deity is a version of the God-people relationship that could function well as a proximate mechanism for group-adaptive behaviors.

This attachment mechanism is also consistent with views of other authors who refer to a link between the attachment (nurturant) system and the social level, including prosocial cooperation or group selection (Boehm 1999*b*; Eibl-Eibesfeldt 1996; Freud 1967 [1922]; Holmes 2002; Marris 1991; Sober 2002). For example, from Eibl-Eibesfeldt (1996),

> The phenomenon of group selection in humans has as a prerequisite a number of characteristics which evolved by individual and kin selection in the service of parent-child nurture and bonding. . . . With the evolution of larger, anonymous societies the individualized small-group ethos was extended to the larger group through the action of cultural institutions which tap the phylogenetically evolved nurturant and group-defensive dispositions. (Pp. 779–780)

Neurobiology studies (see CA+ online supplement B) provide evidence of a link between systems subserving attachment and higher-order cooperation, for example, an association between oxytocin, a neuropeptide important in attachment (Insel and Young 2001; Swain et al. 2007), and trust in others and other prosocial effects (Kosfeld et al. 2005; Moll and Schulkin 2009; Skuse and Gallagher 2008). There is also an overlap between brain regions (e.g., the subgenual region) associated with attachment and charitable giving (Moll and Schulkin 2009). Finally, this mechanism is in concert with recent work showing that the attachment system can modulate how individuals function in groups, group cohesion, and so forth (Marmarosh et al. 2006; Mikulincer and Shaver 2007; Rom and Mikulincer 2003; Smith, Murphy, and Coats 1999).

The attachment system always operates within the larger universe of other relationship and behavioral systems, and the attachment mechanism will likewise operate alongside other mechanisms. Costly signaling of commitment is one mechanism proposed for intragroup cooperation in religion (Alcorta and Sosis 2005; Irons 2001). Attachment is a kind of commitment, and an attachment to the deity could signal willing cooperation with the group. Sosis (2003) has also elaborated on the significance of internalized commitment; an attachment relationship with the deity would be a powerful type of internal commitment. Note that attachment is subserved by powerful neurobiological systems for motivation and commitment, including the dopaminergic mesolimbic reward system that also subserves cocaine and other addictions (Insel 2003; McGregor, Callaghan, and Hunt 2008; Numan 2007; Strathearn et al. 2008).

Also overlapping with attachment are punishment (strong reciprocity) and supernatural mechanisms (Bulbulia 2004; Johnson 2005; Johnson and Bering 2006), for we first experience punishment and its consequences for cooperation within the infant-mother attachment. There are also other kinds of relationships that individuals could have with a deity—coalitional partner, chief, and so forth (Boyer 2001; Kirkpatrick 2005)—either instead of or in addition to attachment and that could function alongside this mechanism, although our mechanism may also be relevant to these kinds of "emotionally valued" relationships.

The attachment-theoretical perspective may be especially relevant to Johnson and Bering's discussions of existential theory of mind and supernatural punishment (Bering 2002; Johnson and Bering 2006). Existential theory of mind accounts for the capacity to infer intentionality and agency with respect to natural phenomena and the universe at large, and it is a basis for inferring and believing in supernatural agency (Bering 2002). Bering described existential theory of mind as an exaptation of theory of mind. However, theory of mind has itself been described by Fonagy and others as developing from infant-mother attachment (Chisholm 2003; Fonagy, Gergely, and Target 2007; Gallese, Eagle, and Migone 2007). Therefore, there is a link between inferences about impersonal natural phenomena and the attachment system, with its inherently interpersonal representations; the attachment system may be the route for the sense of "psychological" or personal agency that many experience with respect to impersonal natural phenomena. Indeed, if one looks at this from the bottom up—standing on the theory-of-mind scaffolding of infant-mother attachment and looking wonderingly at the universe with existential theory of mind—the rise of a sense of personalized agency (anthropomorphic deities, animism) imputed to impersonal phenomena could seem almost inevitable.

Bowlby's libidinized trinity comprised the group leader, the group itself, and policy. Attachment to human leaders of religious groups (Kirkpatrick 2005) is a straightforward variation of this mechanism, with the exception of factors dependent on supernatural agency, although religious leaders may also be imbued with godlike qualities. Outside the religious sphere, studies of attachment to leaders and groups have begun (see the introduction to this paper). With respect to policy, Lakoff (2002) has described an association between attitudes toward parents and political views. As mentioned above, there is some overlap between neural substrates of attachment and complex prosocial policy, for example, charitable giving (Moll et al. 2006). Finally, note that there is a daily Buddhist practice of "taking refuge" in Buddha, dharma (path, "policy"), and sangha (community), prefiguring Bowlby's trilogy.

Further discussion of the attachment system and its function with respect to religious phenomena requires more space than is available (Kirkpatrick 2005). We mention only four points. First, an attachment-theoretical perspective, including consequences of insecurity (by way of an ecology of religion), may be important for an understanding of religious fundamentalism (Atran 2003; Hood, Hill, and Williamson 2005; Marty and Appleby 1993). Second, our proposal may help throw light on the development of monotheism. For example, Sanderson (2008*a*) has associated the emergence of monotheism during the axial age with increased warfare and "socially disruptive" urbanization and has proposed that attachment relationships with a deity could be very helpful when "new needs for security and comfort" arose because of increased warfare and urbanization (p. 153). Our attachment mechanism may help explain this association, especially by noting the role of cooperation or group selection during an increased need for "emergency decision making" (Boehm 1996) and war (Bowles 2006; Turchin 2007). Third, other mechanisms that subserve cooperation bear consideration. For example, work on selective-investment theory and commitment and social selection highlights the benefits of "giving away" or "providing support to others" that would augment the more usual focus on receiving benefits in attachment relationships (Brown and Brown 2006; Brown et al. 2003). Fourth, psychology-of-religion studies of attachment to the deity have usually drawn from mostly Christian populations but would benefit from examining other religions, as indicated here and in work by Davidson and Harrington (2002), Obeyesekere (1990), Spiro (1987), and Vergote and Tamayo (1981), among others.

A General Mechanism

We now turn to the attachment system as a basis for cooperation in groups generally and thus group selection in particular. In this, we follow Bowlby (1946) and others (Boehm 1999*b*; Eibl-Eibesfeldt 1996; Freud 1967 [1922]; Holmes 2002; Marris 1991; Mayseless and Popper 2007; Mikulincer and Shaver 2007; Smith, Murphy, and Coats 1999; Sober 2002), who have considered how the attachment (nurturant) system could be active at the social level, including prosocial cooperation in groups (and, for Eibl-Eibesfeldt, group selection). Application of the described mechanism with respect to a leader of a nonreligious group (or the group itself or policy) is straightforward, with the exception of factors dependent on supernatural agency; this is similar to Bowlby's (1946) original proposal, which was about (nonreligious) groups in general. To consider broader implications of an attachment mechanism for cooperation or group selection, we examine three general theories about human cooperation and describe how an attachment-theoretical perspective could explain important features.

