

HUMAN SOCIAL BEHAVIORAL SYSTEMS: ETHOLOGICAL FRAMEWORK FOR A UNIFIED THEORY

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ABSTRACT

Drive theories of motivation proposed by Lorenz and Tinbergen did not survive experimental scrutiny; however these were replaced by the behavioral systems framework. Unfortunately, political forces within science including the rise of sociobiology and comparative psychology, caused neglect of this important framework. This review revives the concept of behavioral systems and demonstrates its utility in the development of a unified theory of human social behavior and social bonding. Although the term “attachment” has been used to indicate social bonds which motivate affiliation, four differentiable social reward systems mediate social proximity and bond formation: the affiliation (attachment), caregiving, dominance and sexual behavioral systems. Ethology is dedicated to integrating inborn capacities with experiential learning as well as the proximal and ultimate causes of behavior. Hence, the behavioral systems framework developed by ethologists nearly 50 years ago, enables discussion of a unified theory of human social behavior.

Key words: attachment, caregiving, dominance, sex, behavioral systems

INTRODUCTION

The last 50 years has seen the waning of ethology in the United States, accompanied by the growth of sociobiology, comparative psychology and evolutionary psychology (Barlow, 1989; Burkhardt, 2005; Greenberg, 2010). Sociobiologists, in particular, proclaimed the death of ethology and promised their nascent discipline and genetic mechanisms would provide an understanding of human social behavior (Barlow, 1989; E. O. Wilson, 2000). It has been 13 years since the sequencing of the human genome (Venter et al., 2001), sociobiology has fallen into “disarray” (D. S. Wilson & Wilson, 2007) and a unified theory of human social behavior is still lacking. Although Chomsky was not speaking of either ethology or social behavior in the quote below, his words uttered in 1959 articulate nicely what is still missing:

One would naturally expect that prediction of the behavior of a complex organism (or machine) would require, in addition to information about external stimulation, knowledge of the internal structure of the organism, *the ways in*

which it processes input information and organizes its own behavior. These characteristics of the organism are in general a complicated product of inborn structure, the genetically determined course of maturation, and past experience (Chomsky, 1959, p. 26, emphasis added).

These words written in response to Skinner's behaviorism emphasized the importance of understanding the organization of behavior and the neural networks responsible for that organization. Four years later, ethologist, Tinbergen (1963) added questions of adaptive value and ultimate causation to those regarding organization of internal structure, and defined ethology as the discipline concerned with an integrated understanding of the proximate and ultimate causes of behavior. Both Chomsky and Tinbergen were far ahead of their time - noting the evolved interplay between genetics and developmental experience that determines "internal structure" or the brain circuits that organize sensory input, process information and produce behavior.

This paper asserts that *behavioral systems* as conceived of by ethologists Baerends (1976), Hinde (2005; 1982), Bischoff (1975), and others (Hogan, 1994; Waters, 1981) provide a framework for a unified theory of human social behavior vis-à-vis the processing of social information and social reward. This unified theory organizes the body of literature and has direct application to human psychological disorders where social reward, social bonding, and social information processing is impaired. Research in social behavioral systems has focused primarily on the attachment system since Harlow's (1973) discovery that contact comfort and not food reward forms the basis of the infant's tie to its mother. The discovery of this unconditioned reward proved the existence of the *attachment behavioral system* as distinct from the feeding system¹ and furthered our understanding of clinical anxiety and depression - which Bowlby had previously linked to early loss, maternal deprivation and attachment (van der Horst, LeRoy, & van der Veer, 2008). Although Bowlby was a psychoanalyst, his theory of attachment was developed using the ethological framework described herein (Hinde et al., 2005).

While defining and understanding the attachment behavioral system has been extremely important, other human social behavioral systems, their intrinsic rewards, motivations, behaviors and pathologies have been relatively neglected. There is emerging consensus that four differing classes of social reward organize human social information processing via four behavioral systems that have been subject to the evolutionary forces that shaped *Homo sapiens*. Thus, in addition to the attachment behavioral system, there exist, caregiving, dominance and sexual systems that can be understood using the same ethological framework (Goodson & Kabelik, 2009; Johnson, Leedom, & Muhtadie, 2012; Kenrick, 2006; MacDonald, 1995; O'Connell & Hofmann, 2011a, 2011b; Shaver & Mikulincer, 2011). These four behavioral systems explain and organize all of human social behavior both normative and pathological; they mediate four adaptive social goals: safety through affiliation (attachment behavioral system) (Depue & Morrone-Strupinsky, 2005), care of others (care-giving behavioral system) (Preston, 2013),

¹ Freud postulated that the infants tie to its mother was based on food reward; this postulate was definitively refuted (see <http://youtu.be/hsA5Sec6dAI>).

competition (dominance behavioral system) (Johnson et al., 2012; Weisfeld & Dillon, 2012) and mating (sexual behavioral system) (Aron et al., 2005).

The Behavioral System Framework

“Before we can study how behavior develops, or what causes it, or how it affects an animal's ability to survive and reproduce, we must know what the behavior is” (“Ethograms of Mice,” 2000). In the 150+ years since the publication of the *Origin of Species* (Darwin, 1859), ethologists have expertly created ethograms or detailed inventories of species typical behavior (Gordon, 1985) for many species including humans (Eibl-Eibesfeldt, 1989). Lorenz, originally trained as a comparative anatomist, brought theories of anatomy into the study of behavior. He posited that just as homologies occur in morphological structures, species typical behaviors are also homologous and are substrates for natural selection (Burkhardt, 2005). Homologous morphological “structures might differ in shape or even composition, but they were to be recognized by the constancy of relationships to surrounding organs and structures” (Hall, 2012, p. 45). Homologous behaviors are identified by constancy in co-occurrence and context.

