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TITLE: The Behavior of the Chimpanzee (Pan troglodytes and Pan paniscus) - An Annotated Bibliography

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Attili, G., B. Hold, and M. Schleidt. 1986. Relationships among peers in Kindergarten: A cross-cultural study. In: D. Taub and F. King, eds. Current Perspectives in Primate Social Dynamics. New York:Van Nostrand Reinhold.

This study of newcomers in kindergarten classes in Germany and in Italy focuses on the behavior of children in choosing relationships among peers. The choices made by boys and girls for social relationships versus preferred relationships, and whether the choices were for newcomers like themselves or older children are documented. The statistics are especially relevant when observed as behavior of a contact culture as opposed to a non-contact culture. The relationships formed are particularly significant in their comparison to mother-child attachments, and may be compared with relationships created in primate social groups.

Bauer, H.R. 1986. A comparative study of common chimpanzee and human infant sounds. In: D.M. Taub and F.A. King, eds. Current Perspectives in Primate Social Dynamics. New York:Van Nostrand Reinhold.

This contrast of chimpanzee and human infant sounds assumes a knowledge of linguistics, anatomy and acoustical technology. The similarities of human neonatal and chimpanzee vocal tracts are discussed. The anatomical differences between the two are compared. Human neonatal vocal tracts are in some ways more like the vocal tract of a chimpanzee than the human neonate is like the human adult. More interdisciplinary studies with an aim toward the formulation and testing of developmental and evolutionary principles are encouraged.

Beck, B.B. 1982. Chimpoentrism: Bias in cognitive ethology. Journal of Human Evolution, 11:3-17.

Tool-use by chimpanzees and herring gulls is compared in this study. Questions about the evolution of intelligence are raised. It is suggested that there is a bias in favor of chimpanzee cognitive

capacities. Statistics and descriptions of the prey-dropping behavior of gulls observed by Beck are documented. Using data from his own studies in addition to those conducted by Oldham, Barash and others, Beck determined that sensorimotor maturation and reinforcement-mediated learning are operative in the ontogeny of sea gull foraging and chimpanzee tool-use. The role of play in the ontogeny of chimpanzee tool-use and the play-dropping of gulls are seen as analogous. Rather than attributing differences in tool-use repertoire to environmental factors, these differences are seen as "cultural differences, traditions, or behavior dialects." Sociality is seen as the principal agent in the evolution of intelligence.

Bermejo, M., G. Illera, and J. Sabater-Pi. 1989. New observations on the tool-behavior of chimpanzees from Mt. Assirik (Senegal, West Africa). Primates, 30(1):65-73.

In this study of chimpanzee use of sticks to fish for termites and honey, and rocks to crack nuts in West Africa, observation of these activities in progress was not observed; results were inferred from physical evidence remaining at sites known to have been recently occupied. When compared with previous data on "fishing", it was concluded that the evidence at Mt. Assirik for branch and stick tool use was valid though limited; it was the first time evidence for this activity had been discovered in West Africa. Chimpanzee use of stones as hammers to break open hard-shelled fruits in this area is believed to be a first. Stone tool use may be cultural, whereas stick and branch tool use indicates a genetic tendency in all chimpanzees to manipulate and insert objects for the purpose of obtaining food or honey.

Bloomsmith, M.A. 1988. Interactions between adult male and immature captive chimpanzees: Implications for housing chimpanzees. Paper presented at the American Society of Primatologists meeting, New Orleans.

Interactions between adult male chimpanzees and immature chimpanzees of both sexes at the University of Texas Science Park at Bastrop were studied, focusing on the strong relationships casually observed at that facility. Reports from the wild have shown that adult males tend to tolerate immature conspecifics but do not have close relationships with them. At Bastrop, the gender of the immature was not a factor. This does not agree with other reports indicating that male infants are preferable when adult males choose to interact. In this study, adult males initiated most of the play, aggression, and sexual activity. Younger chimpanzees initiated a majority of contact, grooming and proximity-inducing behaviors. It is suggested that the constraints of captive living encourage social relationships that do not exist in the wild. Although adult males increase agonistic behavior as infants age, caging an adult male chimpanzees with immature conspecifics may increase the social complexity of a captive environment. A program to house immature chimpanzees with adult conspecifics could benefit adults who have been socially restricted, as in single caging, for purposes of

biomedical research.

Bloomsmith, M.A., P.L. Alford, and T.L. Maple. 1988. Successful feeding enrichment for captive chimpanzees. American Journal of Primatology, 16:155-164.

A chimpanzee feeding enrichment program consisting of four procedures was studied at the University of Texas Science Park at Bastrop. These feeding procedures were incorporated into the husbandry routines of the facility. The number of chimpanzees ranged from 41 to 37 during the six-month study. Four behavioral categories were analyzed. There were reductions in agonistic and abnormal behaviors, but also a reduced level of social grooming. Feeding time was significantly up. It was determined that foods which required processing before consumption were the most successful, in that they provided long-term attention of the subjects. This method provides a similarity to feeding conditions in the wild. The authors conclude that these results confirm the limited previous studies, indicating that feeding enrichment may reduce some behavioral problems in captive chimpanzees. Improving the social atmosphere of a group may result in better reproductive, maternal and social behavior in a chimpanzee breeding colony.

Bloomstrand, M., K. Riddle, P. Alford and T.L. Maple. 1986. Objective evaluation of a behavioral enrichment device for captive chimpanzees (Pan troglodytes). Zoo Biology, 5:293-300.

The value of a food puzzle designed as an enrichment device for a group of captive, semi-free ranging chimpanzees at the Bastrop facility of the University of Texas is assessed. The purpose of the apparatus is to require the animals to spend more time and effort in obtaining favorite foods. Although dominant males were the most frequent users of the device, use ranged over all age and sex classes. Stereotypic behaviors were not always lessened, as was expected. Individual differences in the use of the puzzle device were observed. It was concluded that these individual differences must be taken into account when planning for enrichment materials and programs. This specific food puzzle device was deemed more appropriate for enrichment of singly caged individuals, as the competition for its use in groups was discovered in the trials.

Boesch, C. and H. Boesch. 1989. Hunting behavior of chimpanzees. American Journal of Physical Anthropology, 78(4):547-573.

Comparison is made between the hunting behavior of wild chimpanzees in the tropical rain forest at Tai National Park in the Ivory Coast with that of chimpanzees in the savanna/woodland environment at Gombe and Mahale Mountains National Parks. This article thoroughly documents details of hunting behavior such as meat sharing by population, age and sex; prey size, species and availability; hunting frequency, duration and success; group versus solitary hunts; killing techniques and sharing qualities. Cross-population studies of chimpanzees may indicate how groups hunt, share food, and engage in other related

behaviors that evolved in nonhuman primates, and subsequently in early hominids. The differences in these chimpanzee populations may be significant in addressing theories that suggest bipedalism, hunting, tool use and food sharing among early hominids had evolved from the transition from forest to savanna environment. The authors suggest that social factors in the Tai population may be the basis for the extensive meat-sharing qualities observed. They also suggest that the proposal that early hominid males traded meat for sexual favors from estrus females may not be well-founded, since the Tai chimpanzees share meat with females with whom they had a good relationship, independent of their sexual cycle. The authors conclude that further study of the various chimpanzee populations and analysis of the results will enhance our understanding of early hominid behavior.

