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Behavior disorders and Psychopathology in non-human primates? A proposal

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When speaking about primates we must distinguish between non-human primates and human primates, as the latter are part of the primate order. Due to their phylogenetic closeness to humans, non-human primates have been of special interest for such disciplines as neurophysiology, biology, genetics and behavior. Research has included a wide range of species and themes, from socioecology to neuroethology, cognition and phenomena such as empathy and theory of mind. In this article, we aim to demonstrate the occurrence of psychopathology, mental disorders and psychopathy in non-human primates and to propose the alternative use of the concept of condition, which refers to how the individual interacts and adapts to the environment. We discuss the fact that human behavioral disorders can also be found in non-human primates. From the perspective of evolutionary psychiatry and developmental psychology, behavior, psychopathology and psychopathy in general are conditions derived from the interaction of biological, psychological and sociological variables, and that reflect strategies with which individuals and groups of individuals contend with the environmental demands in order to survive.

Palabras clave:
Attachment. Depression. Pathological anxiety. Prosimios. Monkey. Apes. Humans.

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¿Trastorno de la conducta y psicopatología en primates no-humanos? Una propuesta

Cuando hablamos de primates debemos hacer la distinción entre primates humanos y primates no-humanos, ya que los seres humanos pertenecemos al orden primate. Por su cercanía filogenética con el humano los primates, han sido de especial interés en el estudio de la neurofisiología, la biología, la genética y la conducta. Las investigaciones se han extendido a diversas especies y abarcan temas desde la socioecología hasta la neuroetología, pasando por la cognición y los fenómenos de la empatía y la teoría de la mente. En este artículo pretendemos demostrar en primates no-humanos, el trastorno mental, la psicopatología y psicopatía y proponer el concepto alterno de condición, que se refiere a cómo el individuo interactúa y se adapta con el mundo circundante. Discutimos el artículo en términos de que los trastornos en la conducta en primates no-humanos encuentran sus correlatos en primates humanos. Desde la perspectiva de la psiquiatría evolutiva y la psicología del desarrollo, la conducta, la psicopatología y la psicopatía en general, son condiciones que derivan de la interacción de variables de orden biológico, psicológico y social, y que reflejan estrategias con las cuales los individuos y los grupos de individuos contienden con las demandas del medio para sobrevivir.

Key words:
Apego. Depresión. Ansiedad patológica. Prosimios. Monos. Simios. Humanos.

INTRODUCTION

When referring to primates we must distinguish between human and nonhuman primates, as humans belong to the primate order. First, we will focus on nonhuman primates, and then we will focus on humans only in some contexts.

Nonhuman primates are divided in prosimians and anthropoids. Prosimian primates, that are the most different from humans, are divided in lemurs, tarsiers, and lorises. They made their appearance in the late Cretaceous period, approximately from 98 to 66 million years ago. They have a quite small complexion and their main characteristic is their inverted rest-activity, sleep-wake rhythm. That is, most of them have nocturnal habits, although among them we can find cathemeral species. Anthropoids, that is, monkeys, apes and humans, are divided into New World and Old World primates, which, respectively, appeared during the Eocene, 55 and 36 million years ago, and the Oligocene, 36 millions

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years ago.[1] Most of these species have diurnal habits, with the exception of the Aotus nocturnal monkey, among which we can find twilight subspecies such as the *Aotus azarae* (an excellent review on rest-activity rhythms can be found in Erkert, 2008).[2] Finally, and closest to the hominids, including the modern human, are the apes, which appeared during the Oligocene between 24 and 36 million years ago. They are characterized by sharing almost 98% of genetic code[3] with humans and they have diurnal habits.