As he created detailed descriptions of behavior, Tinbergen realized that although there is considerable plasticity, behaviors could be hierarchically organized into what Baerends (1976) later termed systems and subsystems. Because detailed descriptions allow for inferences regarding the organization, causes, and goals of behavior, the creation of ethograms was an important first step. Inference of goals and causes enabled hypotheses regarding the nature of motivation. Although Lorenz's successes made essential contributions to ethology, his failures were damaging - especially his “hydraulic reservoir” theory of drives/motivation (Bolduc, 2012; Hinde, 1956). The behavioral system framework described herein replaced the experimentally rejected drive models of motivated behavior, proposed by Lorenz and also Tinbergen (Baerends, 1976; Bolduc, 2012; Burkhardt, 2005; Hinde, 1956). However, with the prominence of behaviorism in the United States and the rise of sociobiology and comparative psychology (Lehrman, 1953), ethology's behavioral system framework has received little recognition. Baerends' important paper “The functional organization of behavior” originally published in 1976 has been cited only 197 times². In a widely cited 1994 paper, Crick and Dodge presented a model of “social information processing” that is similar to that proposed herein (Figure 1); Crick and Dodge did not acknowledge the work of ethologists that predated their model, nor did they discuss the inborn social motives that drive and organize information processing (Crick & Dodge, 1994).

The behavioral systems framework recognizes hierarchical structure and context with respect to behavior and conceptualizes “the motivation and control of a group of behavior patterns that are closely and more or less causally (and often also functionally)

² (if Google Scholar is correct) ... Fortunately, the paper was recently reprinted in *Perspectives in Brain Research* (Baerends, 2011).

related to each other” (Hinde et al., 2005, p. 6)³. A behavioral system is an innate “species-universal behavioral program that governs the choice, activation and termination of behavioral sequences” and that has adaptive advantages for survival and reproduction (Mikulincer, 2006, p. 23)⁴. Behavioral systems appear to be governed by the principles of adaptive control systems (Baerends, 1976; Waters, 1981). Three functions are inherent to adaptive control systems: continuous monitoring (by sensors), comparison between actual state and desired state (by comparators), and output to achieve the desired state (by enactors). Figure 1 is an abstract schematic diagram of a behavioral system as an adaptive control system. Note that the “comparator” function cannot be unitary and is likely performed by a network of subsystems.

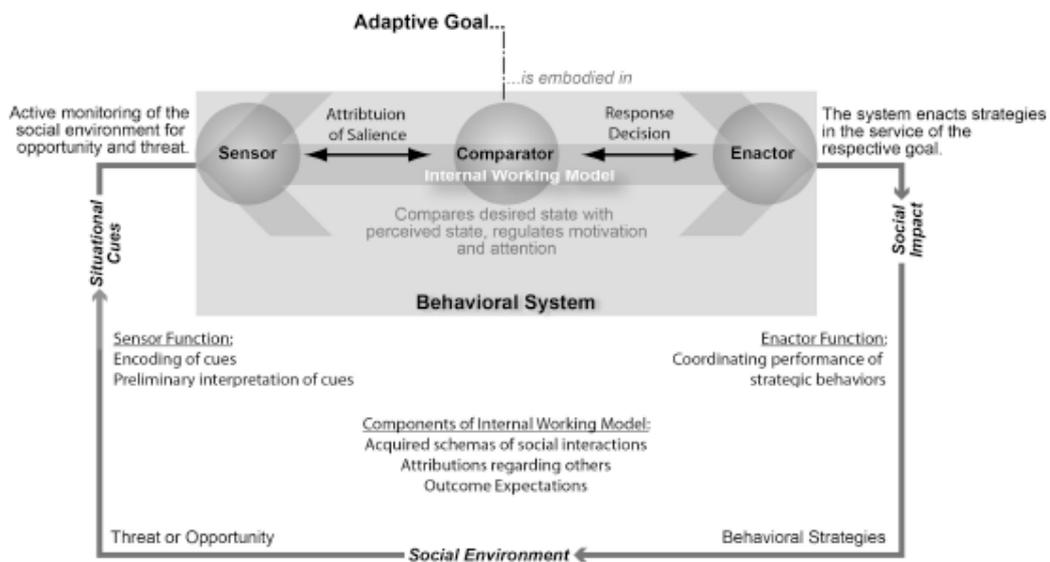


Figure 1. Schematic diagram of the components of a behavioral system.

Stimuli that signal the presence of reward relevant to behavioral systems uniquely capture attention and motivate behavior. Behavioral systems are each defined by a set of rewards that reflect an adaptive goal that is embodied in neural circuits that function as a “comparator.” These neural circuits receive input from both internal and external sensory systems, compare the “desired state” of the system with the perceived state, and then regulate motivation, attention and strategy selection accordingly. The “desired state” is dynamic, not static and is influenced by a number of factors including (but not limited to) hormones and the presence of reward (Baerends, 1976). A set of goal-directed behaviors and physiological responses constitute the output of behavioral systems - the strategies used to attain the particular reward (achieve the goal). Learning occurs with respect to conditioned reward and optimal strategy selection and leads to development

³ Historically, behavioral systems theory was influenced by “adaptive control systems” theory developed in engineering. In the early 1950s the need to design autopilots for high performance aircraft motivated the development of adaptive controllers that could learn and accommodate to changes in aircraft dynamics (Ioannou & Fidan, 2006).

⁴ Behavioral Systems are “instincts.”

and refinement of internal working models (Hogan, 1994). Hence, behavioral systems, via their respective neural circuits, organize information processing, learning and goal directed behavior. Sensation, attention, conscious processing, and memory are all highly selective as the behavioral systems direct social information processing⁵. Because of its central role in reinforcement, the mesolimbic reward circuit, together with the social behavioral network (paralimbic system) (Kiehl, 2006; Nishimura, Yoshii, Watanabe, & Ishiuchi, 2009; O'Connell & Hofmann, 2011b), functions as the "comparator" for social behavioral systems as these integrate sensory input and motor output (Depue & Collins, 1999). Dopamine (DA) has the general function of facilitating neural processes subserving motivation (Depue & Morrone-Strupinsky, 2005). Dopamine increases desire (motivation) to obtain rewards and, therefore, the number of attempted behavioral strategies and the acquisition and maintenance of approach behavior (Schultheiss & Wirth, 2008). The neural circuitry of the attachment, caregiving, dominance and sexual systems is under the regulation of and in turn regulates specific hormones. These hormones direct the interplay between the behavioral systems as they increase the likelihood that particular goals will become salient in the presence of incentive stimuli. Hormones also motivate individuals to seek opportunity with respect to specific goals (Schultheiss & Wirth, 2008).