Boysen, S.T. and G.G. Berntson. 1989. Numerical competence in a chimpanzee (Pan troglodytes). Journal of Comparative Psychology, 103(1):23-31.

This article compares the numerical competence of a chimpanzee raised in a cross-fostered human home with that of human infants. The nature of the chimpanzee's counting strategy is unknown, but it appears that there is algorithmic function. The human strategy of counting-on and counting all is used for the comparisons. It was determined that the chimpanzee could add Arabic numbers or arrays of objects up to 4. The numerical skills exhibited in the chimpanzee testing exceeded the counting criteria in nonhuman species and compared favorably with criteria given for young children.

Boysen, S.T., G.G. Berntson, and J. Prentice. 1987. Simian scribbles: A reappraisal of drawing in the chimpanzee (Pan troglodytes). Journal of Comparative Psychology, 101(1):82-89.

Three chimpanzees ages 2.6 to 4.5 years were given drawing materials. Although two chimps had no prior and the other only minimal experience, none needed to be taught or encouraged to draw. The behavior appeared to be its own reward. Results of several experiments involving blank pages and pages with stimulus figures indicate that the chimpanzees tended to mark toward the horizontal center and the bottom of the page, stimulus figures had little effect on the placement of the marks on the page. Closure and balancing were not a part of the consistent features.

Braggio, J.T., R. Nadler, J. Lance, and D. Misyko. 1978. Sex differences in apes and children. In: D.J. Chivers and J. Herbert, eds. Recent Advances in Primatology, Vol.I, Behavior. London: Academic Press.

This article deals mainly with previous findings that males of both ape and human species determine the initiation and outcome of social interactions more often than females. Similar procedures were used to observe human children and apes (chimpanzees, and orangutans) interacting with conspecifics. Ape subjects were reared in the nursery at Yerkes Regional Primate Research Center; children lived at home with biological parents and attended a nursery school daily. The authors

cite other studies that report similar trends in dimorphic behavior of children as well as apes. It is suggested that the general pattern that human male children and male apes demonstrated a higher frequency of rough and tumble interaction than the female subjects may be due to a common biological mechanism, namely the influence of male hormone prior to the onset of sexual maturity.

Buirski, P., R. Plutchik, and H. Kellerman. 1978. Sex differences, dominance and personality in the chimpanzee. Animal Behavior, 26:123-129.

This study at the Gombe Stream Research Center focused on the personality of the chimpanzee. Evidence for emotions in chimpanzees is documented. The chimpanzee subjects in this study comprised 13 males and 10 females. The rating methodology is based on the Emotions Profile Index (EPI) developed by Kellerman and Plutchik. Pre- or post-doctoral students who were familiar with the animals served as raters. Forty-five sets of paired trait words, such as adventurous-impulsive, were used. They chose one trait from a pair as the more applicable to an individual animal. Results showed males to be relatively more aggressive than females and that aggressiveness correlates with dominance rank. A further comparison of studies using the EPI on humans and baboons implies that the personality traits for each group of male primates are similar. This testing mode appears to be useful in discovering the personality of chimpanzees. The results of this research are compared with other kinds of information already known about chimpanzee personality and thus establish the validity of the EPI.

Clarke, A.S., C.J. Juno, and T.L. Maple. 1982. Behavioral effects of a change in the physical environment: A pilot study of captive chimpanzees. Zoo Biology, 1:371-380.

The incidence of stereotypic behavior in a group of laboratory chimpanzees was studied before and after their translocation to a more natural habitat. This change in physical environment is contrasted with the efforts of Fritz and Fritz and Keeling and Roberts to lessen stress by introductions to more socialized animals. Stereotypy and self-directed behaviors diminished significantly after removal of the chimpanzees to a man-made island. Social play and social grooming increased during the 22 weeks of observation.

Davis, J.H., B.R. McPherson, and J. Moor-Jankowski. 1969. Maintenance and handling of primate animals for medical research. Annals of the New York Academy of Sciences, 162:329-335.

An overall review of the methods used in handling and caring for the primates in a colony of chimpanzees is presented. The authors express

their views of the facility at The Laboratory for Experimental Medicine and Surgery (LEMSIP), its strengths and weaknesses.

Derwelis, S.K., J.D. Douglas, J. Fineg, and T.M. Butler. 1969. Supply, maintenance and handling of chimpanzees. In: E. Goldsmith and J. Moor-Jankowski, eds. Annals of the New York Academy of Sciences, 162:311-324. NO TITLE? OR IS THE "IN" PART NOT NEEDED?

This is a summary of the basic needs of the chimpanzee colony at Holloman Air Force Base in New Mexico. The acquisition, housing and maintenance of the group are briefly described. Nutrition and common medical problems are discussed, emphasizing that these animals are maintained and made available for the purposes of the Air Force Research Laboratory.

de Waal, F. 1989. Peacemaking Among Primates. Cambridge, MA:Harvard University Press.

This highly readable volume on primate behavior concentrates on the documentation of reconciliation behavior across five primates species - chimpanzees, bonobos, stump-tail macaques, rhesus macaques and humans. Comparisons of peacemaking techniques within and between species are documented. Personality differences of the individual species and how these affect peacemaking efforts are presented. de Waal does not take a purely biological approach, as he apparently believes in the cognitive abilities of the nonhuman primates and discusses the ramifications of these abilities. Human primate aggression parallels that of nonhuman primates. He proposes that along with aggressive behavior, human and nonhuman primates developed the means to counteract aggression through reconciliatory behavior. The author takes a philosophical sojourn into historical human aggression and incidents of international peacemaking efforts.

Dienske, H. 1986. A comparative approach to the question of why human infants develop so slowly. In: J.G. Else and P.C. Lee, eds. Primate Ontogeny, Cognition and Social Behavior. Cambridge:Cambridge University Press.

Motor helplessness of human infants may be correlated with the low percentage of the adult brain that has developed at birth, indicating a small amount of maturation of many parts of the brain. Early motor helplessness of human infants is not the result of a short gestation period, narrow pelvic passage or small neonatal brain. Chimpanzees are 3-7 months earlier than human infants in developing behavior repertoires. Slowness in functional maturity is not evident in all behavior. Evolutionary selection may have favored a large adult brain, but may have counteracted with negative effects of inertia. Selection would then favor human infants capable of communication feedback. Phylogenetically, smiling and interactions between infant and mother appear at an earlier ontogenetic phase. The human adult is rich and complex, despite the time an infant takes to develop.

Dienske, H. and R. Griffin. 1977. Abnormal behaviour patterns developing in chimpanzee infants during nursery care - a note. Journal of Child Psychology and Psychiatry, 19:387-391.

This concise article presents the results of research done with chimpanzees at the Primate Center in Rijswijk, Netherlands in which infants were separated from their mother because of illness of the mother or the infant, or when the infants reached seven months of age. The methods of the project are stated, and the results are discussed in terms of redirected clasping, digit-sucking and repetitive movements. The conclusions made from this study indicate that under nursery care infants receive less care than when they are with the mother. Abnormalities increase in dimension the earlier the infants are removed from the mother. It was found that redirected clasping could be attributed to lack of clinging to an adult. Body rocking developed when locomotion was hampered. Digit-sucking behavior results were inconclusive, but raise the possibility that occurrence appears in babies left alone to fall asleep.

Elftman, H. 1944. The bipedal walking of the chimpanzee. Journal of Mammalogy, 25:67-71.