Due to their phylogenetic closeness to humans, primates have been the focus of special interest in neurophysiology, biology, genetics and behavioral studies. This is how Pérez-Rincón,[4] in his 1979 article, presents a substantial summary relating primate studies and mental health, a view Plinio had already expressed. Pérez-Rincón presents a brief review on primate research emphasizing upon what occurred at the time in the experimental field and communication processes best known as nonhuman primate language. However, classic studies on behavior disorders and psychopathology have been biased towards great apes, particularly chimpanzees, due to the influence of traditional studies on intelligence such as Kohler's in 1920 and, allowing a chronological leap, by the work of Van Lawick-Goodall[5] and her observations of free ranging chimpanzees in Tanzania, which were first published in the *American Journal of Psychiatry.* However, this publication not only contributed to biomedical primatological research, but also highlighted the necessity of performing social behavior studies of diverse species in their natural environment. These particular studies have greatly increased all aspects of knowledge, and have contributed to the evolutionary understanding of adaptative, phylogenetic and ontogenetic processes. This is how, recently, the development of primate research spans from socioecology (for a review read the *International Journal of Primatology* 23(4), 2002, issue dedicated to this theme) to neuroethology,[6] including cognition and phenomena such as Empathy and Theory of Mind.[7] In the present article, we intend to demonstrate the existence of phenomena defined by mental health sciences as mental disorder, psychopathology and psychopathy in nonhuman primates and propose an alternative concept of «condition», which refers to how the individual interacts and adapts to its surrounding world.

DEFINITIONS

Approaching the phenomena related to primate behavioral disorders and psychopathology implies assuming definitions that will open a pathway that allows the establishment of their conceptual differences. To accomplish this, a survey among mental health and neuroscience specialists and researchers was performed. Based on this, some definitions emerged and are listed in order to establish a context.

Behavioral Disorder, for the purpose of this paper, is defined as «A condition that starts in childhood and adolescence, and implies strange behaviors inappropriate for the age, history, context and socio-cultural norms. Its correlate on the nervous system level can be genetic, molecular, biochemical, anatomic or functional, and it includes nonadaptive behaviors for the species». Psychopathology is an alteration of mental origin, which produces discomfort, social dysfunction and trespasses normal limits according to the socio-cultural context (survey performed by Muñoz-Delgado J, 2007, among a group of mental health and neuroscience professionals). Finally, we based our definition of Psychopathy on the still prevailing one of Checkley (1941/1982). It is defined as «a group of personality traits; such as lack of empathy, dishonesty, egocentrism, incapability to establish affective bonds with others. There is poor impulse control and incompetence to learn from punishment, these are individuals that take risks, are aggressive and have a superficial attractiveness.»

BEHAVIOR DISORDER

We will begin by describing a series of behavioral disorders studied in primates: In socially-established primate groups, activities of each individual depend on the social status they have. In other words, each individual fulfills a clear function not only during its activity periods but also during rest. That is, during the sleeping period, in which individuals of any species are particularly vulnerable to environmental effects such as predators. For this reason, sleeping site selection as well as the search for partners to spend the night become troublesome and time-consuming daily activities attained through social behaviors such as grooming, nearness, face to face interaction, among others, which ensure a comfortable and safe place to sleep as well as partners that provide mutual thermoregulation through body contact.[8]

In groups with gregarious systems, individuals in peripheral social positions are responsible for the nighttime monitoring of the central group's safety. With this in mind, we designed a study for our stumptailed macaques *(Macaca arctoides)* that allowed us to observe the sleeping strategy followed by peripheral subjects in order not to disregard the central groups.

Videotaped recordings of two peripheral individuals who slept together every night maintaining body contact were made from 7 pm to 7 am, achieving 60 hours distributed into 5 nights for 5 weeks. Based on the minute to minute behavioral analysis, classified as shown in table 1, we found that there is an alternation between both subject's rest-activity behaviors. While one is resting, the other is active, this pattern alternating throughout the night. This not only denotes behavioral plasticity, but is also indicative of sleep behavior alteration which is expressed as periods of insomnia with rebound, that is, with somnolence periods in both individuals several times a day, different from those observed in the rest of the group.[9] We have been able to observe such

sleep rebounds due to an alteration in the rest-activity rhythm in spider monkeys *Ateles geoffroyi,* as a consequence of an increase of activity during the full moon phase in seminatural conditions.[10] In this way, we have been able to detect sleeping behavior disorders and behavioral disorders related to the rest-activity rhythm. If we add information from electrophysiological studies, we can obtain a wider view of this type of behavioral disorders, which as we have seen, could be strategies that have an immediate function, that is, from the evolutive perspective are a proximate cause.[11]