First and still overlapping the religious sphere, Johnson and Bering (2006, 220) "suggest that religious beliefs, specifically the moralizing and sanctioning behavior they generate, may serve as a common origin for human cooperation." This hypothesis follows from their work on supernatural punishment and existential theory of mind. However, this takes us to

theory of mind as well as to punishment and from there to infant-mother attachment, following the work of Fonagy and others, who describe how mind reading and cooperation with an other grows within the infant-mother dyad (Chisholm 2003; Fonagy, Gergely, and Target 2007; Gallese, Eagle, and Migone 2007). Thus, the attachment system appears as a deeper "common origin for human cooperation."

Tribal Social Instincts

Richerson and Boyd's (1999, 2001) explanation of cultural group selection is the tribal-social-instincts hypothesis (also Boyd and Richerson 2006). Tribal social instincts are variously "the emotions and cognitive mechanisms that give rise to group cohesion and strategic action," "proximal psychological mechanisms that produce a measure of unsecured commitment to aid group members" (Richerson and Boyd 2001, 189), the "innate willingness to recognize, aid, and if necessary, punish fellow group members" (p. 190), and "prosocial impulses" (p. 199). We believe that attachment theory and research explain what the "emotions" and "cognitive mechanisms" of tribal social instincts are: the attachment system is the proximate psychological mechanism for prosocial group and group-adaptive behaviors.

Richerson and Boyd (2001) "distinguish them [tribal social instincts] from the more ancient social instincts that underpin cooperation in smaller-scale groups based on nepotism and reciprocity," arguing that "once culture became subject to group selection, prosocial tribal instincts arose by coevolution with group-selected cultural institutions" (p. 189) and that "the tribal social instincts are of relatively recent origin" (p. 190). In their view, tribal social instincts thus did not exist before humans evolved the capacity for culture. However, it is important to consider the proposition that the evolutionary foundation for cultural group selection is as old as attachment itself and that the evolution of the attachment process in humans was itself instrumental in the evolution of the capacity for culture and thus of cultural groups.

Because selection operates only on phenotypes, in order for it to favor the neurobiological mechanisms subserving human cooperation there had to be preexisting phenotypic variation in the phylogenetic precursor of such mechanisms. If the phylogenetic precursor of human cooperation was the mammalian/primate attachment system, it would make sense that cooperation and attachment rely on similar neurobiology. Evidence reviewed above shows that they do. For example, oxytocin and some specific brain regions subserve not only mother-infant and pair-bond attachments but also trust and cooperation in experimental games and charitable behaviors (Skuse and Gallagher 2008; Moll and Schulkin 2009). Moreover, altruistic punishment of "defectors" in experimental games is associated with activation of brain reward centers (Singer et al. 2006). This constitutes an innate emotional benefit. The fact that physical pain and emotional pain involve much the same neurobiology (Eisenberger and Lieberman 2004) harks back to the reptilian "pain avoidance" roots of attachment and provides the basis for emotional costs. Ultimately, emotional costs and benefits are the values driving mother-infant interaction and cooperation generally.

Evidence for the relationship between attachment and theory of mind is another reason we think that our attachment model of the evolution of cultural group selection does the work that Richerson and Boyd's tribal social instincts are meant to do. Following Tomasello (1999), Boyd and Richerson (2006) give central place to the role of theory of mind in the evolution of cultural group selection. It solves what they call the "bootstrap problem" (p. 467): "complex cumulative culture" cannot evolve when the capacity for imitation is weak or rare, nor, therefore, can cultural group selection. They propose that theory of mind greatly increased our ancestors' capacity for imitation by going beyond "learning from" others to "learning through" others by "reading" their intentions. But if "learning through" others is derived from the attachment process, as we described in "Theory of Mind," using work of Fonagy and others, then it does the work of the tribal-social-instincts hypothesis. This also means that the phylogenetic origin of cultural group selection is not "relatively recent" but as old as the attachment process.

Shared Intentionality

Because of its role in cooperation, collaboration, and complex cumulative culture, Tomasello and colleagues (2005) are concerned with the origin and development of our capacity for "shared intentionality" ("we" intentionality). They propose that this capacity arose from a general great ape "understanding [of] others as animate, goal-directed and intentional agents" and a human "species-unique motivation to share emotions, experience, and activities with other persons" (p. 675). They do not say what this "species-unique motivation" is, but they do not think that it is theory of mind, which they believe is itself derived from the "adaptation for participation in collaborative activity" (p. 690) they are looking for. However, evidence of an innate positive emotional response to contingency detection in the context of attachment (not to mention the evidence for the attachment/theory-of-mind nexus described above) suggests that the attachment process may provide this "species-unique motivation."

While more research is clearly needed, we are not persuaded that Tomasello et al. (2005) have effectively ruled out a relationship between "we" intentionality and attachment. For example, they do not think that "we" intentionality requires "any specific experiences" in childhood: "there seems to be fairly wide cultural variation in how infants are treated by adults—with adults in some cultures not really treating infants as fully intentional" (p. 688). With reference to the role of parental "mirroring" in the development of theory of mind, they say that "it is not clear that children in all cultures receive such experiences" (p. 689). Ethnography and attachment theory and evidence make both assertions unlikely. They also

state that "the understanding and sharing of intentions emerges ontogenetically in all cultural settings at around 1 year of age—with no known individual differences due to environmental factors" (p. 690). To the extent that caregivers are part of their children's environment, this is wrong, as studies cited above show. On balance, then, the attachment process is still a good candidate for understanding "we" intentionality.

In a more recent treatment of the origin and development of "we" intentionality, Moll and Tomasello (2007; also Hare and Tomasello 2005) present the idea that reduced aggressiveness might be an important part of our "species-unique motivation to share emotions, experience, and activities with other persons." Noting that relatively nonaggressive, tolerant chimpanzees are more cooperative (with humans and other such chimpanzees) than other chimpanzees, they propose that if some early humans became less aggressive or competitive, this would have allowed more cooperative behaviors to emerge. With fewer aggressive/competitive individuals, selection would then favor those who were even better at cooperation, especially the social-cognitive skills for "we" intentionality. They suggest that one way our ancestors may have become less aggressive is through "a kind of self-domestication, in which the more aggressive and less cooperative members of the group were somehow ostracized or killed" (Moll and Tomasello 2007, 646–647). It is not clear how less aggressive individuals could accomplish this unless they had sufficient "we" intentionality to form coalitions against the dominants ("reverse dominance hierarchies," as Boehm [1999*a*] put it), but then "we" intentionality would have to come before reduced aggression.

