

## SOCIAL AWARENESS AS AN INDICATOR OF SELF-AWARENESS: THE MEAD-COOLEY MODEL AND RESEARCH METHODOLOGY IN NONHUMAN PRIMATES

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### ABSTRACT

Social awareness can be defined as the ability of an organism to understand the social network of which it is a part and its ability to act in congruence with the protocol that governs that network. Therefore, social awareness can be viewed as the precursor to self-awareness in socially complex organisms such as nonhuman primates. The Mead-Cooley model of the social self, which postulates that identity is a product of social interactions, supports this premise. Until recently, the mirror self-recognition task (MSRT) has been the most common technique for measuring self-awareness. However, the inadequacies of MSRT need to be addressed by more complete methodologies that address self-awareness in ecologically valid social situations. Before new techniques can be suggested, it is vital to understand some of the complex social behaviors of nonhuman primates. These behaviors include dominant/subordinate relations, coalitions, aggressive behavior, reconciliation, and kin relations. A review of the social behavior of each species will elucidate the best methodologies for studying the self-awareness each species in terms of its own behavior.

### THE SELF: DEFINING SELF-AWARENESS

Self-awareness is the ability of an organism to be conscious of itself and differentiate itself from other organisms. Some comparative psychologists believe that only understanding of the physical self can be described as self-awareness. Others suggest that social awareness, or the understanding of an organism within its social strata, is the best means for establishing a true definition of self-awareness. This review addresses differences between these two definitions, focusing on social behavior in nonhuman primates as a precursor to identity formation and the best methodologies for studying the self in those organisms.

Careful examination of the theories of Cooley (1912) and Mead (1910) suggests that self-awareness is by no means a simple concept. The Mead-Cooley model postulates that social interactions are the basis for identity development and understanding of one's role in the social network (Gallup, 1977).

Researchers have developed many ways in which to measure the degree to which animals recognize themselves or are *aware* of themselves and their own mind as well as the minds of others. The mirror self-recognition task (MSRT) has been most popularly used to measure self-recognition, a type of self-awareness, in primates (see Parker, Mitchell, and Boccia, 1994, for review). For most species, the results of this task and others like it have not been promising. However, they only reflect the ability of an animal to recognize its physical "self" and understand the properties of a mirror. The test does not measure, as researchers (Gallup, 1977) have claimed, the degree to which animals are truly self-aware. The only methodologies that can effectively address self-awareness are those that replicate and, in some circumstances, invoke social situations. Since primates are very socially adept animals, it is prudent to use replications of social situations that require them to adapt their knowledge of previous experience to accomplish a new goal. The best kind of research on self-awareness involves both ecological validity and triangulation (Heyes, 1993). Using these methods, the degree to which primates are aware of themselves and others in their respective social systems can be established.

Establishing an adequate definition of the self has been a goal of developmental psychology for nearly a century. Lewis (1994) has a multi-component theory of self that can be easily applied to all complex biological beings. According to the theory, the concept of self is inseparable from one's identity. In other words, it seems that once a sense of self has been ingrained into an organism, that sense is not easily altered. This particular concept holds true for social systems such as dominance hierarchies. More importantly, the theory posits that the self is both objective and subjective. Objective self-awareness simply requires the acknowledgement of the self as a physical being. This type of self-awareness is relatively primitive because it only requires things such as self-differentiation, motor capacity, and the conservation of self across time and space. Conversely, subjective self-awareness is the idea of a "me." This concept requires more abstract thinking and more complex methodologies to suggest that an organism possesses it. Generally, this type of self is only seen in organisms with complex social networks, such as primates. These two types of self, one primitive and the other complex, constitute the self (or awareness) in higher order organisms. Certainly lower order organisms have objective awareness characterized by behaviors such as self-preservation, but they may not have the cognitive or social capacity for subjective awareness (Lewis, 1994). Because more socially complex animals (e.g., primates) should possess the idea of "me" bred from their many social interactions, subjective self-awareness will be the focus of this discussion.