The neural circuitry of human social behavioral systems dictates patterned conscious and non-conscious cognitions and emotions. These cognitions and emotions constitute an individual's "internal working model" of the manner in which social interactions unfold (Mikulincer, 2006; Waters, 1981). Developmentally acquired working models include beliefs and expectations regarding the reward value of social interactions, and the ease with which rewards are attained. Ongoing experience is interpreted within the context of internal working models. Although they are subject to revision, working models are a relatively stable aspect of personality (Waters, 1981). Consciousness is to a degree modular because each behavioral system has its own set of associated sensations, actions and memories. Behavioral systems are discrete and have been subjected to differential selection pressures at different evolutionary time points. Importantly though, behavioral systems must also integrate within individuals to bring organization and coherence to behavior. This integration means both conjoint activity and antagonism as context may dictate compatible or incompatible social goals.

In summary, the behavioral systems perspective has several advantages; it:

1. Organizes the body of knowledge that surrounds the set of functionally-grouped behaviors that are enacted in a recurring social context.
2. Organizes patterns of cognitions and emotions relevant to social behavior.
3. Provides a framework for answering all four of Tinbergen's questions.
4. Generates hypotheses for physiological and genetic studies.
5. Recognizes interrelationships between and regulation of social and non-social motivation/behavior.

⁵ Evolutionary psychologists have noted the modularity of the mind, and the existence of modules devoted to domains of the social life (Blunt Bugental, 2000; Kenrick, 2006). The modularity perspective aligns with the behavioral systems framework that was developed first, and yet is not cited by evolutionary psychologists.

6. Provides a framework for characterizing and categorizing psychopathology (behavioral disorders).
7. Provides for mathematical modeling and computer simulations of behavior.

The four human social behavioral systems and their intrinsic rewards, motivations, behaviors and pathologies are briefly outlined in the sections that follow. In this discussion the diverse nature of human social bonds and the nesting of social bonds within social behavioral systems will be demonstrated.

The Attachment Behavioral System

Eibl-Eibesfeldt (1989, p.167) described best the role of the attachment behavioral system and its counterpart, the care-giving system, in the evolution of vertebrate sociability:

A highly significant event for the development of vertebrate sociability was the evolution of maternal care by which friendliness came into existence. For only with the appearance of parent-offspring signals, infantile appeals, and corresponding affectionate responses behavior became available that permitted adults to create friendly and affectionate relationships.

Scott studied the attachment behavioral system in dogs, calling it the et-epimeletic, or care-soliciting behavioral system. He stated, "One of the most general conclusions of this sort of study is that behavioral capacities overlap periods of development beyond those in which they are primarily useful (Scott & Bronson, 1964, p. 175)." Although the mammalian attachment behavioral system evolved in the context of care-solicitation during infancy, this system persists into adulthood in social mammals and fosters sociability. The attachment behavioral system in primates and other social mammals functions adaptively to insure safety from threat and provision of necessities such as milk, warmth, hygiene, and sensory stimulation through motivating individuals to remain in close proximity (Bowlby, 1988). The contention that the attachment and affiliation systems are one (Depue & Morrone-Strupinsky, 2005) is also supported by the observation that the incentive stimuli, rewards (safety and intimacy) and output behaviors related to "general affiliation" are not qualitatively different from those related to "attachment."

Attachment Behavioral System: Assessment and Measurement

Attachment research has been carried out from several different perspectives, primarily developmental, biological, ethological and psychopathological; these are not yet well integrated and few have addressed how the attachment behavioral system in humans may differ from that of other primates (the reader is referred to Cassidy and Shaver (2008)). In all four perspectives, attachment is conceptualized in terms of interpersonal bonds that promote safety and survival and that alleviate fear/anxiety. Using data from observational methods including the strange situation procedure (Ainsworth, Blehar, Waters, & Wall, 1978), ethologists have created extensive flow diagrams of the human attachment behavioral system (Bischof, 1975; Waters, 1981). In such diagrams this system is linked to the fear system and to the exploration⁶ system. When individuals

⁶ The exploration system is also called the "curiosity" system (Schultheiss & Wirth, 2008).

derive security from their attachments, the fear system is inhibited and the exploration system is able to become activated; the infant uses the mother as a “secure base” from which to launch exploratory expeditions. The connection between attachment and safety from threat arises due to the vulnerability of infants, and because group social life evolved in response to threat from predation.

The attachment system has also been assessed using self-report questionnaires (Brennan, Clark, & Shaver, 1998) and with the Adult Attachment Interview (Main, Hesse, & Kaplan, 2005). In spite of the differences in assessing adults and children and the differences between observational, interview and self-report measures, there is consensus regarding the concept of “attachment styles” that reflect individuals’ internal working models of attachment and the interactions between the attachment system and the fear system (for a description of attachment styles see Bartholomew & Horowitz (1991)).