Another behavioral disorder in primates is the one defined by Díaz[12] as anomalous behaviors, while performing systematic observations of spontaneous behavior in three troops of stumptail macaques *Macaca arctoides* living in outdoor captivity. After performing a longitudinal chronicle of the daily life during the conformation of the three troops and based on the study of their social dynamics, structure and history, he distinguished three social dynamics: «integration, disintegration, and change of role,» each of which has its own particular strategy in individuals interactions. While studying the form and function of social behavior and from the analyses of dyadic and triadic relations, Díaz was able to characterize a group of three stereotypes that occurred in different circumstances: self-aggression, anomalous aggression, and bizarre actions. A form of self-aggressive behavior consists on bites and threats the individual directs towards itself, particularly its own arms and legs. It occurs when an individual has been attacked by a dominant animal and «[...] seems to be the outcome of frustration.» The other type of self-aggression was observed in the dominant male after copulation, indicating, among other considerations, that self-aggression in these primates seems to be «[...] an indicator of non adaptive social stress» (table 2).

Anomalous aggression appears during difficult times for the troop, that is, when social chaos is observed, and even acts of violence are expressed as «[...] teeth gnashing, trembling, behavioral ambiguity, extreme restlessness, excessive group monitoring and unrestricted aggression oblivious to submissive and pacifying signals.»

Bizarre actions generally occur during solitude and isolation, such as «[...] repetitive swinging or cheek pulling by a female,» which, according to the author, disappear as soon as the individual engages in social interaction or closeness, that is, when the social dynamics is activated.

Finally, the author describes the behavioral depression individuals presented when they lost a high position within the group or when dominance is lost. In this case, behavioral and physiological correlates are similar to the ones found in humans; alopecia, social and physical isolation, loss of appetite with the consequent weight reduction[12]. All these would be good examples of behavioral disorders or alterations in nonhuman primates.

Table 1 Sleep behaviors recorded in stumptail macaques *Macaca arctoides*

Out
When individual is out of camera frame.
Rest
Rest with myoclonias: The subject is observed in deep rest. The main observable trait is one or several myoclonias.
Rest without myoclonias: The subject is observed resting with tilted head, muscle atony or immobility.
Activity
Transition (with at least one or two pauses per minute): The subject is observed resting, with somnolence characterized by yawning, nodding off, muscular atony, low eye blinking, show eye movements or chewing.
Wakefulness: The subject remains active.

PSYCHOPATHOLOGY

During a primate's development, the quality of mother-infant relationship is one of the events that seem to have an important impact in the emergence of psychopathology, as first life experiences in newborns will be decisive in posterior adult life, with a higher risk of unleashing mental pathology. This does not imply that subjects are not susceptible to change through a treatment, as it is important to enhance plastic and adaptive capability of behavior. An example of this is the effects of repressive or abusive behavior of some mothers towards their infants during the first months of life. McCormack et al.,[13] studied the patterns of maternal nursing and the behavioral development of rhesus macaques *Macaca mulatta* that were abused in the first three months of life. Behavioral abuse was defined as dragging, squeezing, throwing, sitting or stepping on, coarse grooming and abusive carrying. The results showed that these behaviors are more frequent from the mothers towards the infant during the first month of life; they decrease during the second month, and tend to disappear towards the third month. When the authors compared abusive mothers with non-abusive regarding their rejection towards their infants, they found that in a 6-month period, abusive mothers showed a tendency to increase rejection during the first three months, after which the frequency stabilized without disappearing. However, ventral carrying of infant showed no difference between abusive and non-abusive mothers.

Table 2 Dynamics and strategies that characterize the sociostructural process in Macaques. (Title and table appear in the Salud Mental, 1985, 8(8):p.70 with permission of both author and editor).