On the basis of evidence that artificial *selection* for *reduced aggression* ("tameness") in silver foxes works by extended development, that is, an extended period of time between the onset of positive, filial behavior in fox pups and the onset of fearful and aggressive behavior (giving the tame pups more time to experience nonaggressive and tolerant interactions; e.g., Belyaev, Plyusnina, and Trut 1985; Trut 1999), Chisholm (2006) proposed that the reverse might be true in human evolution, that is, that *selection* for slower or *extended development* in early humans would have resulted in lower aggression. As detailed in Chisholm (2003), our infants are born after a relatively short gestation in a state of extreme helplessness. The combination of extreme helplessness and its prolonged duration meant that at some point in our evolutionary history, mothers alone could not provide all the care required to rear children to adulthood. This may have selected for the capacity of infants to elicit even more care from their mothers. Through an increased capacity for eliciting care in the context of the preexisting, mammalian/primate attachment process, those infants who were most successful in "reading" their mother's minds could not help but use their mind-reading skills with others as they matured. These others would have included members of the opposite sex and kin, leading to adult attachment and the family for cooperation in child care (cooperative breeding [Hrdy 2005]) on the one hand and the social-emotional and cognitive capacity for reckoning kinship on the other.

Conclusion

An attachment-theoretical perspective can help inform our understanding of the nature of human cooperation. This paper described how the attachment system and an attachment to the deity could be a mechanism for cooperation in religious groups, including the within-group cooperation required for group selection. This mechanism is consistent with Wilson's (2002) conclusion that the God-people relationship, of which attachment to the deity is a version, is a proximate mechanism for group-adaptive behavior in religion. We have also proposed that the attachment system could be a mechanism for intragroup cooperation more generally and have discussed how attachment theory may provide a deeper level of understanding of how "moralizing and sanctioning behavior . . . may serve as a common origin for human cooperation" (Johnson and Bering 2006, 220) and may explain much about the nature of tribal social instincts (Richerson and Boyd 2001), while a phylogenetic and ontogenetic attachment perspective leads to a picture of the evolution of cooperation different from that proposed in discussions about "shared intentionality" (Moll and Tomasello 2007; Hare and Tomasello 2005). Although other systems are also important in social cooperation, we hope that this discussion lays a foundation for approaches to human cooperation that are more inclusive of attachment-theoretical perspectives as attachment theory returns from its focus on the level of the interpersonal dyad to one of Bowlby's earliest interests, the level of the group.

Coda

The end of Bowlby's discussion on cooperative behavior in groups focused on some types of negative behaviors:

> All our previous experience points inescapably to the conclusion that neither moral exhortation nor fear of punishment will succeed in controlling the use of this weapon [atomic bomb]. Persons bent on suicide and nations bent on war, even suicidal war, are deterred by neither. The hope for the future lies in a far more profound understanding of the nature of the emotional forces involved and the development of scientific social techniques for modifying them. (Bowlby 1946, 76)

The first part of this statement seems almost prescient for current security concerns. Perhaps the last part could be a prescient hope, for which proposals like ours may play some small role.

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Comments

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Weingarten and Chisholm make an excellent, and often overlooked, case for the importance of the attachment system in the evolution of religious belief and behavior, particularly in relation to the individual's perceived relationship with authoritarian and moralistic supernatural agents. They give considerable mention to the role of "theory-of-mind" capacities (which are invoked when reasoning about the unobservable psychological states motivating events and behaviors) as providing vital cognitive scaffolding for their proposed evolutionary mechanisms. I certainly agree that theory of mind is crucial to the attachment system as outlined here, and, like the authors, I suspect that such relationships originate through processes similar to the more mundane parent-child attachment profile.

Bovet (1928), a contemporary of Piaget's, argued that children's representation of God as an omniscient agent was an extension of their original ascription of these "all-knowing" properties to their mothers. Once they escaped their egocentric biases and realized that their mothers could be deceived, argued Bovet, they transferred this omniscience to God, who was conveniently introduced to them via culture around this same time. In fact, recent, unpublished data in the field of cognitive development reveal a clear trajectory in the way young children are able to reason about the extraordinary mental abilities of supernatural agents. Although there is some debate, current work in this area shows that children are unable to truly grasp the construct of omniscience until they are about 5–6 years of age and have been explicitly told that, say, God is an extraordinary agent with special mental abilities. Before this, children who have a theory of mind appear to regard God as being just as psychologically fallible as a run-of-the-mill person, that is to say, as an agent who can hold false beliefs and be confused.

On the surface at least, such data appear to support Weingarten and Chisholm's arguments concerning the shared countenance of parental and supernatural-agent attachment mechanisms, with the latter just being special types of relational partners that, like parents, are expected to react punitively to bad behavior. However, although the attachment system is clearly an important piece of the evolutionary puzzle of religion, it is less obvious to me why this necessarily implicates group-selection processes. As the authors note, there is an empirically established positive correlation between such things as moralistic gods and group size (Roes and Raymond 2003). Although such data can be used to favor group-selection (or multilevel-selection) models, it can do just the same for more standard individual-level arguments of natural selection, and more parsimoniously, for that matter. In terms of the adaptive value of attachment to supernatural agents, what is "good" for the group is typically "good" for the individual group member as well. Even in those cases where this would not obviously apply, such as in examples of costly religious rituals or even suicide, group-level selection arguments are often obviated by the basic principles of inclusive fitness (Bering and Shackelford 2004).

Finally, attachment to supernatural agents is buttressed by perceived ostensive-referential communication signals "emitted" by supernatural agents. In principle, believers should see a natural event, such as a family member's illness, as a form of punishment, but in fact this is a cognitively complex issue, since "punishment" is highly subjective. For the individual who stands to inherit resources in the event that this beloved family members dies, the episode may be privately perceived as a benevolent gesture on the part of the supernatural agent. This is where theory of mind, and in particular being able to attribute privileged epistemic states to relationally attached supernatural agents (e.g., knowing what the self wants, in spite of this desire being hidden from other people), must be accommodated by the authors' attachment model, because such phenomenological nuances seem vastly important.

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Gods of Love? If Darwinian evolution favors self-interest, how is large society possible? One popular idea is that god-commitment polices cooperation through negative punishment incentives (Johnson and Kruger 2004, 173; Bering and Johnson 2005). Attachment theory observes that love also swamps selfish desire. Weingarten and Chisholm argue that religious love is an especially powerful community-building emotion, visible to selection's grain.