The bipedal locomotion of the chimpanzee can be compared with bipedal walking in humans. The transition from quadrupedal to bipedal locomotion in chimpanzees is facilitated by elements in common with humans, including the rhythmic swinging of the fore-limbs. The arm-swing of the chimpanzee in walking is greater than in a human because chimpanzee feet are set down farther apart, with an increase in vertical rotation with each step. The difference in ground reaction distribution in quadrupedal versus bipedal walking, as well as human adaptations such as the loss of the opposable toe and using the ball of the foot for support are discussed. The ratio of extensor to flexor muscles in chimpanzees and humans indicates the adaptation of the human leg for bipedal walking. Bipedal walking requires the center of gravity of the body to be located above the base of support offered by the feet. In chimpanzees this is accomplished by rotating the pelvis until the trunk is somewhat vertical. In humans this is accomplished by vertical position of the trunk with a vertical position of the tibia and the femur. These characteristics result in energy-saving locomotion for humans.

Fouts, R.S. 1973. Acquisition and testing of gestural signs in four young chimpanzees. Science, 180:978-980.

The study reported here was conducted to determine whether Washoe, the first chimpanzee to be taught sign language, was an exceptional animal; whether some signs are consistently easier to learn; and whether there are individual differences in sign acquisition by different

chimpanzees. The author had worked with Washoe and was thoroughly familiar with her and with sign language training. Four young chimpanzees were taught 10 signs and then tested for speed and accuracy of acquisition. Use of double blind tests after criterion for learning the signs had been reached, indicated that Washoe was not exceptional in her abilities to learn sign language; that some signs, for various reasons, were more difficult to learn than others; and that individuals learned at different speeds.

Fouts, R. 1974. Language: Origins, definitions and chimpanzees. Journal of Human Evolution, 3:475-482.

The two main theories of the evolutionary origins of language are reviewed: gestural communication and vocal language. The artificial language studies of chimpanzees conducted by Premack and Rumbaugh are discussed. The American Sign Language studies produced by Gardner and Gardner and by Fouts are evaluated in greater detail. All studies indicate that word order can be exhibited through individual means of communication. There is no universally acceptable definition of language, clearly visible by the different interpretations by Hebb, Lambert and Tucker and by Bronowski and Bellugi of the same basic criteria. The author does not impose a definition of his own; rather, he questions whether the capacities for language in humans and chimpanzees were due to parallel evolution in extant human and chimpanzee, or whether they originated from a common neurological basis.

Gardner, R.A. and B.T. Gardner. 1969. Teaching sign language to a chimpanzee. Science, 165:664-672.

This article documents the beginnings of a long project designed to teach a now-famous chimpanzee named Washoe to communicate via the gestural American Sign Language (ASL) of the deaf. The selection of the candidate, methods, time factors and results are discussed here, after an initial 22 months in the project. The different methods by which Washoe accomplished signs for words include imitation, babbling, molding the hands and instrumental conditioning. Although there are many subsequent accomplishments in the Washoe studies over the ensuing years and up through the present, here an insight is provided into the early phases of this classic attempt to communicate with nonhuman primates.

Goodall, J. 1986. The Chimpanzees of Gombe. Cambridge, MA:Belknap Press of Harvard.

This 670 page book is a recounting of Jane Goodall's 26 years at Gombe, Tanzania, documenting the lives of a colony of wild chimpanzees. This book may be enjoyed by the non-scientist, as it is an opportunity to learn about chimpanzees in a straightforward, readable text. Despite

the appeal to the lay person, the scientific effort in Goodall's data is evident. Each chapter is written so that it may stand on its own, without one's having to read the entire book in sequence. All phases of chimpanzee life are addressed: from ranging behavior to territoriality; from feeding to aggression; from dominance to social awareness, and more. A biography of the better-known, and some lesser-known, individuals that have been a part of Goodall's observations over the years comprises a "Who's Who" chapter. Throughout, there are tables, figures and a generous sprinkling of black and white photographs. After the concluding chapter, there are appendices detailing data collection methods, reports from the field, and other supporting data. A lengthy reference is provided. Goodall reveals her opinions on the basic differences between humans and chimpanzees, in order that man's uniqueness may be understood. Her concluding comments are a plea for captive chimpanzees.

Gould, K.G. and J.R. Faulkner. 1981. Development, validation and application of a rapid method for detection of ovulation in great apes and women. Fertility and Sterility, 35(6):676-682.

This paper describes the modification of a rapid hemagglutination inhibition test for detection of pregnancy in nonhuman primates to permit detection of the mid-cycle luteinizing hormone (LH) peak in the hominid species. Determination of LH levels, which are closely correlated with ovulation, could be significant in experimental and clinical use for ovum recovery, artificial breeding, normal cycle investigation and gynecologic practice in great apes and women.

Graham, C.E. 1977. A survey of advances in chimpanzee reproduction. In: G.H. Bourne, ed. Progress in Ape Research. New York:Academic Press. This is a comprehensive review of advances in knowledge of chimpanzee reproduction from the 1929 publication of Robert and Ada Yerkes' book, The Great Apes, up to 1977. Most of the early work was done by Yerkes and a great deal of the progress reviewed concerns the work of Robert Yerkes and the Primate Center. Significant studies are cited and the reason for their importance. From 1950 to 1970, reproductive studies were not done at Yerkes. A resurgence of interest in chimpanzee reproduction came about around 1970. In the late 1960's, Goodall and Kollar produced landmark studies of wild and captive behavior respectively. Studies on female reproduction have far outweighed the studies on male reproduction. From this review it is evident that the anatomy and reproductive functions of the chimpanzee are so similar to those of humans, that it confirms the important role of the chimpanzee in reproductive research. Reproductive success among captive chimpanzees assures an adequate supply of subjects for further biomedical research.

Guilmet, G.M. 1977. The evolution of tool-using and tool-making behaviour. Man, 12:33-47.

An attempt is made to reconstruct the behavioral context which evolved simultaneously with tool-use and tool-making among hominids. The

earliest hominid artifacts are examined from the Koobi Fora beds east of Lake Rudolf, Kenya; the Shungura Formation of the Lower Omo Valley, Ethiopia; and Beds I and II, Olduvai Gorge, Tanzania. The attributes, assemblages and geographical locations of the sites are compared to behavioural patterns associated with tool-making and tool-use among extant nonhuman primates. A case is made for the use by early hominids of non-stone materials to fabricate tools and other cultural articles. This would be analogous to the fabrication and use of non-stone tools by chimpanzees. The primate use of tools as weapons is considered by some to be a behavior learned from hominids. The discovery of stone tools in archeological assemblages indicates that hominids surpassed the tool-making and tool-use abilities of extant nonhuman primates in the wild.

As early hominids evolved the capacity to pass on to future generations, technical traditions via intentional modeling and/or linguistic instruction, tool use changed. The instructor could impart knowledge about the desired end product. The acquisition of language and tool-use among human children is simultaneous and suggests that the two may result from common programming capacities of the hominid nervous system. Individuals who were able to understand future consequences of past and present behaviour would have had a selective advantage over others, when this ability was linked with the ability to exploit the environment via the use of tools.

Gust, D.A. 1989. Uncertain availability of a preferred food affects choice in a captive group of chimpanzees (Pan troglodytes). American Journal of Primatology, 17:165-171.