GENERAL DYNAMICS		PARTICULAR DYNAMICS	STRATEGIES
Integration	Permanent dynamics	Facilitation of cohesion	Grooming Invitation to aggression Location during sleep
		Distension inhibition	Prevention of aggression Neutralization (through affiliation or relaxation) Derivation or redirection of aggression
	Acute dynamics	Integration of one or a few individuals to a group Cohesion due to intergroup confrontation Intergroups approach	
Desintegration	Permanent dynamics	Repression	Through hierarchy leap Through attack to friendly elements Through solidification of acquired rank
		Aggregate to aggression	
	Acute dynamics	Catastrophe Irreversible violence following a destitution	
Change of role	Acute dynamics	Abdication	Mixed behaviors towards a maturing male Confrontation and submission of previous dominant Solidification of rank through mild aggression
		Destitution	Hierarchy leap and ingraciation Attack in strategic moment Solidification of rank through intense aggression

However, there are studies on the early experiences in the life of nonhuman primates that have shown that, depending on the moment in which the stress occurs at approximately 4 months of age, this experience can have an opposite effect during juvenile stage and, instead of generating a stress condition, or depression or anxiety, resilience could develop.[14] This line of investigation deserves special attention and motivates the development of research protocols in diverse species and ages.

In human primates, it can be seen that mother-infant interaction affects the development of specific behaviors, maturation of brain structures that are determinant in behavior, and affective regulation. Such is the case of the maturation of the right orbito-frontal cortex. Development of this cortical area starts in a specific critical period that begins at the end of the first year of infancy. Schore[15] has suggested that the socioaffective stimulation regulated by the mother, mainly through gazing exchange, is useful for the corregulation of affect and for the induction of neuroendocrine changes that promote maturation of the visuospatial orbitofrontal areas in the right hemisphere and the ascending sympathetic ventral tegmental limbic circuit. In the referred interaction which serves as imprinting, the maturation of excitatory frontolimbic systems are formed, which are responsible for the ontogenic adaptation of what Margaret Mahler[16] describes as the reapproximation phase in which play behavior is observed and the ability to form an interactive representational model is established, this aptitude being the underlying substrate of affect.[15]

In a recent paper, Maestripieri, Lindell and Higley[17] propose that there is an intergenerational transmission of maternal behavior in rhesus macaques *M. mulatta*. These authors performed a longitudinal study throughout approximately 4 to 5 years of a group of females that had been adoption-reared *versus* females that had been reared by their biological mother. They found that females that had received contact, cradling, grooming, restrain, rejection and abuse from their mothers in the first three months reproduced the same behaviors and in the same proportion per hour with their own offsprings when they were adults, with the exception of contact and rejection behaviors.

They also found that adoption-reared females that became rejection-prone as adults presented low concentrations of serotonin in the brainstem fluid, which indicates a neurophysiological imbalance due to early life experiences.

In the case of human primates, the reflexive function, mind theory, and mentalization, develop in relation to the attachment systems (interaction patterns between the sub-

ject which exerts parental care and the infant), as they are object of generational transmission and they also have an effect on the development of psychopathology.

In conclusion, there is an ensemble of pathologies that are observed in primates that have been reared by a biological mother, an adoptive mother, or through assisted breeding. The long lasting relationship of individuals reared by their biological mother provides an adequate environment for learning and socialization, as the mother-infant bond influences affective states. In regard to assisted breeding, the disadvantage we have seen in our groups of stumptail macaques *M. arctoides* has to do with the subsequent difficulty to establish social links, a frequent tendency to occupy peripheral positions within the group, and an inability to breed. Brüne[18] has also observed that females which have been reared in this way tend to generate conflicts and present aggressive behavior. Other evidence is that anxiety in abusive mothers presents characteristic neurochemical profiles related to hyperactivity and stress. High discharge levels of corticotrophine hormone and monoamine metabolites can also be observed in brainstem fluid.[7]