Attachment Behavioral System and Social Bonding

In humans, the attachment behavioral system mediates both a general tendency to affiliate with others and dyadic bonding; these two variables are correlated within individuals (Depue & Morrone-Strupinsky, 2005). When an “attachment” bond forms, the person who is a source of attachment reward takes on special significance and stimuli associated with that person acquire special salience. That process is herein termed special significance and salience acquisition (SSSA), but is commonly called “bonding” (Depue & Morrone-Strupinsky, 2005). A bond is indexed both by proximity seeking and distress in separation. In all primates there is a sensitive period in infancy where caregivers acquire special significance and salience and this acquisition affects sociability in adulthood (Depue & Morrone-Strupinsky, 2005; Harlow, 1973; van Ijzendoorn, Bard, Bakermans-Kranenburg, & Ivan, 2009). That early attachment experiences with mother affect sociability in adulthood is evidence for the proposition that the attachment behavioral system mediates both infant et-epimeletic responses and aspects of adult sociability. Furthermore, the neurochemical process of SSSA itself is affected by deficient early attachment experiences such that disruption in the attachment behavioral system may impair future SSSA to adult social stimuli (Depue & Morrone-Strupinsky, 2005). Although the term “bond” is used synonymously with the word “attachment,” the present work rejects the theory that all social bonds involve the attachment behavioral system. This review hypothesizes that special significance and salience acquisition (bonding) can occur in each of the four social behavioral systems and as a result, social bonding is not a singular phenomenon. Across mammalian species, many social contacts occur but bonding is differentially present and differentially associated with the attachment, caregiving, dominance and sexual behavioral systems (Carter & Cushing, 2004; Leedom, Geislin, & Hartoonian Almas, 2013; Leedom & Swedell, 2013). For example, herd animals incline toward conspecifics but may not always recognize individuals; rat dams do not show bonding with respect to specific pups, not even their own; instead maternal behavior, once hormonally initiated, is directed toward any pup (Schultheiss & Wirth, 2008). In mammals, bonding occurs with mating in monogamous species (Carter & Cushing, 2004) but this is relatively rare (Fraley, Brumbaugh, & Marks, 2005). Bonding or special significance and salience acquisition thus seems to be a

general property of social behavioral systems (Berridge & Robinson, 1998), is adaptive for a given species and is not unique to the attachment behavioral system. Special significance and salience acquisition may be a diffuse property of the mesolimbic reward system with much individual variation (Nedelisky & Steele, 2009). Special significance and salience acquisition in the human caregiving and sexual systems leads to the formation of bonds which some differentiate from “attachment” (Aron et al., 2005; Bartels & Zeki, 2004; Kobak, 2009). Bonding occurs with respect to individuals of other species (Zhou, Zheng, & Fu, 2010), especially dogs (Kurdek, 2009), and inanimate objects (van Ijzendoorn et al., 2009), especially homes (Windsong, 2010), as well as to people. There are also important individual differences in bonding that may underlie the development of addiction (Goldstein & Volkow, 2002) and are associated with developmental psychopathology, which also increases risk for addiction (Blum et al., 2000; Skinstad & Swain, 2001). It is unknown why disruption in special significance and salience acquisition caused by aberrant early attachment experiences enhances bonding to substances of abuse and inanimate objects (Lomanowska et al., 2011).

Attachment Behavioral System: Affective/Emotional Responses

The English language lacks a word for the emotion associated with activation of the attachment system. In Japanese, the emotion is called *amae*; the verb *amaeru* means to depend and presume upon another's love, and to rely on that other for care (Doi, 1973). *Amae* develops in toddlers when they learn to use their mothers as “a secure base” from which to explore the environment (Doi, 1973). Secure children leave their mothers to explore the environment, since the hedonic pull of exploration is stronger than that of mother once security is achieved (Cassidy, 2008). The reward value of intimacy with attachment figures for humans may be underestimated by conceptualizing “mother” as a secure base. Although the “security” functions of attachment are important, positive hedonic experiences also contribute to the formation and maintenance of human attachment bonds (Mayes, Magidson, Lejuez, & Nicholls, 2009; Troisi, Alcini, Coviello, Nanni, & Siracusano, 2010). Ethologist Eibl-Eibesfeldt (1989, p. 188) opined, “Physical care is not the predominant criterion in establishing (attachment), but rather behavioral patterns of loving attraction, such as cuddling, kissing, speaking to inciting dialogue, and, of course, play.” More studies of the attachment behavioral system are needed to differentiate components of the system related to positive and negative reinforcement, and to explore the manner in which the attachment system of humans differs from that of other primates.

Attachment Behavioral System and Psychopathology

The attachment behavioral system has been linked to psychopathology (Dozier, Stovall-McClough, Albus, Cassidy, & Shaver, 2008).⁷ In borderline and dependent personality disorders excessive or aberrant et-epimeletic behavior occurs, and working models of attachment may be disordered (American Psychiatric Association, 2000; Levy, 2005). In schizoid personality and autism spectrum disorders, deficient attachment behavior and motivation occur; this deficiency may connect to excessive anxiety, since the attachment

⁷ This list of psychopathologies in each behavioral system is not meant to be exhaustive but rather to exemplify the utility of the behavioral system framework.

behavioral system is not available to inhibit threat sensitivity (American Psychiatric Association, 2000; Capps, Sigman, & Mundy, 1994; Rutgers, Bakermans-Kranenburg, van IJzendoorn, & van Berckelaer-Onnes, 2004). Loss of attachments is related to propensity to develop major depressive episodes, pathological grief and reactive attachment disorder (American Psychiatric Association, 2013; Bowlby, 1988).

The Caregiving Behavioral System

The caregiving behavioral system began with motherhood (cf. Eibl-Eibesfeldt (1989, p. 167)) and functions in humans (both men and women) to provide protection and support to others, especially offspring and mates; accordingly the goal of the care-giving behavioral system is protection and fostering the growth and development of others. Activation of the care-giving behavioral system necessitates a shift in attentional focus from the self to the other and taking the perspective of the other through empathy, and the goals of this system may conflict with immediate self-interest (Collins & Ford, 2010). The care-giving behavioral system has been studied in terms of its component parts such as empathy, maternal behavior, paternal behavior, spousal caregiving and altruism. Hence, few researchers place their data within the context of the care-giving behavioral system. Altruism, broadly defined as unselfish regard for or devotion to the welfare of others, is mediated by the care-giving behavioral system (Mikulincer, Shaver, Gillath, & Nitzberg, 2005). “The caregiving system is focused on another person’s welfare and therefore directs attention to the other’s needs, wishes, emotions, and intentions rather than to one’s own emotional state (Shaver & Mikulincer, 2006, p. 40).” In a recent theory paper, Preston presents a cogent case that altruism in humans is due to the functioning of the care-giving behavioral system (2013). In most mammalian species, caregiving is restricted to mother-infant relationships and males lack the care-giving behavioral system (or it is suppressed by testosterone (Archer, 2006)).