In a commentary on the conference that spawned the discussion on subjective self-awareness in animals Parker, Mitchell and Boccia (1994) remarked that, "participants [in the conference] agreed with Gallup that the mark test can not be sole criterion for self-awareness because of the possibility that the performance is a fluke, or that it is an artifact of training" (6). They also note that the discrepancies and deficiencies in contemporary research seem to be associated with the inadequacy of commonly used methods.

#### **THE MIRROR SELF-RECOGNITION TASK (MSRT) AND THE MEAD-COOLEY MODEL**

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Gallup (1977) based the mirror self-recognition task (MSRT) on the work of Mead (1910, 1934) and Cooley (1912). The Mead-Cooley model measures the level of self-awareness one can achieve through social awareness. However, one needs to consider the theoretical and methodological shortcomings of MSRT.

The MSRT exposes the subject to a mirror, sometimes with some modification to the subject's physical form (also known as the mark-test or modified MSRT). Commonly, some form of odorless dye or paint is applied to the face of the subject. However, other researchers have used hats and plastic balls attached to the subject's head or arms (Boccia, 1994). Successful completion of the task occurs when mark-directed behavior by the subject significantly increases. This behavior is said to show recognition of the physical self of the subject in the mirror. Since Gallup (1977), there have been many variations of the MSRT.

Although studies have used the MSRT on a wide variety of species, they have done little to suggest that primates possess awareness that extends beyond understanding the properties of a mirror (Boccia, 1994; De Veer and Povinelli, 2002; Eddy, Povinelli, and Gallup, 1996; Gallup, 1977; Hauser, 1995; Povinelli, Bierschwale, and Rulf, 1994). There are reasons, however, why these tasks are so popular among contemporary animal researchers, and none of them are indicative of good science. First, these tests are relatively easy to carry out even with lower level monkeys (Boccia, 1994). Moreover, the results of these studies are widely open for interpretation given the normal amount of face and body touching seen in primates. It is very hard to distinguish between true mark-directed behavior and mere touching and grooming if the experiments are not carefully controlled. Some studies have used more than one mark, a visible mark (e.g., mark on the wrist), and multiple tasks related to recognizing objects that are independent of the subject's body that help eliminate this concern (Boccia, 1994; Plotnik, de Waal, and Reiss, 2006). It is also possible that performance on the MSRT may be related to anesthetic recovery while the mark is applied, but this possibility seems to have been refuted (Van Den Bos, 1999). In addition, these tasks do not reflect any level of ecological validity for most primates, since they rarely encounter their reflections in the wild. Even when a reflection might be possible (e.g., when looking into a pool of water), there is little if any literature that indicates that primates spend any prolonged time staring at their reflections. This might explain why many of the mirror tests require a long habituation and training

for the animal to grasp the idea of a reflection. Finally, Gallup (1977) contends that the MSRT reflects self-sensation. In other words, the images are mere reflections of one's physical self. The question that needs to be asked is whether or not recognizing oneself as a physical being is a necessary or sufficient condition for being self-aware. Most proponents of MSRT believe that this is indeed the case and have applied it to other species such as elephants (Plotnik, de Waal, and Reiss, 2006) and dolphins (Marino, Reiss, and Gallup, 1994; Marten and Pasarakos, 1994). However, MSR studies primarily focus on chimpanzees while other primates as well as nonprimates remain understudied (De Veer and Van Den Bos, 1998).

It is somewhat peculiar that Gallup (1977) cites Cooley (1912) and Mead (1910, 1934) as the primary theorists behind his work on MSRT. Even more curious is the fact that, based on the Mead-Cooley model, even if no reflective surfaces existed on the planet, anima self-awareness would still exist. According to Mead (1910), it is relatively easy to establish whether or not one has a physical self. Simply use the example of another human being, or any physical body, walking towards you. The natural reaction for most living things is to move out of the way to avoid physical harm. Once again, the idea seems intuitive, but self-preservation is obviously crucial for every species. If the awareness of one's physical self is not the best indicator of self-awareness, then there must be a level of social awareness that can truly establish how self-aware some primates are.