Experiments at Yerkes Regional Primate Research Center simulated a natural habitat to ascertain whether the uncertainty of food availability affects choice behavior by group-living captive chimpanzees. The choice response of the chimpanzees to the preferred food changed with the frequency of the availability of the oranges, decreasing when the probability changed from 1.0 to 0.1. Of 16 subjects, only 9 learned the color/food association key to determine which feeder had the preferred food (oranges). It was discovered that individually tested chimpanzees learned the association more quickly than the group tested chimpanzees, confirming earlier theories that learning under social conditions is different from learning under nonsocial conditions.

Hannah, A. and W. McGrew. 1987. Chimpanzees using stones to crack open oil palm nuts in Liberia. Primates, 28(1):31-46.

The possibility of cultural diffusion among a group of chimpanzees in West Africa is presented. Stone tool-use by a group of 6 male and 10 female semi-captive chimpanzees released on an island over a 2-month period is documented. Ad libitum data were collected over a period of 271 hours. The author reports that one female initiated palm nut-cracking and that others observed and began to crack nuts. There were slight differences in the nut-cracking techniques employed. This

group of chimpanzees had access to palm fruits in the laboratory from which they were released, and therefore had a degree of familiarity with the nuts. Human intervention at the island site by the observer may have influenced the activities of the chimpanzees. Human presence and the provisioning of the range of stone sizes may have been a factor in the chimpanzees' use of heavier stones for some nut-cracking.

Harcourt, A.H. 1981. Intermale competition and the reproductive behavior of the great apes. In: C. Graham, ed. *Reproductive Biology of the Great Apes*. New York:Academic Press.

The author discusses gorillas, orangutans and chimpanzees and how the competition for estrous females may impact displays in male courtship, length of female estrous cycle and prominence of perineal swelling. Sexual dimorphism is also associated with the level of aggression between males for females.

Harper, J.S., III, M.R. Johnston, D.L. Sly, and W.T. London. 1982. Successful treatment of an esophageal stricture in a chimpanzee. *American Journal of Primatology*, 3:321-326.

Because the anatomy of the esophagus in chimpanzees and in humans is nearly identical, the case of a 10-year-old female chimpanzee with an esophageal stricture is of interest to medical scientists. Treatment of an esophageal stricture in a chimpanzee is difficult because of the unmanageability of the subject. The details of the procedures used to first nourish the animal via gavage and then to dilate the stricture are presented. Although the cause of the stricture was unknown, it was suspected that many occurrences of administration of anesthesia on this subject for experimental reasons may have caused the lower esophageal sphincter to relax, allowing a reflux of stomach acid to form the stricture. An additional factor here was the presence of strongyloides in the chimpanzee over a period of years, likely causing the initial vomiting. This case confirms that early and persistent treatment of the strongyloides is necessary. This case may encourage caution in scheduling repeated episodes of anesthesia, which may have effects on a chimpanzee subject not previously understood.

Huffman, M.A. and M. Seifu. 1989. Observations on the illness and consumption of a possibly medicinal plant *Vernonia amygdalina* (DEL.), by a wild chimpanzee in the Mahale Mountains National Park, Tanzania. *Primates*, 30(1):51-63.

A female chimpanzee was followed for two days and her behavior documented. Special attention was given to her physical condition (she appeared to be ill) and to what vegetation she consumed. It was discovered that the distressed chimpanzee (CH) was observed to eat a plant that tasted particularly bitter, but is known among local natives for its medicinal value. Other chimps of her troop were observed eating vegetation in the same vicinity, but none ate of the medicinal

plant. One of the other chimpanzees that had been known to eat of the medicinal plant in the past, appeared in good health and did not eat of it during the two days of tracking. CH exhibited the same clinical symptoms of illness as the human inhabitants of the area, and she showed a purpose and speed in consuming the *Vernonia amygdalina*. This observation of a chimpanzee consuming a known medicinal plant in the context of sickness may be pertinent to researchers interested in further observation of social behavior by other members of this group.

Jolly, A. 1985. The Evolution of Primate Behavior. New York:Macmillan. This volume, which has been used as a textbook in primatology courses, is a broad-based and competent review of primate behavior with both an ecological approach and a less than conservative view of the value and intelligence of the primate community. It would appear that all possible subjects concerning primates have been explored by Jolly in a clear and highly readable text. Although the author makes reference to the complete range of primates the emphasis, especially in the area of intelligence, is clearly on the great apes. Jolly expresses an avid interest in the primate mind and an openness to further study and understanding of primates.

Kellog, W.N. 1969. Research on the home-raised chimpanzee. In: G.H. Bourne, ed. The Chimpanzee, Vol. 1. Basel:Karger.

This article reviews some of the research on chimpanzees which have been raised in human homes. It details the subjects covered and the problems incurred by the researchers in trying to discover the extent to which an ape can acquire the civilizing influences of a home environment and to what degree genetics limit development.

Kohler, W. 1927. The Mentality of Apes, 2nd ed., revised. New York: Liveright.

This is an early series of chimpanzee psychological studies conducted from 1913-1917 at the anthropoid station at Tenerife, Canary Islands. The original material was published in 1917 and is dated in some respects. However, Kohler has been quoted often, as he was the first to make certain observations and his methods have been duplicated and elaborated upon by later scientists. Experiments were conducted to test whether chimpanzees could obtain fruit that was out of reach but that might be obtained with the use of boxes, ladders, sticks, etc., or by their removal. The older animal seemed to be the most innovative and accomplished in these tests. Kohler made investigations into chimpanzee locality-memory long before Menzel and de Waal. Spontaneous use of sticks outside of test situations provided a wide variety of innovations created by the chimpanzees. Limitations of chimpanzee understanding of past and future events is presented. Kohler often includes anecdotal remarks refuting anthropomorphism in his work, although by today's standards, much of his commentary would be considered anthropomorphic. Although dated, this work can be of value in understanding the origin of early primate studies and gives a clear appreciation of Kohler as a pioneer in the field of chimpanzee behavior

and psychology.

Kuroda, S. 1984. Rocking gesture as communicative behavior in the wild pygmy chimpanzees in Wamba, Central Zaire. Journal of Ethology, 2:127-137.

Rocking gestures among wild pygmy chimpanzees have been observed as they occur in sexual behavior including precopulatory behavior, invitation to genital rubbing and erotic play. Rocking has also been observed as a gesture inviting grooming and play. Infants rock to solicit an embrace. Mothers rock to call an infant. It is proposed that frustration was the origin of rocking behavior, which then became an element of courtship. This theory appears to hold up under Kuroda's explanations in all areas except that of the mother's rocking gesture to call an infant. Although humans may have difficulty ascertaining the context in which a rocking gesture is displayed, it seems the individual chimpanzees are able to decipher the code. The chimpanzees at this site are able to form "sentences" to convey clear messages to each other. Kuroda proposes that further studies be undertaken to explore the similarities of gestural communication of pygmy chimpanzees and the evolution of language among early hominids.

Maki, S., P. Alford, M.A. Bloomsith, and J. Franklin. 1988. A simulated "termite fishing" food puzzle device for captive chimpanzees (Pan troglodytes). Paper presented at The American Society of Primatologists meeting, New Orleans.

