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Commentary

Sex differences in social behavior and cognition: Utility of sexual selection for hypothesis generation

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Knickmeyer and colleagues' (this issue) provide intriguing evidence for a nascent and possibly hormonally influenced sex difference, favoring preschool girls, for some aspects of theory of mind (ToM), that is, skill at making inferences about the thoughts, feelings, and intentions of other people. The study is important because the measure used to assess the associated generation of mental and affective state terms and intentional propositions to describe object-to-object interactions is more sensitive to sex differences then most ToM tests used at this age. The study also contributes with the use of an evolutionary perspective to generate hypotheses regarding sex differences in ToM and social behavior. In fact, over the past three decades, Darwin's (1871) evolutionary mechanisms of sexual selection (described below) have been used by biologists to generate hypotheses and to better understand sex differences across hundreds of species and in thousands of studies (see Andersson, 1994). Unfortunately, psychologists have been reluctant to follow this lead, neglect and sometimes outright dismissal that are as old as the systematic study of human sex differences itself (e.g., Woolley, 1914). Counter to this historical bias, Knickmeyer and colleagues implicitly use sexual selection, specifically, female–female competition as one potential source of ultimate human sex differences in social cognition. However, sexual selection is much nuanced in humans and leads to a predicted female advantage in some social-cognitive domains, a male advantage in others, and no difference in still others (Geary, 1998, 2002).

The basic mechanisms of sexual selection are competition with members of the same sex over mates (*intrasexual competition*) and discriminative choice of mating partners (*intersexual choice*). In most species, these dynamics primarily manifest as male–male competition and female choice and the most common result is the evolutionary elaboration of the traits that facilitate competition and choice. These dynamics in turn arise from the degree to which each sex invests in parenting and this emerges from more fundamental differences in the potential rate of reproduction (Clutton-Brock and Vincent, 1991; Trivers, 1972). The basic cross-species pattern is that the sex with the slower potential rate of reproduction invests more in parenting, is selective in mate choices, and exhibits less intrasexual competition over mates. The sex with the faster potential rate of reproduction invests less in parenting, is less selective in mate choices, and exhibits more intense intrasexual competition. Because the potential reproductive rate of female mammals is limited by gestation time and length of postpartum suckling, and the theoretical limit for males is the number of females for which they gain sexual access, sex differences in traits associated with intrasexual competition (favoring males), intersexual choice (favoring females), and levels of parental investment (favoring females) are predicted. These differences are found in more than 95% of mammalian species (Clutton-Brock, 1989). The same basic pattern is found in humans, but modified by male parenting. This paternal investment creates female–female competition over resource-holding men and male choosiness when it comes to long-term mates, in addition to male–male competition and female choice.

As noted by Knickmeyer and colleagues, patterns found in related species, such as chimpanzees (Goodall, 1986), and in human population genetic data (e.g., Seielstad et al., 1998) support the argument that males tended to stay in their birth group and females tended to migrate to the group of their mate during hominid evolution. This sets the stage for

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the evolution of social biases in males that support the formation of kin-based coalitions that compete with other coalitions for control of land, territory, and political influence, and the formation of within-coalition dominance hierarchies, as is found across human cultures (Brown, 1991). Thus, male–male competition involves cooperating with other males to form large competitive coalitions and tolerating within-coalition aggression as related to formation of a dominance hierarchy. Women emigrating into these groups have a different set of pressures; specifically, forming a social support network with non-kin and because dominant men marry polygynously, competing with co-wives. Because these social networks are formed with non-kin, they are predicted to be based on reciprocal altruism, relationships that require high investment and strict equality. This in turn limits the number of such relationships. In any case, in comparison to male–male coalitional competition, female–female competition is focused on a smaller number of individuals (e.g., co-wives) with whom they often have day-to-day contact. The competition often involves a more subtle–in relation to male-on-male aggression–manipulation of this web of relationships.

Fig. 1 shows different components of folk psychology that appear to support features of social cognition that are universal across the sexes and human cultures (Geary, 2005). These are composed of brain and cognitive systems (e.g., for face processing) that are centered on the self, individual others, and collections of others (groups). However, the different social pressures that appear to have confronted males and females during human evolution are predicted to have elaborated some of these competencies more in one sex or the other. As suggested by Knickmeyer and colleagues, competition among women may be more heavily dependent on ToM than competition among men; this does not preclude the importance of the mother–child relationship for ToM, but is in addition to this relationship. In fact, female–female relational aggression is predicted to result in a female advantage for all of the individual-level competencies shown in Fig. 1.

Research to date supports a female advantage for processing and interpreting nonverbal behavior, facial expressions, and for language comprehension and production (Hall, 1984). The literature on ToM has been mixed, and thus the Knickmeyer et al. study is a timely contribution. The person schema has not been as extensively studied, but the prediction is that girls and women will invest more time learning about the personality, history, preferences, and so forth of other people in their life; the schema is a long-term memory network that includes representations of the other persons' physical attributes (age, race, sex), memories for specific behavioral episodes, and more abstract trait information, such as sociability and competence (Schneider, 1973). This information will facilitate female-on-female relational aggression and is useful for negotiating other social relationships, in both positive and negative ways.