Cooley (1912) adopted the idea of the "looking glass self." This theory has been a staple of both sociology and psychology for almost a century, but it has never been conclusively applied to comparative psychology. The theory claims that, in highly socialized beings, it is the other individuals that are the markers of the self-awareness of each individual organism. In other words, the other individuals in a society become the "mirrors" by which each individual becomes aware of his or her social role and gains a sense of identity. This suggests that even with no reflective surfaces individuals would retain their sense of identity independent of their physical self-awareness. Obviously this model can be applied only to highly socialized, large-brained animal species such as primates.

Gallup (1977) used the Mead-Cooley model in quite a peculiar fashion, on chimpanzees that were bred in the wild and in isolation. He found that chimps that were kept in isolation spent far more time examining their reflection than those raised among other chimpanzees. This observation is easily explained. Because chimpanzees bred in isolation spend no time with other chimpanzees and thus have no mental model of their physical features, they approached their reflection with special interest. The researcher, however, assumed, following the Mead-Cooley model, that without complex social relationships these animals would have no concept of identity. This is a fair statement, but MSRT was not necessary to establish that fact. Any animal raised in isolation will lack identity based on the Mead-Cooley model regardless of mirror testing. The model depends on the assumption that a species has a relatively large number of social interactions. In animals that are regarded as social as primates, the highest level of self-awareness is to be expected when they are reared in a social network that encourages their sense of identity.

### **PRIMATE SOCIAL INTERACTIONS**

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Now that there is a model that can be used to demonstrate complex self-awareness in primates, some of the complex social behaviors that this model likely reflects must be examined. The life of a primate involves a diverse series of social interactions that demonstrate very high level social cognition and self-awareness. Dominance, kin relations, coalitions, aggressive behavior, and reconciliation and third-party interventions are unique behaviors seen in primates that reflect their social complexity, social awareness, and subsequent self-awareness. By examining their interactions, it becomes evident just how socially complex primates are and, moreover, how deep their understanding and awareness of themselves and their conspecifics runs. One cannot establish the level of awareness of an organism without looking at the group as a whole (de Waal, 1987).

Dominance hierarchies govern virtually every interaction that occurs within most primate species. Although each species has its own dominance systems (e.g., some monkeys live in matrilineal hierarchies, some are completely individual, and some are a mixture of both), there seems to be no dispute that all primates understand the system they are in and act accordingly. Studies support the notion that not only do monkeys and apes understand their place in the hierarchy, but they understand

the interactions between other chimpanzees as a third party (Seyfarth and Cheney, 2000). Even complex interactions between individuals of differing ranks can be understood by third parties. For example, if primate A is dominant to primate B and primate B is dominant to primate C, then a third-party animal can predict an interaction of A and C based on that logic (Seyfarth and Cheney 2000). Without recognizing their own place in the dominance hierarchy, primates would lack the social knowledge required to decide whether or not to challenge a dominant animal for a food item, mate, etc. (Hare, Call, and Tomasello, 2001). In order for this kind of sociocognitive process to occur, animals must understand their own place in the social network. The fact that they *understand* their niche reflects a significant level of self-awareness.

The concept of dominance in a primate social system is controversial among comparative psychologists. One of the principle counterarguments for primates' understanding of dominance is that they simply understand the paired interactions in which they are involved (Seyfarth and Cheney, 2000). For example, individuals would assess who is dominant to them and if they are in competition with them in a given situation. By this principle, internalizing dominance is no more than a type of associative learning. Moreover, many researchers claim that individuals learn their dominance ranks early in life and they never wander into socially diverse territory that is unfamiliar to them. In other words, dominance is a static system that rarely changes, so learning one's role and keeping interactions consistent with that rank is a relatively easy thing to do. However, research shows us that this is not the case and dominance is indeed a very transient characteristic of a primate's life (de Waal, 1987).