Cognitive neuroscience helps to evaluate hypotheses about

how religion works by enabling researchers to identify specific proximate circuits and their relative contributions (Lisdorf 2007). In an intriguing supplement (supplement B), the authors find evidence for their attachment model in the neuroscience of love, focusing especially on the cognitive and behavioral effects of oxytocin and vasopressin. Though promising, such studies bear only indirectly on hypotheses about religion. Here, we review recent religion-specific functional magnetic resonance imaging (fMRI) studies that give qualified support for an attachment model, cast doubt on strong versions of the punishment hypothesis, and signal exciting new interdisciplinary horizons in the naturalistic study of religion.

Neuroscience and Social Cognition. If religion evolved to generate fearful social restraint, then we might expect the presentation of religious stimuli to evoke a fear response in the amygdala or an anxiety response in the anterior cingulate cortex (ACC). A recent NIH (National Institutes of Health) study used fMRI to evaluate Blood-Oxygen-Level-Dependent signal (BOLD) responses to religious expressions reflecting varying degrees of God's emotion and God's involvement (Kapogiannis et al. 2009). Examples included "Religion is moral guiding" and "God is punishing." In the intention and emotion conditions, religious expressions activated prefrontal circuits associated with self-referential thought, language, and the evaluation of intention and emotion. However, only where expressions denied God's existence did the team find elevated emotion (in believers). Further, the regions of activity were located in the anterior insula, suggesting moral disapproval or disgust. No specific amygdala or ACC activity was found and therefore no evidence of increased fear or anxiety. While social-strategic contrasts are needed to specifically evaluate the role of divine punishment in cooperative settings, a strong version of the punishment model implying general fear appears unwarranted. Supporting a broader attachment theory, the activity of social mind circuitry was observed and varied with the presentation of God's involvement and emotion.

The NIH study considered responses to religious statements. Yet how do religious persons *experience* their gods? A series of experiments conducted at Århus University sought to answer this question. Schjødt et al. (2009) compared neural responses for personal petitionary prayer with those for repetitive prayer in a group of devout Danish Christians. The team was interested in how different practices within the same tradition affect non-elite Christians who pray. The two prayer conditions—personal/improvisational and repetitive (the Lord's Prayer)—were further contrasted with comparable secular conditions: making wishes to Santa Claus (improvised) and a nursery rhyme (repetitive). In Christians who pray often, improvisational prayer elicited robust recruitment from social mind networks in the anterior medial prefrontal cortex (mentalizing), the temporoparietal junction (assessing intentional causation), the left temporopolar region (personal autobiography and social narrative processing), and the precuneus (self-referential activity/kinesthetic movement). However, no such effects were found for wishes to Santa. Regarding divine punishment, no specific amygdala or ACC activations were found, casting further doubt on strong versions of the divine-punishment model. As with the NIH study, however, social mind areas were active, giving further support to dynamic attachment. Schjødt et al. (2009) conclude,

> Our results show that young Danish Christian Protestants of IM [Inner Mission] recruit areas of social cognition during personal prayer, which suggests that praying to God is an intersubjective experience comparable to "normal" interpersonal interaction. . . . [I]n terms of brain function, our results suggest that the IM participants mainly think of God as a person, rather than as an abstract entity. (P. 205)

Music to an attachment theorist's ears? There is a twist. The Danish team found no specific BOLD response in social mind networks for repetitive prayer. It appears that when Christians repeat the Lord's Prayer, they do not engage with a representation of their Lord's mind. Instead, the researchers found activation in the dorsal striatum, an area at the head of the caudate nucleus important to reinforcement learning and anticipated reward (Schjødt et al. 2008). Furthermore, goal-oriented neural signatures were observed; there was no evidence of fear or anxiety. Pull—as opposed to push—motivations appear more compatible with dynamic attachment than with punishment. Importantly, only Christians who prayed regularly enlisted reward-related circuitry in repetitive prayer. Rewarding prayer, then, appears to arise through training; it does not arise merely from group membership or belief (on the cognitive importance of training, see Luhrmann 1991). Taken collectively, then, the Danish findings reveal that adoption-specific cultural practices and training matter to religious cognition, even within the context of a small, unified religious community.

These results are consistent with those of older studies showing neural phenotypic variation for distinctive religious practices: suppression of self-referential capacities during mediation (Newberg and Newberg 2008) and altered states of consciousness (Cahn and Polich 2006) and nonaffective abstract cognitive representation during prayer (Azari et al. 2001). Although neural variation is observed, at present we can hardly assess its scope and so cannot properly address the question of how variation relates to attachment models of religion.

Summary. Any honest assessment of the present state of understanding reveals that little is known about how religion operates in the mind. The next few decades may require us to reconsider almost everything we think we know. Better models will arrive through intelligent interdisciplinary collaboration, drawing cultural anthropologists, historians, and scholars of religion into the fold, with no holds barred. Attachment theory carries us one more step toward that intriguing future.

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I came away from Weingarten and Chisholm's article with a keenly felt wish: a better sense of how real primates, including humans and their ancestors, relate emotionally to their caretakers and cooperate with others in their groups. To understand the entwined trajectories of emerging cooperation and emerging religiosity, evolutionary scientists must move beyond a focus on attachment and security toward an understanding of the nitty-gritty of felt emotions and coconstructed behaviors. The authors themselves hint at this with their promise to "bring alive" their ideas with examples; a few paragraphs about Navaho and Shinto attachment to religious figures is a start, but more is needed.

I have begun with a bang, so let me backpedal and acknowledge that Weingarten and Chisholm bring welcome attention to a key question in evolutionary anthropology: How did people in the human lineage come to cooperate within groups to the extent that they did? Although the authors engage heavily with the literature on the origins and evolution of religion, how religion developed is not their main concern; they want to know instead whether attachment to a deity, stemming from attachment to a caretaker, might act as a mechanism for the development of within-group cooperation.

The happy news is that Weingarten and Chisholm situate their ideas squarely in the arena of mother-infant behavior and nurturing behavior more generally, too-often-neglected aspects of evolutionary theorizing. They identify as an underlying theme that "the adult capacity to become emotionally involved with others, and therefore to want to cooperate with them, is the common developmental outcome of an innate capacity for attachment and the attachment process." Yet developmental anthropologists and psychologists have shown convincingly that a focus on innate skills and on attachment and security misses the richness of coregulated interaction that goes on between baby and mother, between toddler and father, and indeed between any child and her caretaker.

Alan Fogel draws the contrast clearly when he writes that, conventionally,

> Relationships are linkages of individual entities. There are senders and receivers who exchange signals. There are innate and acquired characteristics. There are mothers and children who have endowments to reach out toward the other. In this perspective, the entities are primary and the relationships are an afterthought, a way of connecting these autonomous part. (Fogel 2008, 59)

On the other hand, a dynamic systems perspective "emphasizes that people are inherently connected and that development occurs through creative communication. . . . Call it creativity, or emergence, or discovery" (p. 60).