Coalitional male–male competition is predicted to result in a bias for boys and men to form competitive based groups, as noted. Because group competitiveness is often size related and leadership dependent, the social, emotional, and hormonal mechanisms for forming these groups must differ from those found in women (Geary and Flinn, 2002; Wagner et al., 2002). This is because mechanisms based strictly on reciprocal altruism would constrain group size and militate against stable dominance hierarchies. In terms of social cognition and during times of conflict, males are predicted to have greater focus on and stronger attributions related to group-level cognitions; specifically, distorted attributions regarding members of favored in-groups and disfavored out-groups and a heightened tendency to rally around group ideology (e.g., nationalism), which increases in-group size. Horowitz's (2001) studies of ethnic violence

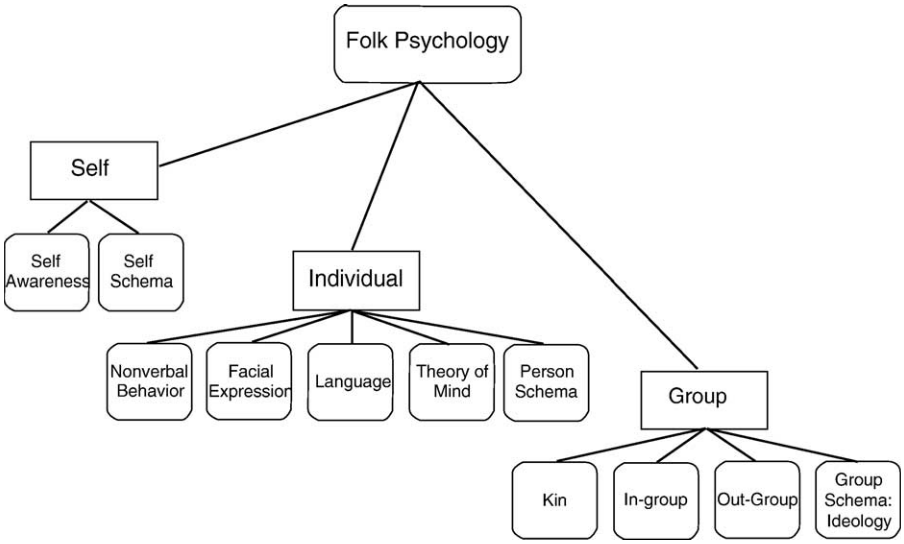

Fig. 1. Human social cognition is predicted to be part of the evolved domain of folk psychology, and to be composed of brain and cognitive systems (e.g., for face processing) that are centered on the self, individual others, and collections of others (groups).

are consistent with these predictions, but they have not been systematically studied in lab settings (but see Arndt et al., 2002).

Predictions regarding self-awareness and elaboration of the self-schema are less clear; the self-schema is a long-term memory network of information that links together knowledge and beliefs about the self, including positive (accentuated) and negative (discounted) traits (e.g., friendliness), episodic memories, self-efficacy in various domains, and so forth. I suspect self-awareness provided advantages for both sexes during human evolution, but the domains in which self-schema are elaborated are predicted to differ: for instance, boys and men are predicted to focus more on self-competencies related to status striving in their competitive niche (e.g., athletic skills, or academic skills), whereas girls and women are predicted to focus on self-attributes associated with equity (e.g., more likely to recall their prosocial acts) and physical attractiveness (related to male choice).

Sex differences in developmental activities are predicted to mirror sex differences in patterns of intrasexual competition, intersexual choice, and parental investment (Geary et al., 2003). At a proximate level and in keeping with patterns found in other species, sex differences in activity biases are predicted to be influenced by pre- and postnatal exposure to sex hormones, but the developing competencies will necessarily emerge from the interactions between early biases in brain organization, perception, attentional focus, and child-initiated activities and the specifics of the ecological and social niches in which the children are situated. Although many sex differences will not emerge until the hormonal changes associated with puberty, other differences may emerge early in life. These are predicted to be the competencies that require many years of practice (e.g., as related to relational aggression) to master. The expectation is that most of these sex differences will be small early in life but will increase in magnitude as result sex differences in activity patterns. These activity patterns will be, in part, child-initiated and related to hormones, but also potentially influenced by other people, including parents and peers. Knickmeyer and colleagues' results are in keeping with the prediction of an early difference potentially related to female–female competition, and I concur with their excellent suggestion that they assess these children again at a later age. In addition to fetal testosterone, it would be of interest to know if early sex differences in ToM are also related to later sex differences in peer relationships: Do preschool girls with strong ToM become elementary school girls who are skilled at assessing and manipulating relationships with other girls?

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