In order to cope with the inequality of dominance systems, many primates demonstrate another very interesting social phenomenon. Coalitions are used by lower ranking males to associate themselves with higher ranking males for obvious benefits (e.g., grooming, food, mate selection, and, most importantly, protection). Research suggests that most coalitions occur between lower ranking males and higher ranking males because male dominance is more dynamic than dominance between females. Hence, it is likely that there is more competition between males than females (Silk, 1987). Hierarchies among females are more likely to be static because most Old World primate species have matrilineal dominance systems. In other words, once a female is born into a certain rank it is highly unlikely that rank will change unless her whole family changes rank (Silk, 1987). A given female may remain dominant over any male in the hierarchy for her entire life. This type of attention to the social status of an organism requires awareness of two things: its position in the social hierarchy and the benefits that come with joining with more dominant males. Without the knowledge of these two things, the formation of coalitions in the wild would have no plausible explanation.

The formation of coalitions, among other things, is likely to result in instances of aggressive behavior. Most aggressive behavior occurs when a subordinate individual challenges a dominant for a food item, mate, or resting spot, or fails to show the proper signs of subordination (Walters and Seyfarth, 1987). Aggressive behavior (e.g., fighting, threat stares, etc.) can be directed at the individual or at a related member (Judge, 1982, as cited by Seyfarth and Cheney, 2000). Aggressive behavior will also occur between the relatives of two feuding primates (Silk, 1987). This also shows understanding of relations between primates and their kin and a feuding primate and its kin.

In order to maintain order in the face of aggressive encounters, many primate species have developed elaborate reconciliation behaviors (de Waal, 1987; Walters and Seyfarth, 1987). According to de Waal (1987), reconciliation behaviors "provide losers with a white flag and winners with an understanding of its meaning" (422). Moreover Schenckel (1967), as cited by de Waal (1987) remarks that "submission is the effort of the inferior to attain friendly or harmonic social integration" (319). There are many types of species-specific submissive behaviors. Some species of monkeys use teeth bearing and high pitched grunts. Chimpanzees use low panting grunts while approaching their adversary. Moreover, some other species raise their tails as a sign of submission (de Waal, 1987). Obviously these submissive rituals are very important to the maintenance of the social network and in order for them to be so widely used, the primates have to understand their meaning. In order for this ritualizing to arise, there has to be a certain set of behavioral protocols for animals at all ranks in the hierarchy. In addition, many of these submissive behaviors are a means of reconciliation. There are certain mechanisms by which peace between enemies is established and perpetuated.

De Waal (1987) describes the formation of these *status mechanisms*, as he terms them. In order for them to arise, there has to be a system by which they are understood and each component helps address how certain primates understand them. The first component is the *formalization* of the submissive behavior. In other words, the display of vulnerability is used often and understood by all. The second component is *conditional reassurance*. This type of behavior reflects the recognition by the subordinate that a given animal is dominant over it. This is important to the dominant because it means that as long as he or she is being conditionally reassured, he or she will not be challenged for his or her role on the social ladder. Conditional reassurance usually requires increased and selective contact between two adversaries. For example, two chimpanzees will interact frequently and often exclusively to establish the relationship by one showing submissive behavior (e.g., panting and grunting). Also, there will be a much higher frequency of vulnerable behavior than usual because this type of behavior occurs even when reconciliation is not taking place. For example, a subordinate chimpanzee may spend more time around his adversary demonstrating the proper species-specific submissive behavior. This behavior would usually occur regardless of conflict, but there will be a significantly higher frequency following a dispute and it will be mutually exclusive between the adversaries. The subordinate will go to lengths to prove to the dominant that he or she is secure in his or her rank. Finally, *status striving* occurs in dominance systems all the time. It seems that the goal of most primates (especially males) is to subordinate as many individuals to them as possible. This desire for social control reflects complete understanding of the benefits of dominance. Most free-floating aggression in primate communities comes from males and is related to one animal challenging another. Sometimes the challenge is successful and the old dominant becomes newly subordinate or the dominant wins out and the proper vulnerability behaviors are displayed. This very complex series of interactions speaks volumes about how adept primates are at understanding relationships and the benefits of social harmony and social mobility. Even humans sometimes do things that are detrimental to their social networks, but it seems that certain primates appreciate the importance of social harmony. This suggests they understand their place (or their subjective self) in that system and what they can do to facilitate harmonious interactions.