These cluster of phenomena along with captivity conditions can degenerate into other pathologies defined as pathological anxiety, which are characterized by stereotyped behaviors similar to those present in human autism, selfmutilation, and even the pica syndrome, explained as the compulsive act of garbage ingestion,[6] and coprophagia, as seen in our group of spider monkeys *A. geoffroyi.* However, these phenomena are not only seen in captive conditions. Some of these pathologies have also been seen in natural conditions where sensorial deprivation can occur. For example, the intense infant anaclitic depression described by Van-Lawick Goodall[5] as a result of the sudden loss of the mother, and consequent loss of the infant, was a classic observation made in natural conditions, in a chimpanzee troop of Gombe, Africa, reported in the first publication that appeared in the American Journal of Psychiatry about chimpanzee life in their natural habitat. Depression in juvenile primates has been observed as a consequence of social isolation in captive or semicaptive conditions. As an effect of these disorders, it has been described that in adult life these individuals are incapable of establishing good social relations with conspecifics. Another phenomenon is that in adult primates, depression can appear as a consequence of dramatic changes in social status, which also implies changes in neurochemical levels.[7]

Events occurring early in life produce certain vulnerability or risk factor which, before adverse environmental events, can trigger a mental pathology in adult life. An extensive review on human and primate depression done by Gilmer and McKinney[19] narrates that one of the risk factors for the appearance of depression in women during adult life was mother loss due to death or parents divorce before they were 11 years old. Environmental factors and intrapsychic conditions made these women more prone to depression than those who did not live such experience.

PSYCHOPATHY

Animal research has been central for the development of many areas of psychology such as perception, learning, psychobiology and psychopathology. Among other reasons, it is important to perform comparative studies because the finding can be used to reflect on the adaptive meaning of anatomic, behavioral and, in this case, personality traits.

Personality traits are not behavioral units, but asseverations that describe the probability of change in the frequency of behavioral patterns against the environment and that are consistent throughout the situations and time.[20]

In primates, personality traits can be assessed through questionnaires or similar tools that are useful to describe, predict, and explain an individual's behavior.[21] There are presently a good number of studies on primates and other animals' personality from which we can infer that the efforts made in this area are mainly directed toward the correlation between personality traits and biological, social and even ecological variables. In addition, studies can be cross-sectional or longitudinal, so the information provided by these studies is quite complete. For example, in a longitudinal study done by Santillán-Doherty et al.,[22] it was reported that global personality changed for most subjects in the course of 8 years. During this time, the subjects studied changed age category (for example, went from juvenile to adult), and changed their biosocial circumstances (for example, subordinate/dominant or nulliparous/mother). It was proposed that the changes observed in personality were adjustments to the life history of the subjects. Interestingly, in this study, the authors also found that there was continuity in certain traits through all development stages and it was proposed that these traits that seem to accompany subjects throughout life are probably defining their temperament.

In a general sense, temperament traits indicate the reactivity style of the subjects against the environment. It is an emotional, automatic, moderately inheritable and stable response that has been correlated to neurochemical systems. Ebstein et al.[23] found a correlation between the D4 dopamine receptor gene and a temperament dimension called Novelty Seeking. In primates, this type of temperament has also been studied in order to obtain phylogenetic information about this dimension. A proper and reliable method was generated to assess said temperament in two primate species, *Ateles geoffroyi and Macaca arctoides.*[24] Afterward, both species were compared and the temperament was correlated with biosocial variables and with the behavioral categories of affiliation, aggression and submission. Comparison between the two species showed significant differences;[25] *Ateles* were more Novelty Seekers than

macaques. These differences were ascribed to the socioecological characteristics of each species. While *Ateles* are fission-fusion societies with minimum social rules in which animals disperse, exploring their territory almost in a solitary fashion, macaques form highly structured groups with rigid social rules that compel individual not to disperse but to remain grouped. In this work, it was suggested that Novelty Seeking temperament probably promotes *Ateles* to contend with its socioecological environment. Respecting the correlation of this trait with behavioral variables, it was shown that Novelty Seeking is associated with high hierarchy, that it is more frequently related to males than females, and that it is more common among young animals, three biosocial characteristics that imply risk taking, in which a Novelty Seeking temperament would by highly adaptive.