A food puzzle device was constructed of PVC pipe as an aid in providing enrichment to captive chimpanzees at the University of Texas Science Park at Bastrop. The device was given to a corral-housed group of 9-12 animals and a conventional concrete and metal indoor-outdoor run group of 8 animals. The device allowed the chimpanzees to insert branches, straws, etc. to obtain a desirable food such as mashed bananas. The ease of use and care of the pipe feeders is explained. There were no significant sex differences in pipe feeder use. Animals in the runs used the devices more often than those in the corrals. The success of the pipe device was measured by increased activity and decreased abnormal behaviors by the captive chimpanzees, while eliciting species-typical tool using behavior. The competition for a single feeder may have discouraged use by some individuals. To avoid the agonistic behavior exhibited during this study, the use of multiple feeders for group-housed chimpanzees is recommended. This device is especially useful for the enrichment of singly caged captive chimpanzees.

Maki, S. and M.A. Bloomsith. 1989. Uprooted trees facilitate the psychological well-being of captive chimpanzees. Zoo Biology, 8:79-87.

Display of species-specific behaviors in captivity is one way of measuring the psychological well-being of captive chimpanzees. Uprooted trees were introduced to a group of 28 chimpanzees living in three social groups at the University of Texas at Bastrop.

Observations were done of thirteen behaviors in two categories: physical contact with the main part of the tree and use of material broken from the tree. There were no sex differences in the total amount of tree use time. Immature chimpanzees used the trees more than the adults did. Although tree use was at its highest during the first two days after introduction, the subjects used the trees consistently over time. Species-specific behaviors documented during this study indicate that trees do provide psychological enrichment for captive chimpanzees.

Maple, T. and E.L. Zucker. 1978. Ethological studies of play behavior in captive great apes. In: E.O. Smith, ed. *Social Play in Primates*. New York:Academic Press.

The focus of this study concentrates on play behavior of orangutans, but is useful in its comparisons in some sections with chimpanzees and gorillas. The captive subjects in all three species were housed at Yerkes Regional Primate Center or Grant Park Zoo in Atlanta. In orang-utan adult male-offspring play, it was found that there was a high frequency of play, and in 20 out of 24 observations, the initiator was the infant. In a like pairing of gorillas, the initiation to play was made by the adult male in 68 out of 76 contacts. To study peer play, three juvenile orangutans and three juvenile chimpanzees were observed together. Of 216 play behaviors, 198 were interspecific with only 9 chimp-chimp and 9 orang-orang contacts. Although both species initiated interactions, chimpanzees initiated a greater number, attributed here to the greater gregariousness and activity of the chimpanzee. During play activities, chimpanzees spent more time on the ground than orang-utans did, indicating their natural behavior in the wild. Adult solitary play in orang-utans has not been observed in males. Solitary play in female orangutans has often been observed in a cyclical trend, and may be an indicator of hormonal status. Social play in orang-utans is usually initiated by the female. Thus far, no copulations have been observed to follow social play. A section on play signals deals only with "play face" in all three species, and is discounted at this time as a reliable source due to a paucity of knowledge of this behavior. Comparative and developmental study of play may be a way to discover the functions of play. Small sample sizes and the length of maturation time of the three species make studies difficult and time-consuming. A need for comparative data from field studies on chimpanzees, gorillas, and orang-utans will further corroborate the findings of this study.

Mason, W. 1965. Determinants of social behavior in young chimpanzees. In: A. Schrier, H. Harlow and F. Stollnitz, eds. *Behavior of Nonhuman Primates*. New York:Academic.

This chapter discusses the determinants of variations in the social behavior of young chimpanzees. Social responses here are defined as actions elicited by social stimuli, and have some effect on other individuals. Chimpanzees at the Delta Regional Primate Research Center were tested in a variety of ways, using different stimuli to determine

the variables affecting clinging, grooming and play-fighting (those activities most common in young chimpanzees). Play appears to be the preferred activity in most situations, appearing after the first few weeks of life, but some time before the end of the first year. When in a familiar situation, chimpanzees preferred play over clinging. Under stress, clinging was chosen over other activities. Habituation to a situation lowered the level of choice for being held versus playing. Many studies are cited concerning variables resulting in activity choices made by chimpanzees. These include social deprivation (separation from cage mates) and arousal-reducing factors. It was found that play increases arousal. When the intensity level of play becomes uncomfortable, there is a tendency to shift to a less arousing stimulus (grooming, clinging). Conversely, clinging appears to be less attractive to the unaroused chimpanzee.

Mathieu, M., N. Daudelin, Y. Dagenais, and T. Decarie. 1980. Piagetian causality in two house-reared chimpanzees. Canadian Journal of Psychology, 34(2):179-186.

The development of sensorimotor intelligence in chimpanzees was documented, using Piaget's theory of causality, a model considered by the authors to be the most promising for the study of animal intelligence. This study utilized two house-reared chimpanzees, a male aged 2.6 years and a female aged 1.10 years. During each of three testing periods for the female and two for the male, groups of tasks were given to the subjects. Common toys, the same as those used for human subjects, were chosen for purposes of the experiment. Eleven of the thirteen tasks were deemed well adapted to chimpanzees. Despite motor activity and emotional differences between human and chimpanzee infants, the responses to the testing were similar. According to Piaget's model, achievement of Stage VI behavior is indicative of mental representation. Stage VI behavior was attained in several of the tasks assigned. The Piagetian model can be a tool for studying the intelligence of chimpanzees.

Mitchell, G. 1979. Learning and Performance. In: Behavioral Sex Differences in Nonhuman Primates. New York:Van Nostrand Reinhold.

This chapter proposes the possibility that there are differences in learning and performance behavior in male and female primates, including homo sapiens. The author maintains that among apes, females are more interactive with objects than males, thus confirming that females primates have always been the central figures in the social context of symbols, plans and tool use. From several quoted sources, the conclusion is made that there is no difference in how males and females learn, but perhaps that one sex may find some things easier to learn than the other.

Moor-Jankowski, J. and E.I. Goldsmith. 1969. The laboratory for experimental medicine and surgery in primates. Annals of the New York Academy of Sciences, 162:324-328.

This article details the concept of research at LEMSIP's biomedical

research facility - its beginnings, goals, ethics and purposes as they relate to the large colony of primates (primarily chimpanzees) it supports.

Moor-Jankowski, J. and C.J. Mahoney. 1989. Chimpanzees in captivity: Humane handling and breeding within the confines imposed by medical research and testing. Journal of Medical Primatology, 18:1-26.

This paper focuses on the psychological well-being of chimpanzees in a captive colony at the Laboratory for Experimental Medicine and Surgery in Primates (LEMSIP). At this biomedical research facility, low morbidity and mortality, normal reproductive activity, lack of stereotypic behavior, and the ability for group resocialization of individuals formerly singly caged for research and testing are discussed at length. The social needs of the chimpanzee subjects are balanced with the requirements of medical research. Isolation factors sometimes necessary in the study of infectious diseases are mediated by singly caging individuals of social groups together in the same room. LEMSIP uses cages that allow the maximum visual and aural stimulation, and resocializes into groups those animals which have completed their studies. Caretaker personnel contact is maximized. The dimensions of rooms and cages are given and care of the physical facility is detailed. Reasons for the systems employed, such as cleaning and cage size, are discussed. Social factors are considered to be a necessity in assuring psychological well-being among chimpanzees. Mother-infant relationships, weaning, and breeding are often dependent on the care a mother is able to afford her offspring. Rapid return to cyclicity is not a factor in maternal care, as evidence indicates that breeding in post-parturition chimpanzees is not delayed by nursing an infant. The quantitative and qualitative care that a chimpanzee infant receives from human surrogates in a biomedical research facility nursery will affect the social adjustments of those infants. This applies whether the animal is removed from the mother at birth or is weaned at a later time. The need to adopt a policy concerning chimpanzees which are no longer viable for research is addressed. The retirement possibilities are explored and one plan already being implemented is presented.