De Waal (1987) also summarized the role of third parties in conflict and reconciliation. The intervention of third-party animals reflects the same striving for social integration evident in reconciliation behaviors. According to this research, there are four main types of intervention behaviors. First, *bond-dependent interventions* occur when closely related or allied animals break up a fight between one of their allies or kin and an adversary. The motivation here is clear: protect those closest to you because they are your protection in similar situations. Also, this type of intervention contributes to the social harmony. Another type of intervention is *scapegoating*. Sometimes when a primate community experiences stress because of scarce resources or crowding, dominants will bully lower ranking animals. Although this might seem detrimental to the group, it represents one animal's attempt to diagnose and remedy a social problem. Whether their attribution is erroneous or not, it reflects a degree of social awareness. Similarly, *exploitative conditions* occur when coalitions form to facilitate moving up the social hierarchy. While such attempts foster disharmony in the group as a whole, they reflect cooperation within cohorts for a common goal. These factions also show understanding of self awareness in the social system and the desire of animals to move up in rank. Finally, simple *breaking up of fights* occurs all the time in social groups. These are particularly remarkable because animals with no ties to either feuding animal will simply jump in and attempt to break up the fight. This often occurs to the detriment of the third party. There can be no other explanation for this phenomenon than social altruism used to maintain the equilibrium of the society. Indeed, primates cope with aggressive behavior much as humans do.

Kinship is a very important aspect in the lives of most primates. The relationship between mother and child is particularly strong and many researchers have manipulated that relationship in social contexts to gain an understanding of how much primates are aware of their own relationships and relationships to other primates. Most females will go to any length to protect their offspring and they will even feud with another female or a female or male related to that female if her young is ever threatened (Seyfarth and Cheney, 2000). It seems that it is adaptive for a mother to have a certain level of understanding of the relationships of others when it comes to protecting her young. If an entire faction or family is instigating a conflict, then it is supremely important to know who is related to whom.

Many studies have assessed how adept some primates are at recognizing the calls of others' kin. One particular study of vervet monkeys involved playing through a speaker the distress call of a given mother's juvenile in the presence of two unrelated females. The ecological validity of this study is unquestionable because many primate species use vocal signaling for many situations other than just distress (Halberg, Nelson, and Boysen, 2003). The researchers "were able to use a monkey's knowledge of other individuals as an indirect measure of the monkey's knowledge of him or herself" (Seyfarth and Cheney, 2000, p. 903). They found that there was increased speaker-directed behavior by the mother when the distress call was played. This result was expected because most animals can recognize the call of their own young. The most impressive part was that the two unrelated females demonstrated increased mother-directed behavior. This understanding of the relations of others has supreme survival value and reflects a type of awareness-identity switch (Silk, 1987). In other words, the other females were able to empathize with the other mother as if it were their young that was in danger (Seyfarth and Cheney, 2000). This type of self awareness is extremely advanced and allows certain primates to attribute mental states (Povinelli and Vonk, 2003; Tomasello, et al., 2003). Seyfarth and Cheney (2000) also demonstrated that monkeys could use abstract categories to label the relationships of others and relate them to their own. The monkeys behave in a way that reflects their "social selves."

### **COUNTERARGUMENTS: CHUNKING AND EQUIVALENCE CLASSES**

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There are many counterarguments to the notion that primates act in a manner that reflects social and self-awareness. It has been a central dogma of many comparative psychologists not to exaggerate the psychological sophistication of an animal to explain its behavior when a simpler explanation can be found (Morgan, 1894). The following two counterarguments rely on this premise. Rather than attributing primates' unique social abilities to an understanding of complex social interactions, they merely credit them with associative learning and cognitive shortcuts.