Care-Giving behavioral system: Assessment and Measurement

The care-giving behavioral system has been studied in terms of its component parts using physiologic, observational and self-report measures (Britner, Marvin, & Pianta, 2005; Greimel et al., 2010; Preston, 2013). The system has also been examined using physiological, observational and self-report techniques in studies of parenting. Self-report and other report measures have been used to assess spousal care-giving (Kunze & Shaver, 1994; Mikulincer et al., 2005). In spite of the many different approaches, there is emerging consensus regarding individual differences in the care-giving behavioral system and cross situational consistency in care-giving behavior (Bell & Richard, 2000; Solomon & George, 1996); these relate to personality traits (see below).

Care-Giving behavioral system and Social Bonding

A care-giving bond reflects special significance and salience acquisition in the care-giving behavioral system and greatly increases the likelihood that this system will be activated by another’s expression of need. The role of oxytocin in cortical remodeling and the formation of bonds within the care-giving behavioral system has been extensively studied in ewes - which strongly bond to and care for only their own offspring (Nowak, Keller, & Levy, 2011). Humans have the most broad-based caregiving of any existing

species, this capacity being fully developed in men and both sexes demonstrating true altruistic behavior even toward adult strangers (Sampson, 2003). Alloparental care and the prolonged post-weaning provisioning of subadults by related adults were important to human evolution and likely explains the extreme caregiving in humans (O'Connell, Hawkes, & Blurton Jones, 1999; Van Schaik & Burkart, 2010). Although care-giving bonds exist in humans, care-giving behaviors may be directed toward individuals with whom no preexisting bond exists.

Care-Giving behavioral system: Affective/Emotional Responses

Shiotta and colleagues (2006, p. 64) defined *compassion* as the emotion associated with the caregiving behavioral system. "This positive emotion is defined by feelings of concern for another's well-being, stimulates nurturant behavior toward offspring and significant others in need, and is elicited by cues of vulnerability, helplessness, cuteness, and distress." Bell and Richards (2000) proposed that the emotion caring be conceptualized as the affect and motivation for caregiving. They further suggested that sensitivity and responsiveness arise from this emotion-motive. Caring is defined as:

an enduring dyadic emotion that continues over the long term and that serves as an autonomous motivation to see that the needs of a specific partner are met... First caring constitutes a motivation for the caregiving process. Second, caring grounds caregiving in emotion rather than in cognition and information processing (p. 75).

Bell and Richard's ideas received much criticism; Youngstrom (2000) pointed out that emotion theorists do not consider caring to be a universal primary emotion (cf. Weisfeld & Goetz (2013)) and it is unclear how caring relates to the primary emotions that have been identified⁸. Although in healthy individuals, caregiving behavior endures, the emotion of caring as a positive affect is not always present during caregiving (Finkenauer & Meeus, 2000). The proposal that caring is an emotion that motivates behavior also appears to be circular (Noller & Feeney, 2000); as Bell and Richard state, "The caregiving bond endures because it is the enduring emotion of caring." On the other hand, critics of caring as an emotion have not explained why it is a reported feeling state in children and adults that is indeed connected with the performance of care-giving behaviors. *Subjectively, caring appears to motivate caregiving.* Youngstrom (2000) suggested that Bell and Richards used the term caring in the same context as Shaver et al. use the term love, and so proposed that caring and love are the same emotion. Others, such as Trivers (1971) and some developmental psychologists, employ the term sympathy (or empathy).

In light of the identity theory of mental and neural processes (Shaffer, 1961), there is a logical resolution to the arguments that surround caring and love as emotions. This resolution also eliminates the need for circular reasoning regarding "feeling caring," interpersonal bonds and performing care-giving behaviors. Caring likely represents cognitive labeling of the activation of the caregiving behavioral system. It follows that activation of each social behavioral system is associated with a particular affect that

⁸ It is unclear how any of the emotions described herein relate to the very narrow definition of primary emotions (Weisfeld & Goetz, 2013)

corresponds to cognitive labeling of behavioral system activation (cf. *amae* in the attachment system). Rephrasing Bell and Richard's proposition to eliminate circularity: the emotion caring reflects the activation of the caregiving behavioral system usually in the context of an enduring bond.

Care-Giving Behavioral System and Psychopathology

Considering the importance of the care-giving behavioral system to human social behavior, there are few studies of caregiving behavior, altruism and parenting within the context of mental illness, though many different disorders negatively impact parenting (Brown & Roberts, 2000; Laurent & Ablow, 2013; Leedom, Bass, & Almas, 2013; Ostler, 2010). The connection between social reward and the experience of empathy is illustrated by the disorders in which both of these are impaired - substance abuse, depression, autism spectrum disorders, and antisocial disorders. The antisocial disorders are associated with impaired emotional empathy, although not all antisocial individuals completely lack emotional empathy (White & Frick, 2010). Decety and Meyer (2008) *contrast* the apathetic responses toward others' distress in individuals with autism with the *aggressive* responses toward others' distress seen in those with antisocial disorders. Psychopathy is a severe form of antisocial personality disorder which is characterized by impaired empathy and lack of empathetic care-giving (Blair, Mitchell, & Blair, 2005; Cleckley, 1964; Leedom, Geislin, et al., 2013). It appears that both autistic and antisocial disorders involve disruption in social reward, empathy and the care-giving behavioral system. However, only antisocial individuals are characteristically instrumentally aggressive. Individuals with autism may aggress when frightened but they do not seek opportunity to aggress as is central to the antisocial disorders. These observations speak against deficits in empathy as directly causal to aggression in antisocial disorders. Instead a specific *motive to aggress* linked to activation of the dominance behavioral system (Johnson et al., 2012) is likely causal to aggression in antisocial disorders (Decety, Michalska, Akitsuki, & Lahey, 2009) as will be discussed.