Lilienfeld et al.[26] developed an instrument to evaluate psychopathy in a population of 34 chimpanzees, after having determined the personality traits. They constructed a psychopathy measurement based on analogous traits described for human psychopaths and examining the behavioral correlates of the personality traits. After applying the instrument, they found evidence of construct reliability and validity of the measurements of psychopathy in chimpanzees and by extension, of the construct of psychopathy in these species. As in humans, it was found that the scores were higher in males than in females. A correlation was found among the competitive-aggressive measurements, sexual activity, intrepid behaviors, «gentle» teasing, silent ranting exhibitions, and tantrums; which have been described in human psychopaths as aggressive, promiscuous, defiant and novelty seekers. However, authors finally state that the chimpanzee model of psychopathy is not conclusive, and that exhaustive research as well as physiological measurements are needed.

The attempt to study behavioral alterations in primates leads us to a series of fundamental questioning, as the parameters or criteria to consider a behavior as pathological in humans has delimitation issues. This becomes clearer when these same criteria are used in its research and classification in nonhuman primates. Psychopathology is equivalent to departing from the norm. Is this necessarily desadaptive? Are abnormal behavior alterations necessarily dysfunctional? Or is functional or dysfunctional dictated by the cultural context or, worst yet, by the theoretical model applied? Darwinian psychiatry theorizers have suggested that instead of using the term «psychopathology» it would be better to use the term «condition,» referring to the particular situation of the individual by which he moves in the world.

DISCUSSION

Basically, behavioral disorders and psychopathology seem to be the consequence of the interaction process, the bonding, between individuals. Behavioral disorders in nonhuman primates described in this text are equivalent to those of human primates. The causes of behavioral disorders and psychopathology allow us to propose that it is the «bonding» process among individuals that shapes behavior.

Primatological studies are pertinent for the comprehension of human behavior. Observation of nonhuman primate behavior allows the reflection on the co-regulation mechanisms that have been considered as pre-verbal language in humans.[27] From the perspective of evolutive psychiatry and behavioral developmental psychology, behavior, psychopathy and psychopathology in general are conditions that result from the interaction of biological, psychological and social variables. They reflect strategies with which individuals and groups of individuals contend with environmental demands in order to survive. Observations of nonhuman primates have also allowed the identification of similar phenomena in humans. For the comprehension and assistance of mentally ill humans, phenomenology of attachment, mind theory and mentalization take on cardinal importance.[28] We refer to the importance that co-regulation phenomena have among individuals (human and nonhuman primates) mainly because in current times, when psychiatry rests basically on the description of the phenomena, therapeutic interventions are structured from classificatory systems that allow the recognition of diagnostic categories. The causes of the phenomena described and treated as mental disorders are still being investigated. From this point of view, ethology, developmental psychology and evolutionary psychology join in the task of identifying the causal and originative processes of the psychopathology that emerges in «in relation» subjects.

In human interaction, not only the ability to modulate the affects is shaped but also the infant develops the proficiency to interpret his/her and others mental states through the reflexive function, also called mind theory or mentalization.[29] Reflexive function is an acquisition during development that allows the infant not only to respond to another person's behavior, but to form his/her «conception» he/she has of the beliefs, emotions, attitudes, wishes, pretensions and intentions of the «other». Reflexive function, mind theory or mentalization allows the child to «read» mental states and intentionality in the «others». This interaction experience between the child and the «other» allows the child to make «sense» and predict the behavior of the others with which he/she interacts as well as to develop a self-concept as a different individual.[30] These acquisitions have to do, precisely, with the modulation of emotions and the possibility to distinguish between «I» and «not I». From the nosological point of view, these are two dimensions that, in their dysfunction, explain a part of the phenomenology of behavioral disorders and psychosis.