Mori, A. 1983. Comparison of the communicative vocalizations and behaviors of group ranging in eastern gorillas, chimpanzees and pygmy chimpanzees. Primates, 24(4):486-500.

Vocalizations of eastern gorillas, chimpanzees and pygmy chimpanzees are compared to determine the vocalizations of a common ancestor. Through the vocalizations, social structures of the common ancestor might be discovered. Patterns and functions of specific vocalizations such as "hoot" and "wraagh" are compared. Mori's studies conclude that the common ancestor of Gorilla and Pan had territorial "hoot" calls and that males were antagonistic to each other. The common ancestor did not have long distance calling because the society was small, compact, and moved on the ground. Pygmy chimpanzees have lost the strong antagonism between males, evolving into a different social structure from the common ancestor.

Nadler, R.D. 1977. Sexual behavior of the chimpanzee in relation to the gorilla and orang-utan. In: G.H. Bourne, ed. *Progress in Ape Research*. New York:Academic Press.

This chapter reviews the early studies of sexual behavior among chimpanzees conducted by Robert Yerkes and others. Those efforts gave an understanding that sexual behavior was influenced primarily by social relationships, the environmental setting and individual characteristics of the subjects. Yerkes proposed that phylogenetically, copulations are based on two issues: general intelligence of the species and male sexual dominance. Later studies deemed the intelligence of gorillas, chimpanzees and orang-utans to be fairly equal, thus eliminating the issue of intelligence as it affects sexual behavior. Studies of gorillas and of orang-utans at Yerkes over the years have shed light on the time frames during which copulations occur. All results suggest that the degree to which copulation is restricted during the sexual cycle is related to the degree that the female controls sexual interactions (and therefore to the degree that the male controls such interactions). Where sexual partners are more accessible, females are more in control of matings.

Nadler, R.D. 1989. Sexual aggression in common chimpanzee, gorilla and orang-utan. *Primate Report*, 23:5-11.

Sexual behavior of gorillas, orang-utans and chimpanzees in three settings are compared: traditional laboratory pair-tests, restricted-access tests with female choice, and natural habitats. It was initially found that sexual behavior during the menstrual cycle of laboratory paired subjects exceeded frequency of each species in natural settings. Restricted-access tests with female choice were compared with the restricted-access tests with no female choice; it was determined that increased copulation was due to male influence. Distortion of species-typical courtship behavior appears to be the common factor in sexual aggression in great apes. Captive conditions force a proximity between individuals that may not occur in a free-ranging environment. That adult males are larger and usually dominant over adult females must be considered an auxiliary factor. Further, since it is unlikely that adult females in a group will be related, alliances to form a defense against males will not be created.

Nishida, T. 1980. The leaf-clipping display: A newly-discovered expressive gesture in wild chimpanzees. *Journal of Human Evolution*, 9:117-128.

Among a group of chimpanzees in the Mahale Mountains in Tanzania, a culturally-specific display of biting leaves. This behavior is called leaf-clipping and was observed in two broad contexts: one associated with the preparation of leaf branches used in fishing activities, and the other with courtship. Adolescent or juvenile males appear to be the most frequent employers of this method of precopulatory behavior, possibly as a subtle way of attracting attention without offending the dominant males. Other contexts for leaf-clipping behavior include an estrous female wanting to copulate with an adolescent male and an adult male when the estrous female with whom he is in consortship will

not follow him. Leaf-clipping has evolved from a displacement activity for adolescent males in the presence of higher ranking males. Nishida speculates that this may be evidence of a courtship signal derived from a displacement tool-making activity.

Nishida, T. and M. Hiraiwa. 1982. Natural history of a tool-using behavior by wild chimpanzees in feeding upon wood-boring ants. Journal of Human Evolution, 11:73-99.

Anting behavior is presented from data gathered on chimpanzees of the K group in the Mahale mountains. A subspecies of Camponotus ants and the host trees are described in detail. The chimpanzees usually ant at familiar sites, rarely exploiting new anting sites. The tool-making behavior of the chimpanzees is described, with specifics of the materials selected and of the quality of the fishing implements. Tools that are carried to the anting site are carried either in the mouth, the neck-pocket, the armpit or the groin pocket. The chimpanzees have never been observed to carry the tools while walking bipedally. A detailed account of the method and time element involved in the actual anting behavior is given. Competition for location has been observed along the lines of dominance rank. In comparing anting and termite-fishing behavior, evidence indicates that at a young age there are similarities. After the age of four, skills are different, but both behaviors follow stages of learning. In-depth statistics are presented for the consumption of the ants, the time each day spent in anting behavior, and the seasonal variances for this activity. Ant-fishing is seen as only one of several tool-using activities which include communication, toilet, resting and subsistence. Nutritional benefits of insect consumption are discussed with no substantive results produced. Eating insects is proposed as a cultural diversification in chimpanzees and may be meaningful in the study of human culture.

Paquette, D. and J. Prescott. 1988. Use of novel objects to enhance environments of captive chimpanzees. Zoo Biology, 7:15-23.

The presentation of novel objects to a group of captive chimpanzees at the Jardin Zoologique du Quebec affected their behavior in several ways. Manipulation frequency increased; inactivity and self-grooming decreased; stereotypic behaviors were almost eliminated; social interactions were not affected. Increasing the number of available objects counteracted the problem of dominant individuals monopolizing objects. Over time, the chimpanzees spent less time manipulating objects, thus suggesting the advisability of changing or rotating objects to keep the novel effect.

Plooij, F.X. 1988. Some basic traits of language in wild chimpanzees? In: A. Locke, ed. Action, Gesture and Symbol, 1988:111-131.

Gestures interpreted as language among the chimpanzees of Gombe are briefly summarized. Comparisons are made between chimpanzee babies and human babies documenting similar developmental sequences in language

acquisition. The ability of adult chimpanzees to combine gestures and to use one gesture in different contexts suggest that chimpanzee language is closer to human language than previously believed. The study of chimpanzee gestural communication could lead to a better understanding of early hominid language, which may have been gestural rather than verbal. Plooij attributes the evolution of language to social changes rather than ecological pressures.

Premack, D. and A.J. Premack. 1983. The Mind of an Ape. New York:W.W. Norton.

The many years of testing and teaching a language to a number of chimpanzees in a captive setting are documented in this volume. A language was created using colored plastic chips and taught initially to one chimpanzee, Sarah. Subsequently, language was taught to other chimpanzees and included a group of four juvenile chimpanzees. Over a span of fifteen years, in addition to language, the capacity for other mental processes was examined - arithmetic, map reading, abstract reasoning and analogies, among others. Throughout, comparison is made for the abilities, results and capabilities between human children and chimpanzees. The authors differentiate between test-solving on a sensory level as young children do, versus test solving in terms of the problem. Tests were created to determine the chimpanzee's understanding of action and conservation and to ascertain whether chimpanzees can make simple judgments and analogies. It was determined that Sarah has both intentions and the ability to attribute a state of mind to others. Social cueing is addressed and discounted. Successful performance was due to correct problem solving and not to social cues. The authors conclude that language facilitates the chimpanzee's ability to solve problems. However, it is emphasized that the difference between ape and human language is that of chimpanzee construction of words as opposed to sentence structure in human language.