The richness of child-caregiver interactions in humans and other primates is better captured by a focus on coregulation, contingency, and creativity than by attachment's limited focus on protection, security, relief, and comfort (see Greenspan and Shanker 2004, 115–116). What happens to Weingarten and Chisholm's hypotheses if we shift away from an attachment perspective to one based on contingent coregulation? Is there a way to assess the degree of contingent coregulation in people's relating with God or other deities, that is, a way to assess whether the new perspective aptly applies to people's behavior with supernatural agents? How does within-group cooperation look when based on contingent coregulation? I do not know, but I do worry about "paying forward" (toward understanding the emergence of within-group cooperation) a theory that falls short of describing what primates do in their emotional lives.

Weingarten and Chisholm's perspective on attachment is avowedly evolutionary and indeed goes as far back as reptiles and early mammals. It is important to acknowledge explicitly that nurturing behavior not only may result from natural selection but also may drive it and thus drive evolutionary change (see papers in Fogel, King, and Shanker 2008). Further, if we are going to think productively about burgeoning human religiosity and cooperation, we have to model as completely as possible the specific changes in early and later *Homo* species that emerge from an ape and early-hominid behavioral platform. A provocative source for discussion along these lines is Tomasello's *Origins of Human Communication* (2008), although in my own books *The Dynamic Dance* (King 2004) and *Evolving God* (King 2007), I prefer to construct a behavioral platform for language and religion that rests on recognition of an ape platform more elaborate than Tomasello's with regard to communication and emotion.

In conclusion, Weingarten and Chisholm's account is rightly rooted in nurturing behavior yet cries out for greater engagement with the emotionally based developmental dynamics of real flesh-and-blood primates.

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Given that Weingarten and Chisholm's ideas about attachment to deities draw heavily from my work, I (of course) could not agree with them more. However, for reasons I have detailed elsewhere (Kirkpatrick 2005), I could not *disagree* more with their effort to expand attachment theory into an explanation of group cooperation.

Drawing on modern evolutionary psychology, I argue that humans possess numerous evolved, specialized psychological systems for negotiating functionally distinct types of social relationships. The attachment system is one of these, and I believe that a coalitional-psychology system is another, along

with other systems designed to regulate behavior in relationships based on social exchange, kinship, and intrasexual competition. The adaptive problems posed by attachment and coalitional relationships are fundamentally very different, and it therefore seems probable that we possess functionally distinct psychological adaptations in response to them. Although my own research has focused largely on the role of attachment, I argue that any or all of these systems can provide a psychological foundation for religion, with varying effects.

None of the arguments presented in this article convince me otherwise. For example: (1) The authors lean heavily on Bowlby's "insights" regarding attachment to groups, but these are from a 1946 paper, long before exposure to ethology radically altered his thinking. The concept of "libidinization of group leaders" seems to me exactly the kind of wild Freudian speculation that attachment theory was intended to supplant. (2) The authors overestimate the degree to which mother-infant relationships are inherently cooperative. In reality, they are rife with conflict when the mother's and the offspring's inclusive-fitness interests diverge, as with respect to the timing of weaning (Trivers 1974) and the biochemical arms race between mothers and fetuses over nutritional resources (Haig 1993). (3) The argument for theory of mind (ToM) as a crucial link between attachment and group cooperation fails because, although ToM has "roots" in early attachment relationships, this is true only in a weak sense. Countless other skills, abilities, and kinds of knowledge emerge in this context, from learning to walk and talk to using a toilet. Walking is learned in the context of an attachment relationship, and walking is an essential prerequisite for playing tennis, but it does not therefore follow that attachment theory is important for understanding tennis. (4) The authors take for granted that proximity seeking, also "rooted in" the attachment system, is "expected to promote proximity to the group," and thus increase "opportunities for imitation and within-group cooperation," but it is not clear why proximity is not just as likely to promote conflict as to promote cooperation.

The attachment system evolved because of the survival (and thus, indirectly, reproductive) benefits to infants who possessed such a system. It is adaptive only because of the (pre)existence of an evolved parental caregiving system that is responsive to attachment behaviors, which in turn evolved because of parents' inclusive-fitness interests in the survival and well-being of their offspring. Because social groups are not as invested in the welfare of an individual as are mothers, the functional organization of the attachment system would be poorly designed for regulating behavior toward groups.

It might be possible to link attachment to group cooperation in a very different way, however, if we diverge from Bowlby by differentiating the attachment system qua control system from attachment as an emotional *bond*. The powerful emotion of *love* represents a clever tactical solution, designed by natural selection, to motivate individuals to invest in and care about others to whom their own inclusive-fitness outcomes are somehow yoked. In Frank's (1988) terms, love functions as a "commitment device." Such a mechanism plays a crucial role in both the child's attachment system and the mother's caregiving system as well as in romantic relationships (Frank 1988) and close friendships (Tooby and Cosmides 1996). Perhaps—and I wish to emphasize that this is mere speculation—this same mechanism might similarly be recruited by the coalitional-psychology system, under certain conditions, in a manner that gives rise to so-called tribal instincts. In this view, the control systems regulating group and attachment behavior are recognized as functionally distinct but share a common (but otherwise functionally distinct) subsystem. Whales are well designed for swimming but not for walking, and vice versa for cows, but they both have a heart.

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Weingarten and Chisholm's article is a unique contribution to the emerging literature on the evolution of religion. However, if it is to provide a foundation for future evolutionary studies, various issues must be addressed. Whether attachment processes are a proximate mechanism for understanding how religious communities achieve intragroup cooperation is a debate we leave for other commentators, but human–supernatural agent attachments appear more varied, complex, and socially and environmentally contingent than the authors suggest (e.g., Spiro and D'Andrade 1958). Although attachment processes may have been important in the transformation of religion in the axial age, as Sanderson (2008*b*) proposes, attachments of the nature proposed by the authors seem less applicable in tribal and chiefdom religions than in the Abrahamic and other contemporary world religions. We focus our comments here on the relevance of group selection in the model offered by Weingarten and Chisholm.