The Dominance Behavioral System

Boehm (1999, p. 147) aptly states, "There is in fact a 'universal drive to dominance' in our species in the sense that we readily learn both domination and submission... behavior that because of our genes is more readily learned in our particular species." The dominance behavioral system is the reason behaviors related to status are so readily learned (Johnson et al., 2012). The dominance behavioral system, also called the "rank regulation system" (Zuroff, Fournier, Patall, and Leybman, 2010), evolved to motivate individuals to gain control over rewards and punishments as applied to self and others in the group; as such it is concerned with the achievement of rank, privileged access to resources, attainment of interpersonal power, and autonomy of the self (within a social context)⁹. Resistance to external control termed reactance by social psychologists is a

⁹ Humans are a cooperatively breeding species (Van Schaik & Burkart, 2010), as such the group is a "resource" for reproductive success. Furthermore, since humans engage in intergroup warfare, control of the group may confer adaptive advantage (Bowles, 2009). Cooperative breeding and warfare may be connected and together these make the possession of power central to social dominance in humans.

process of the dominance behavioral system and reflects the active avoidance component of this system (Baumeister, Catanese, & Wallace, 2002). The goal of the dominance behavioral system is understood herein to be both resource control and *interpersonal power*. Schultheiss (2007, p. 177) points to the individual differences in dominance behavioral system function, "Individuals high in power motivation have a capacity to derive pleasure from having physical, mental, or emotional impact on other individuals or groups of individuals and to experience the impact of others on themselves as aversive... power-motivated individuals are quick to pick up and retain behaviors that helped them dominate others, but equally quick to inhibit behaviors that in the past have been associated with their being defeated by others."

Dominance Behavioral System: Assessment and Measurement

For a complete discussion of dominance behavioral system assessment and measurement see Johnson et al. (2012). Dominance motivation has been studied using implicit, physiologic and self-report methods; implicit methods use word searches and the Picture Story Exercise to tap unconscious motivational processes (Schultheiss, 2007; Sellers, Mehl, & Josephs, 2007). In a series of elegant studies Hawley used observational and self-report methods to study dominance behaviors in humans across development (Hawley, 1999). The behavioral strategies of the dominance behavioral system have been a source of confusion for those trying to parse social motives. The term dominance implies, as Adler (1976) says, "a quest for superiority." Operationally, this superiority is broadly defined; humans and other primates share resources to achieve control over other individuals. Only a thorough examination of inter-individual dynamics over time reveals the connection between this sharing and attained "superiority" and reveals that sharing, while appearing "altruistic," may be a dominance behavior. Thus, apparently prosocial behaviors, such as "affection," and anti-social behaviors, such as aggression or coercion, may be behavioral outputs of the dominance behavioral system as these all reflect effective strategies for dominance (Hawley, 2002).

Hawley (2009) has identified five subgroups of human individuals based on power strategies employed: bistrategic controllers employ both prosocial and aggressive strategies to a high degree relative to peers, coercive controllers employ coercive strategies to a high degree, prosocial controllers employ prosocial strategies to a high degree, and non-controllers are low on both relative to others (i.e., they are not particularly power motivated). Typical controllers are the largest remaining group and are average on both strategies. Bistrategic controllers are the most successful in gaining power across all age groups in American society. Hawley's results have implications for the study of reciprocal altruism (resource exchange) and suggest that the term "altruism" be reserved for behaviors of the care-giving behavioral system (West, Griffin, & Gardner, 2007). Reciprocal altruism, in the form of resource exchange, appears to reflect dominance behavioral system activity. Primates including *Pan* have remarkable memory for patterns of resource exchange that enable punishment of cheaters (de Waal, 1998). Generally speaking, in primates, prosocial strategies, such as negotiating and allocating resources justly, are requirements for procuring power and the injudicious use of aggressive strategies can backfire (Boehm, 1993; de Waal, Aureli, & Judge, 2000).

Dominance Behavioral System and Social Bonding

There are two important characteristics of the human dominance behavioral system that warrant emphasis. First, the dominance behavioral system and its hedonic experience is inherently social, thus the dominance behavioral system belongs in any discussion of *social* reward. In non-social mammals competition leads to aggression followed by dispersion; however, social mammals must compete while attached. Coalitions between individuals that aid in resource acquisition also link social reward and bonding to the dominance behavioral system. That the dominance behavioral system in humans is social may explain why individual trait dominance links to extraversion and affiliation (Depue & Collins, 1999) as discussed below. Second, that bonding can occur within the dominance system may be responsible for confusion over the coercion that occurs within intimate relationships once “romantic love” wanes (Dutton & Goodman, 2005; Leedom, Geislin, et al., 2013; Leedom & Swedell, 2013). Since power is inherently rewarding, stimuli from subordinate individuals become salient; and bonding in the dominance system is a likely mechanism through which subordinates and intimate partners come to be regarded as “possessions” (cf. slavery).

Dominance Behavioral System: Affective/Emotional Responses

A diverse group of emotional responses link to dominance behavioral system activation and inactivation. Activation of the dominance behavioral system is associated with positive affect, namely euphoria (Johnson & Carver, 2012) or, more specifically, pride (Weisfeld & Dillon, 2012). Dysphoria, shame and guilt are associated with deactivation of the system (Johnson et al., 2012; Weisfeld & Goetz, 2013). Frustration of dominance motives is accompanied by negative affect: anger, envy and humiliation (van de Ven, Zeelenberg, & Pieters, 2012; Walker & Knauer, 2011). Anger, envy and humiliation motivate behaviors to restore or gain status or power. For more complete discussion of dominance motivation and emotion see Gilbert (1992), Gilbert et al. (2002), Johnson et al. (2012) and Weisfeld and Dillon (2012).

Dominance Behavioral System and Psychopathology

Both activation and deactivation of the dominance behavioral system contribute to clinical disorders; see Johnson et al. (2013) for a comprehensive discussion. Depression and anxiety may result from social defeat and deactivation of the dominance behavioral system (Gilbert, 1992). Note that heteronomy is due to the need for defeated individuals of social species to remain in the group rather than to flee their oppressors. It may be adaptive for individuals with less access to rewards to enter a state of relatively low motivation and refrain from wasting energy on fruitless competition (Gilbert, 1992). The symptoms and pathophysiology of depression are certainly consistent with such a state of decreased responsiveness to reward.