Premack, D. and G. Woodruff. 1978. Does the chimpanzee have a theory of mind? Behavioral and Brain Sciences, 4:515-526.

The possibility that a chimpanzee may be capable of imputing mental states to himself and to others is explored through research primarily conducted with an African-born chimpanzee via videotapes and a selection process. The chimpanzee (Sarah) had been used from the age of one year in many laboratory testing procedures, thus giving her a large frame of reference. It is possible that she had learned to learn. Her accomplishments and her abilities may confirm that Sarah can impute states of mind of others, but more trials on other subjects would be necessary to make the generalization sought here.

Riesen, A. and E. Kinder. 1952. Postural Development of Infant Chimpanzees. New Haven:Yale University Press.

Many studies have been done since the publication of this volume documenting the results of research done at the Yerkes Regional Primate Center, thereby rendering some of the material dated. However, the

studies were ambitious, comparing the postural development of infant chimpanzees from the age of 4 weeks up to one year using the Gesell Thompson behavior examinations. The major finding would appear to be the fact that the age at which chimpanzees exhibit the appearance of developmental items averaged one third earlier than for humans. This study suggests an association of length of gestation with the rate of postural development. Several concepts of development are addressed: alternation of flexor and extensor dominance; anterior-posterior growth law; the principle of rigid sequential development; principle of the assumption of cortical control; individuation and integration; the recapitulation theory; and the theory of correspondence. The data collected seem to support some of these theories, but fail to find agreement in others.

There are several problems with the testing procedures, most of which the authors are aware. A knowledge of the Gesell exams is helpful but not necessary for understanding the results of the experiments. There are 202 postures which are referred to by number, (e.g. PR 44), and which the reader must memorize or refer back to in master tables. The experiments do not address the prenatal or immediately postnatal postural behavior which is often different in chimpanzees than it is in humans. Data collection at two and four week intervals loses valuable material at critical in-between times. Results are restricted by the approach of using testing procedures devised for the study of humans. This is crucial, knowing that chimpanzees exhibit postural behaviors which are not evident in humans.

Riopelle, A. and C. Rogers. 1965. Age changes in chimpanzees. In: A. Schrier, H. Harlow and F. Stollnitz, eds. Behavior of Nonhuman Primates. New York:Academic Press.

At the Delta Regional Primate Center and at the Yerkes Laboratories of Primate Biology, tests were undertaken to determine age changes in chimpanzees. Comparisons of life histories between humans and chimpanzees were divided into three categories: infancy and prepuberty; adolescence; and old age. Factors determining age at each level of maturity are discussed. Performances on formal tests of behavior included consecutive concurrent and difficult pattern discriminations, as well as spatial delayed response, four-choice oddity, and novelty and perseveration. While some chimpanzees actually fared better on consecutive discriminations, their ability declined in spatial delayed response and four-choice oddity. When there is a decline it is generally during early maturity (7-20 years), which is consistent with data on humans. The patterns of loss in these studies are consistent with the results of other testing, indicating that decline with age is in the prefrontal-lobe system. Tests on animals that had been subjected to radiation showed no significant difference from animals that had not been irradiated. It was determined that performance changes associated with age are specific and differ from one situation to another.

Rodman, P.S. 1984. Foraging and social systems of orangutans and

chimpanzees. In: P. Rodman and J. Cant, eds. Adaptations for Foraging in Nonhuman Primates. New York:Columbia University Press.

The social systems and foraging patterns of orangutans and chimpanzees in the wild are compared. Data are presented to propose that female patterns in both species are similar. The food sources of orangutans are larger than those of chimpanzees. Morphological and behavioral differences allow greater mobility of both male and female chimpanzees when compared with orangutans. Male chimpanzees have foregone the greater sexual dimorphism of male orangutans in favor of power in numbers.

Russon, A.E. 1988. The ontogeny of peer social interaction in infant chimpanzees: A description and comparative analysis. Unpublished manuscript.

The interactions of two nursery-reared chimpanzees are observed through the age of one year. The development theories of Piaget and Harlow are utilized in delineating similarities and differences in cross-species comparisons. Comparison studies are limited to those using social interaction as a unit of measure for peer social development. There is developmental acceleration in the nonhuman primates at the earlier stages of development, but increasing divergence between species and subsequent lag in the nonhuman primates at the upper developmental levels. The findings suggest increasing complexity in social development from monkeys through chimpanzees and other apes to humans, with chimpanzees appearing closer to humans than to monkeys.

Savage-Rumbaugh, S., B. Wilkerson, and R. Bakeman. 1977. Spontaneous gestural communication among conspecifics in the pygmy chimpanzee (Pan paniscus). In: G.H. Bourne, ed. Progress in Ape Research. New York:Academic Press.

Studies of one male and two female pygmy chimpanzees at Yerkes provide information on gestural communication, primarily associated with copulatory behavior. Gestures were broken down into three basic forms: position movements, touch movements and iconic hand motions. It was determined that gestures used prior to copulation were not employed randomly, but that certain gestures were linked together and to make known the wishes of the individual gesturing. In some cases, there appeared to be a two-way communication regarding a compromise in settling on a copulatory position. It is suggested that further study of pygmy chimpanzee gestural communication might be the best ape model for the study of linguistic precursors of language origins in humans.

Snowden, C. and S. Suomi. 1982. Paternal behavior in primates. In: C. Snowden, ed. Primate Behavior. New York:Cambridge University Press.

The authors discuss the definition and meaning of paternal care in primates, dividing behavior into substitutive and complementary categories. Biological theories for the evolution of paternal care are explored with emphasis on the case for parental investment and parental certainty as they apply to monogamy, harems and promiscuous groups.

Alternatives to the parental certainty hypothesis include economic and defensive considerations. The authors propose that a male's early experience with infants and its current physical and social environment are the proximate influences on the expression of paternal behavior. Finally, the various kinds of paternal care in nonhuman primates are related to similar patterns in human societies. Not including the pregnancy itself and the nursing of the infant, the authors conclude that there is no evidence that infant care is biologically determined.

Spijkerman, R.P. 1987. Behavior development of infant chimpanzees with the mother and in peer groups. REP Annual Report Division for Health Research, The Netherlands: TNOM, pp.309-312.

Comparisons were made between zoo-reared, mother-reared and incubator-reared chimpanzee infants. The beneficial effects of each situation as manifested in the later years of the chimpanzees are discussed. Social play and body rocking are used as indicators in concluding that separation of infant from mother should take place as late as possible.

Sugiyama, Y. 1988. Grooming interactions among adult chimpanzees at Bossou, Guinea, with special reference to social structure. International Journal of Primatology, 9(5):393-407.

Grooming and proximity behaviors between males, between females, and between males and females were observed in a group of wild chimpanzees numbering from 17 to 22 members. Male-female grooming and proximity was lower than expected; female-female grooming and proximity was higher than expected; male-male interactions were split, with grooming up and proximity down. The high proportion of female-female grooming bouts is similar to the behavior found in female-bonded Japanese macaques. More group cohesiveness was found in this group than in any of the East African populations of chimpanzees. The small size of the food patch, 6 square kilometers, is suggested as a possible reason for this cohesiveness.

Sugiyama, Y. and Koman J. 1979. Tool-using and -making behavior in wild chimpanzees at Bossou, Guinea. Primates, 20(4):513-524.