Whether group-selection pressures have shaped religious behavior is a question that must be answered with empirical data. Recent survey articles describing the resurrection of group selection are based on rigorous empirical work (Borrello 2005; Wilson and Wilson 2007); however, none of this research has been conducted on religious groups or any human population. While religious practices and beliefs do indeed seem to promote intragroup cooperation (e.g., Shariff and Norenzayan 2007; Soler 2008; Sosis and Bressler 2003; Sosis and Ruffle 2003), this is not a demonstration of group selection, as Weingarten and Chisholm suggest. The authors cite studies by D. S. Wilson (2002, 2005), whose work we greatly admire and respect, but these studies do not demonstrate group selection either, as we suspect Wilson himself would readily admit. Wilson provides compelling evidence that many religious doctrines and teachings are consistent with group selection; they are aimed at encouraging members to behave for the benefit of the group. But individual-level

interpretations of these results are also possible, and data on actual behavior are necessary to fully examine the selective pressures involved.

Sober and Wilson (1998) advocate a multilevel-selection approach in which within-group (individual level) and between-group (group level) fitness effects are estimated. Multilevel selection is a potentially powerful theory for evaluating evolutionary dynamics, especially those that seem to defy individual- or gene-level explanations, such as religion. To evaluate individual- and group-level adaptations, we recommend the methods detailed by Sober and Wilson (1998). They outline a stepwise procedure to examine the relative strength of natural selection at multiple levels, simplified here (and in their book) to focus on individual- and group-level dynamics. The core of their procedure is as follows: (1) determine what would evolve if group selection were the only evolutionary force; (2) do the same for individual selection; (3) determine the pattern of phenotypic variation within and among groups; (4) determine the heritability of phenotypic differences; and (5) determine the fitness consequences of phenotypic variation within and among groups. We are not aware of any human studies that have fully carried out this program.

We appreciate Weingarten and Chisholm's focus on the proximate mechanisms of religious systems; however, delineating underlying proximate mechanisms is largely irrelevant for understanding the selective pressures that have shaped a phenotypic trait. Note that proximate mechanisms are entirely absent from Sober and Wilson's procedure for assessing selective pressures. Discovering, for example, the proximate neural mechanisms underlying facial recognition would not help us understand why facial recognition evolved. Examining proximate mechanisms is, of course, vital for a comprehensive understanding of any trait, and it can uncover constraints under which the trait evolved, but it tells us little about the selective pressures that have shaped the trait. Thus, proximate mechanisms, such as attachment processes, cannot support or deny individual-selection, group-selection, or by-product accounts of religion. Indeed, although Kirkpatrick (2005) argues extensively for the role of attachment theory in understanding religion, he rejects group-selection interpretations and is partial to by-product accounts of religion.

We recommend that Weingarten and Chisholm clarify the group-selective account they are offering. It is often unclear in the article whether they are claiming that religion evolved through processes of group selection, that current religions face group-selective pressures, or both. The differences are important because adaptation and current adaptiveness are different questions: providing evidence for current adaptiveness does not allow us to conclude that a trait is an adaptation (Laland and Brown 2002). We would also like to know how the proposed attachment mechanism interrelates with the many elements of the religious system that were not discussed in the article, such as ritual, myth, and afterlife beliefs. Furthermore, what socioecological factors influence the development of the mechanism and its eventual form? We encourage the authors to empirically test the many ideas they offer, and we look forward to the further development of their research program.

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Weingarten and Chisholm provide an important contribution to understanding how multilevel and group-selection processes expanded the capacities of the attachment system for enhanced cooperation within groups, by using the supernatural-agent premise as a mechanism for intragroup cooperation. These contributions have to be further contextualized within the broader context of the adaptive functions of ritual behavior and within the linkages of both ritual and opioid dynamics to modifications of consciousness that produce the experiences of the supernatural other.

The attachment dynamics underlying religiosity have deeper phylogenetic roots in the context of vertebrate capacities for ritual social coordination and communication. The basic cooperative and communicative elements of the attachment dynamics have continuity with the basic function of ritualized behaviors in lower species: communication for enhancing cooperation within groups (see Laughlin and d'Aquili 1974; d'Aquili, Laughlin, and McManus 1979). Weingarten and Chisholm correctly note that religiosity has foundations in cultural group selection and the attachment system, but these dynamics have older foundations in ritual behaviors. Conceptualizing the origins of religiosity in ritual rather than attachment provides a broader context for assessing the exaptations of the attachment dynamics for new adaptive functions that meet the needs of larger integrated social groups (Winkelman and Baker 2008).

Expansion of the earlier reptilian ritual dynamics of dominance and subordination associated with deity concepts also requires an expanded theory of mind. Emotional aspects of theory-of-mind relations with deity were exapted from the mammalian mother-other into broader personal, social, cognitive, and symbolic relations with "others." This raises the question of the source of such experiences of the supernatural other and demands that we pay attention to another dimension of religiosity associated with the biological bases of the attachment dynamics. The hominid line underwent selection for enhanced opioid systems and a capacity for metabolizing exogenous sources of opioids and other significant but rare neurotransmitter analogs that produce powerful modifications of consciousness typically experienced as interactions with a deity (Sullivan, Hagen, and Hammerstein 2008; Rockman et al. 2005). Indistinguishable altered states of consciousness (ASCs) are produced by both endogenous and exogenous sources of opioids, which evoke experiences of the

supernatural other, both the self as spirit (out-of-body or soul-flight experiences) and the externalized supernatural other (Griffiths et al. 2006; Winkelman 2000).

Winkelman and Baker (2008) review evidence of the interdependence of these ASC experiences and the opioid system from the selection in humans for enhanced opioid responses; this illustrates that supernatural experiences were an early feature the development of human religiosity. The ability of exogenous and endogenous sources of opioids to produce these supernatural experiences requires that the attachment theory of religiosity address these experiential dynamics as part of a comprehensive consideration of the relationship of the opioid system to religiosity. These neurobiological aspects of religiosity both precede and extend beyond the opioid aspects of attachment systems to include the roles of neuropeptides in a variety of higher-order cognitive processes. These aspects of human evolution increased our religious capacity, which was subsequently expanded through the use of exogenous sources of these significant brain chemicals and the ritually enhanced production of these substances.

The capacity to conceptualize spirits that emerges from the dynamic of modeling the other's mind, emotions, and intents involves key aspects of religiosity that were selected for across human evolution. The ability of spirit-other relations to expand the repertoire of possible others for self-processes constitutes a significant expansion of religiosity beyond the original functions of ritual. Conceptualizations of spirits expand the dynamics of self-other relations by a number of mechanisms that extend perceived/possible capabilities and outcomes beyond those achievable within recognized human capacities. The human unconscious and its wisdom are given certain control over decision making, externalized in the concepts of spirits who provide a hierarchy of higher-order decision-making processes through these modifications of consciousness (Winkelman 2000).