Mania on the other hand, includes excessive pursuit of reward and a focus on extrinsic goals such as fame and wealth even while not in the manic state (Johnson & Carver, 2006). Dominance behavioral system function in animal models has furthered understanding of mania, as dominance behavior is reduced by mood stabilizing (anti-manic) drugs like lithium, anticonvulsants and dopamine blocking agents (Malatynska & Knapp, 2005). Narcissistic personality and antisocial disorders are often comorbid with

mania and are associated with excessive dominance motivation and aggressive dominance strategies (Johnson et al., 2012).

The Sexual Behavioral System¹⁰

The goal of the sexual behavioral system is sexual arousal, intercourse and ultimately reproductive success. The sexual behavioral system is the most studied of the social behavioral systems; sexual arousal, reward and behavior have been extensively investigated in animal models (Pfaus et al., 2012; Pfaus, Kippin, & Coria-Avila, 2003) and humans (Aron et al., 2005; Goldey & van Anders, 2012; Masters & Johnson, 1966). This extensive body of research supports the utility of the behavioral systems model with respect to understanding sexuality (Georgiadis & Kringelbach, 2012). Work on the sexual behavioral system of rodents demonstrates that (similar to the attachment behavioral system) although the requisite neural circuitry, sensory and behavioral propensities are inborn, developmental experiences strongly influence the structure of the system in adulthood (Pfaus et al., 2012). Sexual stimuli are “highly salient and their processing [is] rapid and potentially automatic” (Gillath & Canterberry, 2012, p. 934) (see also Legrand, Del Zotto, Tyrand, & Pegna (2013)). These stimuli are interpreted in the context of internal working models that include “(memories of) experiences, feelings, expectations, and beliefs about the self, the sexual partner, and sexual activity with the partner (or potential partner) (Birnbaum & Gillath, 2006, p. 677).” Sexual strategies are also part of the internal working model and consist of sexual scripts (McCormick, 1987) and behaviors.

Sexual Behavioral System: Assessment and Measurement

The use of observational methods to assess the sexual behavioral system dates to *The Descent of Man and Selection in Relation to Sex* (Darwin, 1871). Observational methods have been used to study human sexual behavior both in the field (Eibl-Eibesfeldt, 1989) and in the laboratory (Masters & Johnson, 1966). Self-report methods including questionnaires and behavioral diaries have yielded important insights regarding the interactions between the sexual, attachment and caregiving behavioral systems (Birnbaum, Mikulincer, Reis, Gillath, & Orpaz, 2006; Goldey & van Anders, 2012; Rubin & Campbell, 2012; Shaver & Mikulincer, 2006; Simpson & Gangestad, 1992). Experiments have examined individuals’ reactions to sexual stimuli, and self-report studies have been used to investigate the characteristics of preferred mates (Buss, 1989; Dixson, Halliwell, East, Wignarajah, & Anderson, 2003). More recently, functional MRI studies have revealed the neural correlates of sexual motivation, sexual reward and sexual bonding (Cacioppo, Bianchi-Demicheli, Frum, Pfaus, & Lewis, 2012; Georgiadis & Kringelbach, 2012; Gillath & Canterberry, 2012; Ortigue, Bianchi-Demicheli, Patel, Frum, & Lewis, 2010).

Sexual Behavioral System and Social Bonding

Sociosexuality refers to individual differences in willingness to engage in sexual relations with strangers and casual acquaintances (Simpson & Gangestad, 1992). The Sociosexual

¹⁰ This discussion of the sexual behavioral system is by necessity very brief and is focused on aspects that relate to the other three social behavioral systems.

Orientation Inventory (SOI) measures willingness to engage in uncommitted sex along a single bipolar continuum - from unrestricted to restricted (Simpson & Gangestad, 1992). Restricted individuals require greater closeness and commitment prior to having sexual relations. Sociosexuality therefore indexes the capacity for significance and salience acquisition within the sexual behavioral system. Individuals with a restricted sociosexual orientation are the most biologically monogamous and readily develop bonds toward sex partners. That individuals who appear “sexually bonded” differentially engage in attachment, caregiving, (Feeney & Collins, 2001) and dominance of their partner (Leedom, Bass, et al., 2013; Leedom & Swedell, 2013) is evidence for bonding being a property of the sexual system itself (see Fisher’s research below). That sexual behavior promotes bonding in monogamous mammals is not disputed (Carter & Cushing, 2004). In humans sexual bonds are evidenced by research indicating a correlation between sexual intimacy and relationship quality measures (Costa & Brody, 2007; Mikulincer, 2006). Eibl-Eibesfeldt (1989) opined that near continuous sexual receptivity in women and concealed ovulation relate to the bond promoting function of sexual activity in humans.

Sexual Behavioral System: Affective/Emotional Responses

Sexual jealousy is a negative emotion linked to intimate partner violence and mate guarding (Dutton & Goodman, 2005; Shackelford, Goetz, Buss, Euler, & Hoier, 2005). Positive emotions associated with the sexual behavioral system include sexual arousal, pleasure/euphoria with consummation (orgasm) and bonding (romantic love) (Fisher, 2006). Felt sexual desire/arousal reflects an individual’s motivation to seek out sexual partners or to engage in sexual activities. Sexual desire is differentiable from romantic love - the emotion applied to powerful feelings of infatuation and bonding between intimate partners (Diamond & Dickenson, 2012). Romantic love is identified by “heightened interest in and preoccupation with a specific individual, characterized by intense desires for proximity and physical contact, resistance to separation, and feelings of excitement and euphoria when receiving the partner’s attention (Diamond & Dickenson, 2012, p. 117).” Fisher differentiates romantic love from what she calls “attachment” or love associated with care-giving of partners and offspring (that emotion is herein referred to as caring); she makes a compelling case for romantic love and “attachment” (caring) being differentiable with respect to neural circuitry (Aron et al., 2005; Fisher, 2006).