A group of 21 chimpanzees at Bossou, Guinea was observed over a six month period to document their tool-using and -making behaviors. Members of this group drank water with a leaf-spoon, dug termites with a stick, engaged in aimed throwing of tree branches at observers, cracked nuts with stones and displayed branch hauling with a stick. Because the tools used by the chimpanzees at Bossou are similar to those used by populations at other locations, there is reason to believe that there exists, albeit primitive, a cultural difference among separate groups of chimpanzees. The effective use of branches against intruders suggests the importance of weapon carrying and throwing in the evolution of bipedalism and culture among early

hominids. The nut cracking behavior of this population may be the precursor to the stone-tool culture of early hominids. The preparation of stick-tools by the Bossou chimpanzees may provide a clue as to the early, but not preserved in the fossil record, manufacture of non-stone tools. The excitement exhibited by the chimpanzees upon success, after lengthy effort to achieve a goal, may be based on human-like emotions of a thinking mind.

Sumner, D.R., M.E. Morbeck, and J.J. Lobick. 1989. Apparent age-related bone loss among adult female Gombe chimpanzees. American Journal of Physical Anthropology, 79(2):225-234.

This article describes the differences in femoral bone mineral content and measurement in young and old adult Gombe female chimpanzees. Comparison is then made with the results of similar measurements made on humans. While no age-related change in bone length has been observed in adult humans, among chimpanzees there is a tendency for older adult females to have longer femora than younger adult females. Individual variation among the chimpanzees is excluded for this occurrence and the authors conclude that there may be species-related difference in patterns of bone loss. Although bone loss in chimpanzees may not be directly related to menopause, endocrine changes may be involved. Diet, decreased activity in later life, and demands of pregnancy and lactation were probable factors in bone loss among the Gombe chimpanzees.

Teleki, G. 1974. Chimpanzee subsistence technology: materials and skills. Journal of Human Evolution, 3:575-594.

Technological behavior and capability of chimpanzees is reviewed. Chimpanzees are known to use objects in the contexts of pounding, probing, prying, poking, digging, sponging and wiping. A table of subsistence technology citing country, site, food type, action and object used, modification, and source of reference is provided. Despite the variety of tool-use behaviors observed, not all behaviors have been found in any one locale. Many words are used such as "technological variability" and "flexibility", skirting around the issue of cultural differences. Two differences are noted between chimpanzee and human subsistence technology: (1) chimpanzees have not been observed to use objects for killing prey; (2) the subsurface vegetable matter exploited by hunter-gatherer peoples are not sought by chimpanzees. Termiting skills are discussed at length, with the conclusion that the process is complicated and requires skills (choosing a site, locating tunnels and, selecting materials) which the author considers himself inadequate to perform despite lengthy trials. Objects used by chimpanzees in subsistence technology are perishable and indistinguishable from other materials in the area. It is postulated that many "human" traits, including tool-use, family structure, community organization and communication, initially arose in primate populations. It is suggested that the study of extant pongids may lead to the understanding of early hominids.

Tomasello, M., D. Gust, and G.T. Frost. 1989. A longitudinal investigation of gestural communication in young chimpanzees. Primates, 30(1):35-50.

Five to eight year old chimpanzees, previously studied by Tomasello at the Yerkes Field Station, were observed for development of gestural communication. Comparisons are made longitudinally to determine which social functions arise, decline or change over time. It was concluded that there are three ways in which the chimpanzees would acquire gestures: conventionalization, second-person imitation, and third-person imitation. Many of the infantile functions are lost and other, more adult-like, gestures are gained during this 5 to 8 year old age period. The possibility of cultural transmission of some gestures, including tool use is presented, but with great caution until further evidence is reported.

Vauclair, J. and K. Bard. 1983. Development of manipulations with objects in ape and human infants. Journal of Human Evolution, 12:631-645.

Differences in exploration and manipulation of objects by human and nonhuman primate infants were studied in a human infant, a chimpanzee and a bonobo, all between the ages of seven and twelve lunar months. The objects used and the sexes of the participants were deliberately chosen to give the nonhuman participants an advantage. The authors admit that the results of the study were based on a minimal sample and must therefore be considered preliminary. Caution is urged against generalization, as variation among individuals is broad in human and apes. However, the important results in this study seem to be that (1) mouthing is a prevalent way of interacting with objects in some nonhuman primates; (2) the bonobo infant used mouthing less often than did the chimpanzee; and (3) both chimpanzee and bonobo infants manipulated objects without extracting them from her background, while the human infant did often extract objects from their background. Since adult chimpanzees have the ability to extract objects from a background, it would be of interest to ascertain at what point in time they acquire this behavior.

Walsh, S., C.A. Bramblett, and P.L. Alford. 1982. A vocabulary of abnormal behaviors in restrictively reared chimpanzees. American Journal of Primatology, 3:315-319.

This paper establishes a vocabulary to document the abnormal behavior of restrictively reared chimpanzees and to provide a standard of comparison for future studies of chimpanzees, humans and other primates. Abnormal is described here as species-atypical behavior, occurring more frequently in restrictively reared animals, and similar to behavior displayed by "mentally deficient humans." Abnormal behavior may result in the inability to successfully reproduce and rear offspring. Data were collected at the University of Texas Science Park at Bastrop. Observations were made of 91 chimpanzees. Twenty-seven vocabulary terms such as rocking, head banging, and coprophagy were developed. It was concluded that abnormal behavior is exhibited in chimpanzees deprived of maternal care and which are subsequently

restricted. Behavior patterns differ widely according to individuals. It is theorized that chimpanzees develop abnormal behavior in the form of self-stimulation, which may be an adaptive response to the restricted and often sterile environment.

Whiten, A. 1989. Transmission mechanisms in primate cultural evolution. Trends in Ecology and Evolution, 4(3). NO PAGE NUMBERS?

Whiten reviews some of the examples that have been used to infer cultural transmission mechanisms in nonhuman primates, such as sweet potato washing among Japanese macaques. Whiten, in his re-evaluation, proposes that although chimpanzees have a greater ability to imitate than monkeys, they have far less ability than humans. More fieldwork and experimentation in cultural transmission processes are recommended.

Wood, S., K. Moriarty, B. Gardner, and R.A. Gardner. 1980. Object permanence in child and chimpanzee. Animal Learning and Behavior, 8(1):3-9.

The author used two infant chimpanzees and three human infants to test the validity of the Uzgiris and Hunt scales of infant development. It was confirmed that younger subjects took longer to reach criterion than older ones. More sessions were required to reach criterion on advanced tasks. Home reared chimpanzees, like human children, develop object concepts gradually and in an orderly sequence. Comparative testing at some levels of cognitive development is possible when chimpanzees use sign language to effect two way communication.

Zihlman, A.L., M.E. Morbeck, and D.R. Sumner, Jr. 1989. Tales of Gombe chimps as told in their bones. Anthroquest, 40:20-22.

The skeletal remains of 22 chimpanzees at Gombe have been subjected to intensive studies including CT scans, bone mineral scans and x-rays. The advantages of studying the skeletal remains of modern day primates in conjunction with gathering life histories of the individuals are detailed. Among these are anatomical variation within a population and data for comparison with other groups. Factors that influence anatomy and what is necessary to be reproductively successful may be learned. Knowledge of chimpanzee behavior and biology may be significant in interpreting human origins.

This information is provided as a service of
The Consortium of Aquariums, Universities and Zoos (C.A.U.Z.)

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