Weingarten and Chisholm note the link between these supernatural concepts and the inherently interpersonal properties of the representations produced by the attachment system as the basis for this sense of personal agency. ASCs not only produce this spirit experience of personal agency but also create a sense of interpersonal bonding that extends attachment beyond mother-infant dynamics. Hayden (2003) proposes that ritually induced shamanic experiences relaxed selective pressures that favored in-group cooperation and out-group hostility, with ASCs reducing ego boundaries and providing experiences of unity that permitted the inclusion of others into the group. Given the interdependent dynamics of the opioid system and ASCs in producing both a special sense of the "other" and an expansion of the sense of bondedness beyond kin, explanations of the role of the opioid system in the origins of religion must give attention to the special role of ritual activities and environmental sources of opioids and other neurotransmitters in selecting for the capacity for these ASC experiences and the experiences of the other, self, and group they typically produce.

Reply

We offer sincere thanks to commentators for their time, effort, and valuable insights.

After our manuscript was completed, a landmark neuroimaging study was published on "cognitive and neural foundations of religious belief" (Kapogiannis et al. 2009). In June 2009, as we write this reply, another study appeared, on prayer (Schjødt et al. 2009). Thus, we are very fortunate to receive comments and discussions of these studies from Bulbulia and Krueger. They herald an increasing ability to probe the neurobiological underpinnings of religion. It is encouraging that results of these studies may provide some support for an attachment model and a role for neural substrates of social cognition. Many brain regions observed in these studies also overlap regions we observed in a neuroimaging study on memory of autobiographical interpersonal relationships (J. Loughead, L. Luborsky, C. Popp, R. German, D. Kirk, B. Krause, and R. C. Gur, unpublished manuscript).

Results from Kapogiannis et al. (2009) indicate that reward systems can be more important than fear. The "ultimate motivation" in attachment is love, consistent with a "pull motivation" and involvement of the reward system. Future studies might, however, probe whether some religions or their members did develop a dependence on "fearful social restraint." Anxiety, fear, conflict, and punishment are parts of normal, healthy attachment relationships (think of your own child-parent relationships). Perhaps the balance between love and fear is contingent on local historical epidemiology of secure versus insecure attachment. Reward is also consistent with Winkelman's important attention to the opioid system. Endogenous opioids mediate some of the rewarding aspects of attachment via an ancient dopaminergic mesocorticolimbic reward system that probably evolved for attachment (Insel 2003). Winkelman's comments on ritual also tie into neurobiological studies (see supplement B). A partnership between neuroimagers and anthropologists on the variety of ritual experiences might lead to a wealth of findings.

Another neuroimaging study just published used narratives about compassion or admiration (Immordino-Yang et al. 2009). Collective moral narratives (histories, folk tales, scriptures) have been central to transmission of culture, especially religion and moral, prosocial behaviors. Collective narrative may also have an essential, ontogenetic role in construction of the self (Nelson 2003). Because religious/moral narratives may contain representations of deities as attachment figures (Obeyesekere 1990; Popp et al. 2003), there may be links between some religious/moral narratives and this attachment mechanism. It would be nice to know what these narratives do to brains. As Bulbulia and Krueger say, "little is known about how religion operates in the mind," and this means the delightful circumstance of a wide-open door for discoveries.

Sosis and Shaver highlighted many important topics on selection. They emphasized that identifying proximate mechanisms behind a trait says nothing about its ultimate causes, the selection pressures giving rise to the mechanisms. Thus, our hypothesis about the role of the attachment process in human "ultracooperation," as exemplified in religious groups, does not support or deny "individual-selection, group-selection, or by-product accounts of religion." But choosing between these alternatives was not our goal. Instead, our goal was the more modest one of identifying a credible proximate mechanism, connected to theory and data in potentially relevant fields, whereby intragroup cooperation in religious groups might arise.

Many investigators have described how individual- and group-level selection interpretations are interchangeable and mathematically equivalent (Boyd 2006; Wilson and Wilson 2007; Hölldobler and Wilson 2009; Nowak 2006; Reeve and Hölldobler 2007). For example, inclusive-fitness arguments can be group-selection arguments: if an individual sacrifices individual fitness with the consequence that relatives benefit, the effect is that of group (kin-group) selection. Therefore, although individual-level inclusive-fitness interpretations can be made—as Bering and Sosis and Shaver rightly note—these do not obviate group-level interpretations.

Sosis and Shaver described Sober and Wilson's (1998) "stepwise procedure" for evaluating the "relative strength of natural selection at multiple levels," adding that to their knowledge this has not been fully carried out. However, Sober and Wilson stated, "we do not wish to imply . . . that all of them are required for the study of every trait" (pp. 102–103). They chose "a somewhat different approach . . . to evaluate the major factors . . . that would make group selection a significant force in human biological and cultural evolution" (p. 160). Wilson (2005) described evolutionary hypotheses about religion and tested them in a sample of religions. Although clearly more work remains to be done, good steps have begun on cultural group selection in humans (Wilson and Wilson 2007).

Those going forward into empirical studies can also draw insight from others. Thus, Reeve and Hölldobler (2007) advise that because individual-selection and trait-group-selection models are interchangeable, the "truly interesting problem" is not choosing between the two but "how intergroup competition can increase the extent to which social groups can be viewed as coherent vehicles for gene propagation, i.e., superorganisms" (p. 9736). Their work can be extended to human groups and cultural selection. For example: "if . . . between-group competition is much greater than that of within-group competition . . . within-group cooperation approaches 1.0 regardless of relatedness. The latter result has the potential to explain cooperation among nonrelatives in human societies" (p. 9739). Another interesting prediction is "within-group cooperation will decline as between-group relatedness increases" (p. 9739).

Sosis and Shaver ask whether we "are claiming that religion evolved through processes of group selection, that current religions face group-selective pressures, or both." Briefly, our primary claims are not about religion per se but about *cooperation* in religious *groups*. We concur that "all selection is multilevel" (Hölldobler and Wilson 2009, 24); and between-group competition and selection—sometimes historically, sometimes currently—are key to cooperation in some, but not necessarily all, religious groups. Sosis and Shaver helpfully ask "how the proposed attachment mechanism interrelates with . . . ritual, myth, afterlife beliefs" and "what socioecological factors influence the development of the mechanism?" We expect to see representations of attachment to the deity, in conjunction with promotion of group-beneficial cooperation, interwoven into ritual, myth, and afterlife beliefs; emotionally significant maternal or paternal portrayals of one or a few deities; promotion of love for the deity; promotion of group-beneficial behaviors in conjunction with the deity; communal rituals with songs or calls for prayer to loving, gracious, and merciful divinity (see supplement B regarding music and attachment); collective narrative portraying deities as maternal/paternal attachment figures promoting group-beneficial cooperation; or in afterlife beliefs in which moral, prosocial individuals are rewarded in heaven, where a loving relationship with the deity continues, or death is regarded as part of cycles of rebirth protected by "taking refuge" in Buddha (to feel "secure" or "protected" in "a place we can rely on," such as "in our mother's womb"; Hanh 1999, 161) until compassionate and wise living leads to enlightenment. Socioecological factors include, especially, circumstances that increase between-group competition. Sightings of the four horsemen of the apocalypse—invasion, war, famine, and death—make a great starting point. Thus, Sanderson (2008*a*; published after our paper was submitted) described war, urbanization/social disruption, and attachment associated with the evolution of religion; our perspectives see this in new light (also see Turchin 2007).