Respecting psychotic disorders, such as schizophrenia, less activity has been observed in the dorsal areas of the medial prefrontal cortex, the right temporal areas as well as in the left tempo-parietal association areas. All of these are

involved in the self-referential assessment and in the attribution of mental states.[31]

In the case of the borderline personality disorder, the dysfunction found both in the affective modulation and in the recognition of the management, motivations and mental states of the «other,» is associated with the confusion in the representation of the «self» (identity diffusion) and with self-mutilation behaviors.[32]

Observation of nonhuman primates' behavior allows the identification of phenomena that, in human beings, acquire importance in the understanding of the mind and its alterations, but perhaps if we adopt the concept of condition, we would be able to unravel the group of behavior traits of behavioral alterations and of psychopathology and analyze them in their own dimension in order to understand the adaptive value of these particular behavioral states.

PROPOSALS

1. Based in the considerations developed here, we believe that mental health should consult primatological research, studying diverse species of primates in their natural habitat in order to understand the environmental and social pressures that have generated different strategies that allow them to contend with their physical and social environment.
2. It is also necessary to approach those studies done in seminatural conditions, which allow a more precise behavioral observation of aspects that are not easy to grasp in natural conditions. In addition, studies should be done in captivity with individuals in both the social group and under experimental isolation conditions. These offer the possibility of correlating social and behavioral dynamics with neurophysiological data and developing a neuroethological approach with which the phenomena can be supported by phylogenetic and ontogenetic processes.
3. It is important to consider resilience states that can be found in some nonhuman primate species and in humans.
4. We should increase the number of studies on human nonverbal behavior.
5. The concept of nonhuman primate's psychopathology should be discussed, raising the concept of adaptive condition.

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REFERENCES

1. Napier JR. The natural History of the Primates. Massachusetts: The Mit press Cambridge, 1985.
2. Erkert HG. Diurnality and nocturnality in nonhuman primates: comparative chronobiological studies in laboratory and nature. Biol Rhythm Research 2008,39(3):229-67.
3. Salamanca F. Los cromosomas de los humanos y de los primates. En Muñoz-Delgado J, Serrano Sánchez C. (compiladores). Primates, evolución e identidad humana. México: Instituto Mexicano de Psiquiatría, 1999.
4. Pérez-Rincón H. Quid dicis, Simia? (Una rápida visión de algunos estudios de Primatología de interés para la Psiquiatría. Salud Mental 1979;9(3):27-31.
5. Van Lawick-Goodall J. The Behavior of Chimpanzees in Their Natural Habitat. Am J Psychiatry 1973;130:1:1-12.
6. Gothard K M. The place of non-human primates in neuroethology. Newsletter International Society for Neuroethology 2007;6-10.
7. Brüne M, Brüne-Cohrs U. Theory of mind-evolution, ontogeny, brain mechanisms and psychopathology. Neurosci Biobehav Rev 2006;30:437-55.
8. Anderson JR. Sleep-related behavioural adaptations in free-ranging anthropoid primates. Sleep Med 2000;4(4):355-73.
9. Muñoz-Delgado J, Moreno CB, Talero C, Ruíz J, Boni J, Mier V, Varga-Marosi C, Chiapa P, Santillán-Doherty AM. Possible Alternation of Rest-Activity Cycle and Vigilance Behavior in Peripheral Male Stumptailed Macaques (Macaca arctoides) in Exterior Captivity: A preliminary Report. Salud Mental 2004;27(6):34-9.
10. Muñoz-Delgado J, Variaciones del período de reposo-actividad del mono araña Ateles geoffroyi, relacionados con cambios diarios, lunares y anuales. Tesis de doctorado, UNAM, 2004.
11. Tinbergen N.On aims and methods of Ethology. Zeitschrift für Tierpsychologie 1963;20:410-33.
12. Díaz JL. Grupos no manipulados de primates cautivos como modelos en la investigación psiquiátrica. Salud Mental 1985;8(2):67-74.
13. McCormack K, Sanchez M.M., Bardi M, Maestripieri D. Maternal Care Patterns and Behavioral Development of Rhesus Macaque Abused Infants in the First 6 Months of Life. Development Psychobiology 2006;48:537-50.
14. Lyons D, Parker, K. Stress Inoculation-Induced Indications of Resilience in Monkeys. J Trauma Stress 2007;20(4):423-33.
15. Schore A. Affect Regulation and the Origin of the Self. The Neurobiology of emotional development (p. 65). Lawrence Erlbaum Associates, publishers, 1994.
16. Mahler M. Rapprochment subphase of the separation-individuation process. En R. Lax, S. Bach & JA Burland (Eds), Rapprochment: The critical subphase of separation-individuation (pp.3-19). New York: Jason Aronson, 1980.
17. Maestripieri D, Lindell S, Higley J.D. Intergenerational Transmission of Maternal Behavior in Rhesus Macaques and Its Underlying Mechanisms. Dev Psychobiol 2007;49:165-71.