The first counterargument to the social awareness theory involves what are called equivalence classes. Originally the concept was applied to sea lions that could associate normally unrelated objects into classes based on past associations (Schusterman and Kastak 1993, 1998, as cited by Schusterman, Kastak, and Kastak, 2003). Consequently, some researchers have suggested that certain primates use classes similar to these to govern their social relationships. By this standard, simple prior association of two animals would be enough to link them as kin or as allies. Also, similar facial features may hint that two animals are related. Shared history can also play a role in the formation of equivalence classes (Seyfarth and Cheney, 2003). If all of these things are true, then related animals can be interchanged in certain social situations. For example, this would explain why two feuding animals may direct their aggression toward the kin or allies of their adversary. If one animal resembles another, it seems cognitively efficient to conflate their identities.

This explanation however, is problematic. Not all aggression is redirected at an adversary's kin; that just happens in certain opportunistic situations. It is more likely that primates recognize individuals with which they are feuding. This is not to say that primates do not use tools such as out-group homogeneity (Hamilton and Gifford, 1976, as it applies to humans) to establish who is related and what they are like, but they certainly seem able to recognize individuals.

The second means of explaining social behavior without attributing social awareness is a cognitive tool known as chunking (Schusterman and Kastak 2003), which is widely used by cognitively complex organisms including humans. It occurs when related material is grouped together and perceived as the same. The principal difference between chunking and equivalence classes is that things that are chunked are usually somehow related. With this said, the same levels of association can be used to make associations between related and allied members (similar facial features, shared history, and prior associations).

But chunking's cognitively restricted explanations often do not work. For example, in recognizing allied group members as the same, an animal could not use facial features because there is no guarantee that allies are related or physically similar. Prior associations might work, but the likelihood that interactions between allies are merely fortuitous is too great. If all primates used chunking as a

strategy then they should understand the dominant-subordinate reconciliation rituals as symbolic of kinship or a coalition. Since primates behave in congruence with their social protocol, it is safe to say that chunking does not completely govern their social interactions. This is not to say they do not use chunking and other cognitive shortcuts as humans do, but they certainly are not limited to such strategies.

### **STUDYING PRIMATES: ECOLOGICAL VALIDITY AND TRIANGULATION**

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Having considered primate social behavior, I shall now address some of the better methodologies for studying self-awareness. Ecological validity should be an experimental priority among all comparative psychologists. It requires that all experimental procedures reflect the natural environment of the animal under study. Since primates are social beings, that sociality should be an object of investigation. Unless the subject of study is itself adaptation, only those behaviors and situations which are familiar and useful to the animal should be studied. For this reason, tests such as MSRT do little more than reflect the ability of an animal to learn the properties of a mirror. This is why these studies are usually only successfully completed by higher order primates (e.g., chimpanzees and orangutans). If we wish truly to understand an animal's level of awareness of itself as a distinct being with social awareness (subjective self), we must test animals in social situations that they will find familiar.

The methods of observational and anecdotal research are prone to experiment bias and attributional ambiguity. Researchers, however, have suggested a tool that avoids the artificial environments often found in traditional laboratory experiments and does not rely on anecdotal research (Heyes, 1993). This method, known as triangulation, has been successfully used in a few recent studies.

Full triangulation requires two components: a conditional discrimination task and a transfer task (Heyes, 1993). The problem with conditional discrimination is that it is based solely on observable components that the animal can use to get a reward. Since no study can be completely devoid of these observables, it is best to follow up the initial task with a transfer test that has observables, but not the same ones (Heyes, 1993). A test-retest method such as this limits the likelihood that the animal's performance on the first task will be attributed to associative learning. Indeed, the transfer task requires the application of knowledge: the subject must take given information and employ it on a different task. This aspect of triangulation reflects the type of thinking that occurs in the wild. For example, a chimpanzee can use one course of action to deceive a dominant chimpanzee into thinking that it does not have a food item. However, if another, more clever dominant perceived that deception and this was discovered by the subordinate chimpanzee, the subordinate chimpanzee must know how to modify its deceptive tactics. Few studies have been able to do this successfully.