We are happy that Kirkpatrick agrees in part. Regarding disagreements, a suggestion that the attachment system generally may be "poorly designed" for involvement in group processes is inconsistent with empirical data. Some studies are offshoots of attachment theory: Marmarosh et al. (2006), Mayseless and Popper (2007), Mikulincer and Shaver (2007), Rom and Mikulincer (2003), and Smith, Murphy, and Coats (1999). Other work comes from neurocognitive studies in social and moral cognition that discuss attachment-related neurobiology and prosocial cooperation/morality, including Moll et al. (2006), Moll and Schulkin (2009), Zak, Kurzban, and Matzner (2005), and many more (see supplement B). Kirkpatrick's comment that "ToM has 'roots' in early attachment relationships . . . only in a weak sense" is inconsistent with significant work by Fonagy, Gergely, and Target (2007), Gallese, Eagle, and Migone (2007), and others. Further, many researchers have highlighted theory of mind as a foundation for prosocial cooperation/morality, for example, Adolphs (2009), Bering (2002), Johnson and Bering (2006), and Moll

and Schulkin (2009). For example, internal working models are for intuiting the mother's beliefs, desires, and intentions. With time, the same operations embodied in internal working models are also brought to bear in theory of mind, for the adaptive problems are the same: figuring out what I (or you) should do according to what you (or I) think the other believes, desires, and intends to do and vice versa. With respect to "coalitional" relationships, the people involved may be different, but the problems to be solved are the same: forming coalitions first with mothers, then with others. For example, Rilling et al. (2008) specifically targeted in-group-out-group processes with respect to coalitional psychology—and found involvement of regions subserving theory of mind. Overall, our model builds from work by many others, as noted in our paper, and our perspective, which highlights involvement of multiple complex, overlapping neurocognitive systems in many psychological phenomena, is also useful.

Kirkpatrick critiqued Bowlby's "libidinization of group leaders" as "wild Freudian speculation." It is probably true that the concept of "libidinization" has been complicated by Freud's concept of "libido," which is widely misunderstood to refer narrowly to sexual feelings or motivations. More to the point, Bowlby (1946) described "to be libidinized" as to be "emotionally valued," as we noted in our paper, and spoke of "love" and "trust." Talking about "libidinization" was but the currency of the day, and we would express gratitude for what we learned.

We do not "overestimate the degree to which mother-infant relationships are inherently cooperative." Instead, we have described an evolutionary "arms race" between mother and infant, with mothers under increased selection to allocate their limited resources even more wisely and infants under increased selection to elicit even more investment (Chisholm 1999, 2003). It is because conflict between mother and infant is inherent and inescapable that selection would have favored mechanisms for maximizing mother-infant cooperation. We do not "take for granted" that proximity can lead to increased cooperation; for example, see assortative encounters (Sober and Wilson 1998).

Kirkpatrick proposes a link between the attachment system, love, and coalitional psychology as a basis for intragroup cooperation. However, his wish to differentiate attachment as control system from attachment as emotional bond is difficult to grant because the attachment system exerts its control on maternal and infant behavior through motivations associated with love. The emotional bond between mother and infant constitutes the "value principle" (Frank's [1988] "commitment device"; see also Damasio's [1994] "somatic marker hypothesis" of the emotions) that motivates them to interact as they do, as each attempts to "control" the other's behavior. In addition, Kirkpatrick's speculation that the emotional bond between mother and infant might be "recruited" by his "coalitional-psychology system" to give rise to the "so-called tribal instincts" is what we described, without the "coalitional-psychology" step, for tribal social instincts in our paper. Still, many mechanisms contribute to group-beneficial cooperation, and Kirkpatrick's additions are welcome.

We wholeheartedly agree with King on the value of discussing the nitty-gritty of relationships and hope to do so. However, attachment is *all about* emotion, especially, but not limited to, love. It is therefore not possible to "move *beyond*" or "shift away from" attachment toward "the nitty-gritty of felt emotions" or "contingent coregulation," because that is where attachment theory *already is*. This is one reason why the work of Fonagy, Gergely, Target, and others on contingency detection is so critical and why volumes of research on attachment formation show that maternal and infant sensitivity and responsiveness to each other's behaviors are so critical for development of individual differences. King calls for more connection with other primates; we hope to say more on K selection and the evolution of human sociality soon.

Bering's discussion is a reminder of his seminal work on theory of mind in religion. He raises the need to accommodate nuanced theory of mind:

> In principle, believers should see a natural event, such as a family member's illness, as a form of punishment, but in fact this is a cognitively complex issue. . . . For the individual who stands to inherit resources in the event that this beloved family members dies, the episode may be privately perceived as a benevolent gesture on the part of the supernatural agent.

Attachment relationships, among our most significant, complex, and nuanced, do accommodate highly nuanced theory-of-mind capacities. We add that Bering's choices may not be the only ones. Perhaps illness is "God's will," to be trusted and accepted. Death may be a gift because it ends suffering: most persons in the world age and die with only poor pain treatment. Among Christians, illness may be modeled by Jesus on the cross and therefore be an "opportunity" to understand with "felt experience" something more about the suffering that Jesus (and human altruists) incurred to benefit others. Nuances of theory of mind in religion are rich areas for exploration.

Sosis and Shaver comment that our model "seems less applicable in tribal and chiefdom religions than in the Abrahamic and other contemporary world religions." We see no reason why our model could not apply to some of these religions but agree that it is an empirical question. However, Abrahamic monotheisms have been successful for thousands of years and are currently the dominant religious and cultural influence for a couple of billion people. Therefore, it would be useful to understand these groups even if they comprise a small percentage of religions, for they are very large. If this attachment mechanism is more prevalent in contemporary religions, we can ask whether it has been a mechanism for their success in the modern world, with its histories of between-group competitions, or, following Wilson, whether some contemporary religions are group adaptive and whether an attachment version of the God (deity)-people relationship is an important proximate mechanism. Finally, rarity threw

light on eusociality (Wilson and Hölldobler 2005). Perhaps it could throw light on human cooperation.

—Carol Popp Weingarten and James S. Chisholm

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