18. Brüne M. Social Cognition and Psychopathology in an Evolutionary Perspective. Psychopathology 2001;34:85-94.
19. Gilmer WS, McKinney WT. Early experience and depressive disorders: human and non-human primate studies. J Affect Disord 2003;75:97-113.
20. John OP y Gosling SD. Personality traits. In: AE Kazdin (ed.), Encyclopedia of Psychology (vol. 6, pp. 140-144). Washington: American Psychological Association, 2000.
21. Santillán-Doherty AM, Muñoz-Delgado J, Nicolini H. La medición de la personalidad en primates no humanos. Salud Mental 2004;27(1): 50-9.
22. Santillán-Doherty AM, Mayagoitia L, Kajihara K, Mendoza M, Muñoz-Delgado J. Estudio longitudinal de la personalidad en primates no-humanos. Revista Latinoamericana de Psicología 2002;34(3):241-9.
23. Ebstein RP, Novick O, Umansky R, Priel B, Osher Y, Blaine D, Bennett ER, Nemanov L, Katz M y Belmaker RH. Dopamine D4 receptor (D4DR) exon III polymorphism associated with human personality trait Novelty Seeking. Nature Genetics 1996;12:78-84.
24. Santillán-Doherty AM, Muñoz-Delgado J, Arenas R, Márquez-Arias A, Cortés J. Reliability of a method to measure Novelty Seeking in nonhuman primates. Am J Primatol 2006;68: 1098-113.
25. Santillán-Doherty AM. La busqueda de la novedad (novelty seeking) en primates no humanos. Tesis de doctorado en psicología, UNAM; 2004.
26. Lilienfeld SO, Gershon J, Duke M, Marino L, de Waal FBM. A preliminary Investigation of the Construct of Psychopathic Personality (Psychopathy) in Chimpanzees (Pan troglodytes). J Comp Psychol 1999;113(4):365-75.
27. Tronik EZ, Cohn J. Infant-Mother face to face interactions: Age and Gender differences in coordination and occurrence of miscoordination. Child Development 1989; 60;85-92.
28. Siegel,D. Toward an interpersonal neurobiology of the developing mind: Attachment relationships, «mindsight», and neural integration. Infant Mental Health Journal 2001; 22(1/2),67–94.
29. Allen,J. Mentalizing in practice in Handbook of Mentalization-Based Treatment. In: Jon G. Allen, Meter Fonagy. John Wliey & Sons, Ltd. 2006 (pp. 5-25).
30. Fonagy P, Gergely G, Jurist E, Target M. Affect Regulation, Mentalization, and the Development of the Self (pp. 25). Other Press, 2002.
31. Brüne M, Lissek S, Fuchs N, Witthaus H, Peters S, Nicolas V, Juckel G, Tegenthoff M. An fMRI study of theory of mind in schizophrenic patients with «passivity» symptoms. Neuropsicología 2008 (en prensa).
32. Damman G. Borderline Personality Disorder and Theory of Mind: An evolutionary perspective. In: M. Brüne, H. Ribbert and W. Schiefenhovël (eds.). The Social Brain: Evolution and Pathology. John Wiley & Sons, 2003.