Perhaps the best example of triangulation comes from a theory of mind study that measured the chimpanzees' understanding of visual knowledge as it relates to dominance and competition (Hare, Call, and Tomasello, 2001). In an initial task, a series of subordinate chimpanzees were allowed to see a piece of food being hidden behind an occluder. Each subordinate chimpanzee was paired with a dominant that either did or did not see the final placement of the food (the food was placed and then moved in some cases). The two chimpanzees were then allowed to compete for the food. The researchers found that the subordinate would compete significantly less often when it saw the dominant looking at the food. This finding alone is astonishing in that the subjects attributed knowledge of the placement of the food to the gaze direction of the dominant. However, associative learning could have taken place during these observations (e.g., subordinates learn not to approach food when they can see the dominant during food placement). Thus, a transfer task was used in which the same conditions were in place but the original dominant was switched with another dominant that did not know the location of the food. The subordinate competed for the food significantly more against an ignorant dominant than a knowledgeable one. Since triangulation was used, it is safe to say that this study strongly supports the notion that chimpanzees understand the mental state that is knowledge (Hare, Call, and Tomasello, 2001). There is still much speculation as to how this system of understanding works in primates (Povinelli and Vonk, 2003; Tomasello, Call, and Hare, 2003).

There are many reasons why studies like this are considered ideal for understanding primates. Obviously triangulation plays a pivotal role, but there is something else about the nature of these experiments that makes them important: such studies address the cognitive ability of the animal in an arena that replicates interactions seen in its natural environment.

## CONCLUSIONS AND FUTURE RESEARCH

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It is abundantly clear that we have a relatively complete understanding of primate social dynamics. Unfortunately, much of our knowledge has come from anecdotal research as opposed to controlled, ecologically valid laboratory experiments. This is not to say that what we have found thus far is not relevant, but in order to produce more concrete evidence more triangulation studies should be used.

The Mead-Cooley model reflects the value of these triangulation studies. The use of methodologies that take into account the ever-changing natural environment of primates supports the use of this model. Through dynamic interactions with their conspecifics (kin relations, cooperation, aggression, dominance, etc.), primates are able to establish an identity and become self-aware in the subjective sense. They become aware of themselves as much more than physical beings. The "looking glass self" becomes the mirror by which some animals establish who they are and where they stand in their social network. This looking glass provides the opportunity for the subjective self to develop.

## REFERENCES

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- Boccia, M. L. (1994). Mirror behavior in macaques. In S. T. Parker, R. W. Mitchell, and M. L. Boccia (Eds.), *Self-awareness in animals humans: Developmental perspectives* (pp. 350-360). Cambridge: Cambridge University Press.
- Cooley, C. H. (1912). *Human nature and the social order*. New York: Scribner's.
- De Veer, M. W. and Van Den Bos, R. (1998). A critical review of methodology and interpretation of mirror self-recognition research in nonhuman primates. *Animal Behaviour*, 58, 459-468.
- De Veer, M. W., Gallup, G. G., Theall, L. A., Van Den Bos, R., and Povinelli, D. (2002). An 8-year longitudinal study of mirror self-recognition in chimpanzees. *Neuropsychologia*, 41, 229-234.
- De Waal, F. B. M. (2003). Social syntax: The if-then structure of social problem solving. In F. B. de Waal and P. L. Tyack (Eds.), *Animal social complex* (pp. 230-248). Cambridge: Harvard University Press.
- Gallup, G. G. (1977). Self-recognition in primates: A comparative approach to the bidirectional properties of consciousness. *American Psychologist*, 32, 329-337.
- Gouzoules, H., and Gouzoules S. (1987). Kinship. In B. B. Smuts, D. L. Cheney, R. M. Seyfarth, R. W. Wrangham, and T. T. Struhsaker (Eds.), *Primate societies* (pp. 299-305). Chicago: University of Chicago Press.
- Hallberg, K. I., Neson, D. A., and Boysen, S. T. (2003). Representational vocal signaling in the chimpanzee. In F. B. de Waal and P.L. Tyack (Eds.), *Animal social complex* (pp. 299-305). Cambridge: Harvard University Press.
- Hamilton, D. L. and Gifford, R. K. (1976). Illusory correlation in interpersonal perception: A cognitive basis of stereotypic judgments. *Journal of Experimental Social Psychology*, 12, 392-407.
- Hare, B., Call, J. and Tomasello, M. (2001). Do chimpanzees know what conspecifics know? *Animal Behavior*, 61, 139-151.
- Hauser, M. D., Kralik, J., Botto-Mahan, C., Garret, M. and Oser, J. (1995). Self-recognition in primates: Phylogeny and the salience of species-typical features. *PNAS*, 92, 10811-10814.
- Heyes, C. M. (1993). Anecdotes, training, trapping and triangulating: do animals attribute mental states? *Animal Behavior*, 46, 177-188.
- Lewis, M. (1994). Myself and me. In S. T. Parker, R. W. Mitchell and M. L. Boccia (Eds.), *Self awareness in animals and humans* (pp. 20-34). New York: Cambridge University Press.
- Marino, L., Reiss, D. and Gallup, G. (1994). Mirror self-recognition in bottlenose dolphins: Implications for comparative investigations of highly dissimilar species. In S. T. Parker, R. W. Mitchell and M. L. Boccia (Eds.), *Self-awareness in animals and humans* (pp. 380-391). New York: Cambridge University Press.