Other primates may also experience the emotion of romantic love. Consortships are temporary liaisons that occur between males and estrous females in multi-male multi-female groups (Manson, 1997). Consort partners coordinate their activities and engage in grooming and courtship behavior. Consort partners may also seek proximity to one another outside of a mating context (Buchan, Alberts, Silk, & Altmann, 2003; Smuts, 1985). It appears that in *Papio*, male-female pair bonds evolved out of longer term associations between consort partners (Bergman, 2006). The developmental trajectory of pair-bonding in *Papio hamadryas* is similar to the developmental trajectory proposed for human romantic love - socioemotional/attraction bonding develops prior to genital arousal linked to external causes which develops prior to sexual reward (Pfaus

et al., 2012). Sub-adult hamadryas males are strongly attracted to juvenile females and maintain bonds with them years before any sexual activity begins (Kummer, 1968).

Sexual Behavioral System and Psychopathology

Psychopathologies of the sexual behavioral system involve deactivation, excessive activation, aberrant object choice and aberrant sexual strategies. "Sex addiction" or hypersexual disorder was considered for placement in DSM 5; although ultimately the disorder was not included in the manual, multicenter field trials were conducted and an operational definition and rating instruments were developed for future research (Kafka, 2013; Reid et al., 2012).

Personality Traits, Dyadic Behavior and Social Behavioral System Interactions

Within individuals, the four social behavioral systems and their regulation determine the Big 5 personality traits of extraversion and agreeableness, and dyadic bonding patterns. Within a society, the functioning of the behavioral systems within individuals, and social bonds between individuals, impact social structure. The orthogonal relationship between dominance and care-giving motivation has been defined since Wiggins et al. (1988) introduced the interpersonal circumplex, and is supported by observations that testosterone levels decline in men to promote care-giving responses (Booth & Dabbs, 1993; Gray, Kahlenberg, Barrett, Lipson, & Ellison, 2002). Using the self-report IAS-R, Wiggins et al. represented interpersonal interactions in terms of two dimensions, dominance and nurturance. In their formulation, nurture contains elements of attachment and sociability as does the dominance dimension. The plane of the interpersonal circumplex therefore may also be rotated to represent the Big Five (NEO-PI) trait facets, extraversion (containing elements of dominance, sociability and nurturance) and agreeableness (compliant, caring sociability) as orthogonal factors (Wiggins & Pincus, 2002). Alternatively, removing the affiliation-attachment dimension from dominance and nurturance and giving this dimension its own axis, results in a three dimensional interpersonal circumplex with the dominance behavioral system and care-giving behavioral system in the Y-X plane and the attachment behavioral system on the Z axis (Figure 2). This three dimensional system more accurately places Big Five extraversion into the dominant, gregarious quadrant extending three dimensionally into the nurturant quadrant due to "warmth;" and Big Five agreeableness into the nurturant, gregarious quadrant extending three dimensionally into the submissive quadrant due to "compliance." The observation that Big Five personality traits are best represented by three rather than two interpersonal dimensions reflects behavioral system integration and the normative tendency of humans toward heteronomy, affiliation and nurturance (Eibl-Eibesfeldt, 1989).

Behavior towards mates and offspring reflects interactions between all four social behavioral systems. Individuals with deficient care-giving motivation and empathy and excessive dominance motivation are at high risk to abuse their partners and children (Leedom, Geislin, et al., 2013). In Fisher's model, care-giving and "attachment" (*caring* based) love replaces romantic love in long term sexual partnerships (since romantic love tends to wane). In some individuals, the capacity for this *caring* is lacking, and when romantic love wanes, dominance responses maintain the bond (Leedom, Geislin, et al.,

2013; Leedom & Swedell, 2013), including exchange of favors. Coercive control of partners also known as intimate partner terrorism begins in marriages after the “honeymoon phase” and involves emotional, physical, sexual and financial abuse of partners (Dutton & Goodman, 2005).

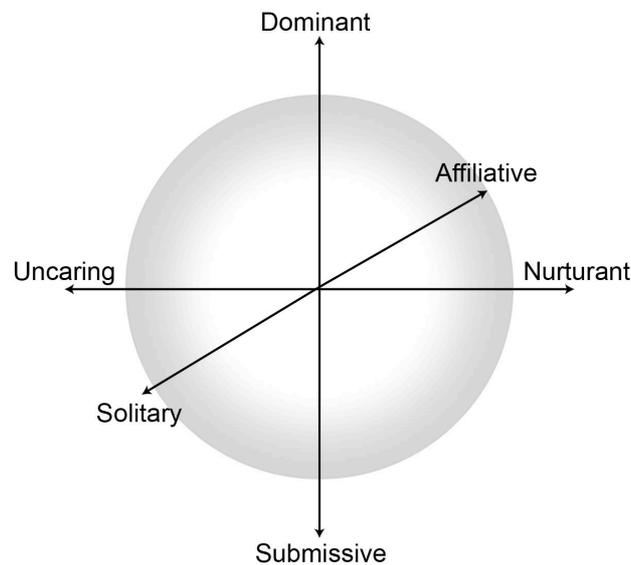


Figure 2. Three dimensional interpersonal circumplex reflecting the attachment/affiliation, caregiving and dominance behavioral systems.

CONCLUSION

This paper sought to revive the behavioral systems framework and to discuss the human attachment, care-giving, dominance and sexual behavioral systems. These systems, shaped by developmental experiences and hormones such as testosterone and oxytocin, direct information processing and the situational expression of personality. In each system, stimuli derived from other people and associated with reward take on special significance and salience. The sight, smell, feel, taste and sound of special others acquire salience, these others become emotionally significant and social bonds form. This process of bonding occurs dimensionally and is subject to individual variation. The functioning of the social behavioral systems within the individuals that comprise a social group influences the social organization of the group. A unified theory of human social behavior is derived from defining the social behavioral systems: attachment, care-giving, dominance and sex, and their interrelationships and linking these to social structure. It is important to acknowledge the pivotal role ethology has played in our understanding of these systems and their implications for society as well as normative and pathological behavior. The disciplines of social psychology, evolutionary psychology and sociobiology have neglected important aspects of proximal causation, and have not integrated proximate and ultimate causation with social structure; they have therefore not replaced ethology.

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