- Marten, K. and Psarakos, S. (1994). Evidence of self-awareness in the bottlenose dolphin (*Tursiops truncatus*). In S. T. Parker, R. W. Mitchell and M. L. Boccia (Eds.), *Self-awareness in animals and humans* (pp. 361-379). New York: Cambridge University Press.
- Mead, G. H. (1910). Social consciousness and the consciousness of meaning. *Psychological Bulletin*, 7, 397-405.
- Mead, G. H. (1934). *Mind, self and society: From the standpoint of a social behaviorist*. Chicago: University of Chicago Press.
- Morgan, C. L., (1894). *Introduction to comparative psychology*. London: Scott.
- Parker, S. T., Mitchell, R. W. and Boccia, M. L., (1994). Expanding dimensions of the self: Through the looking glass and beyond. In S. T. Parker, R. W. Mitchell and M. L. Boccia (Eds.), *Self-awareness in animals and humans* (pp. 3-19). New York: Cambridge University Press.
- Parker, S. T., Mitchell, R. W. and Boccia, M. L. (1994.). *Self-awareness in animals and humans*. New York: Cambridge University Press.
- Plotnik, J. M., de Waal, F. B. and Reiss, D. (2006). Self-recognition in an Asian elephant. *PNAS*, 103, 17053-17057.
- Povinelli, D. J. and Vonk, J. (2003). Chimpanzee minds: Suspiciously human? *TRENDS in Cognitive Sciences*, 7, 157-160.
- Schusterman, R. J., Kastak, C. R. and Kastak, D. (2003). Equivalence classification an approach to social knowledge: From sea lions to simians. *Animal social complex* (pp. 179-206). Cambridge: Harvard University Press.
- Seyfarth, R. M. and Cheney, D. L. (2000). Social awareness in monkeys. *Animal Zoology*, 40, 902-909.
- Seyfarth, R. M. and Cheney, D. L. (2003). The structure of social knowledge in monkeys. In F. B. de Waal and P. L. Tyack (Eds.), *Animal social complex* (pp. 207-229). Cambridge: Harvard University Press.
- Silk, J. B. (1987). Social behavior in evolutionary perspective. In B. B. Smuts, D. L., Cheney, R. M. Seyfarth, R. W. Wrangham and T. T. Struhsaker (Eds.), *Primate societies* (pp. 318-329). Chicago: University of Chicago Press.
- Tomasello, M., Call, J. and Hare, B. (2003). Chimpanzees understand psychological states--the question is which ones and to what extent. *TRENDS in Cognitive Sciences*, 7, 153-156.
- Van Den Bos, R. (1998). Reflections on self-recognition in nonhuman primates. *Animal Behaviour*, 58, F1-F9.
- Walters, J. R. and Seyfarth, R. M. (1987). Conflict and cooperation. In B. B. Smuts, D. L. Cheney, R. M. Seyfarth, R. W. Wrangham and T. T. Struhsaker (Eds.), *Primate societies* (pp. 306-317). Chicago: University of Chicago Press.