

## Cultural and Linguistic Competencies in Bonobo Chimpanzees

The Great Ape Trust for Bonbons chimps is located in a 200-acre plot of ground, donated by the city of Des Moines (Iowa), for the purpose of research, education and sanctuary for all 4 species of great apes. All animals that come to the facility, and their offspring are assured lifetime care. The center is unique in its focus on language and cognition and its avoidance of invasive research in great apes. The Great Ape Trust facility is designed for lifespan cross-generational cultural research.

The development of this unique colony of bonobos has been possible because of sustained research funding devoted to understanding the emergence of language and other uniquely human cognitive processes. The colony is now at the point where the human cultural input has the potential to become self-perpetuating if new technologies, freedoms, and outdoor environments are made available to the bonobos in the proper manner. This type of long-term work has the potential to provide us with unique understandings of the ways in which human abilities came to function and change in nonhuman groups, as well as how they alter and transfer across time. The history of these apes has been documented on videotape since 1975. A companion archiving project has been underway to preserve these materials for study by other scholars since it is no longer possible to replicate this colony, nor its history, as other bonobos are not available for research purposes outside of the Congo. The size of the colony has increased by natural birth (and importation of one male from Japan) from one ape to twelve apes, represented by two different species. The bonobo group has been part of the NICHD research program since the arrival of the matriarch (Matata) from the Democratic Republic of the Congo in 1975. Currently the eight bonobos are divided into two groups. Group A is composed of a captive born female (Panbanisha), and a captive born male (Kanzi) and Panbanisha's two offspring Nyota (five years) and Nathan (three years) fathered by P-suke.

In the past, the basic research method has consisted of rearing two groups of bonobos with differential human cultural input. Group A was exposed to a variety of human activities centered on travel to various feeding sites, play, social grooming, and interaction with human artifacts and activities. Group B was not exposed directly to these activities though they viewed them on tape and were exposed to language use by keepers caring for them outside of the cage. In addition individuals of group B have been given opportunities to observe individuals in Group A use the keyboard, make rock tools, write, play music and engage in other human like activities.

Within this basic research paradigm, most of the reporting has focused on the competencies of Group A, rather than the lack of skills in Group B. In part this is because members of group B are not as accustomed to human contact or tests and it is difficult to get them to even attempt tasks that are easily accomplished by Group A. For example although over 100 attempts have been made to teach P-Suke to knap stone, he still refuses to try or even to hold a rock in each hand.

### Linguistic skills

The bonobos in group A are unique in their comprehension of spoken English and in their attempts to engage in speech-like conversational exchanges with human companions. Kanzi and Panbanisha understand complex spoken English, including novel sentences of various syntactical constructions, they employ a lexigram keyboard, and they

manufacture stone tools. They can understand simple stories that are read to them and they eagerly watch movies, showing clear evidence of favorite movies and even scenes within those movies. Kanzi can gather materials and construct small fires and also extinguish them. Kanzi has had early experience planting foods and tending them as they grew.

Group B, however, is composed of a wild caught female (Matata), a wild caught male (P-Suke) and two offspring. None of these bonobos possesses the capacity to comprehend spoken English, to utilize the keyboard, or to make stone tools, plant foods or construct fire. Four years were spent attempting to teach Matata lexigrams, with no success. In addition, three youngsters from group B were introduced to group A at three years of age and then participated in the activities of group A for two years. None of these three individuals learned spoken English words, lexigrams, rock knapping, drawing, or fire construction—all skills that are present in group A. Individuals in group B attempt to use the keyboard, however there is no appropriate relationship between the symbols they select and the items they are attempting to reference. Extensive attempts have also been made to teach rock knapping. For example, although over 100 attempts have been made to encourage the adult male P-Suke to knap stone, the most he will do is to hold the rocks in his hands for a few moments. Thus there appears to be a critical age during which the cultural trajectory is set by the activities experienced by the young infant during both prenatal and postnatal ontogeny. This trajectory prepares and sensitizes that individual such that he or she is enabled to easily acquire complex skills later on.

Given that their level of English comprehension is exceptionally high, it should not be surprising that Kanzi and Panbanisha are attempting to speak. Moreover, informal evaluation of archived tapes suggests that although this phenomenon has been occurring for some time it is much more frequent now than it was six to ten years ago. The main event that has occurred across this period of time is the maturation of a second individual with keyboard skills and high levels of English comprehension. Initially, when the project began, we had the impression that Kanzi was attempting to speak to the caretakers and we were able to show that he produced a number of sounds not found in bonobos in a related captive colony. Kanzi not only vocalized to his caretakers, he also exchanged vocalizations with his adoptive mother, Matata. However, Matata's vocal skill was acquired in the Congo and her perception of human speech is nonexistent. Thus if Kanzi were trying to produce human-like speech within the constraints of the bonobo vocal tract, there was little reason to suspect that his mother would comprehend such attempts.

However, the same would not be true of Panbanisha. As Panbanisha became increasingly competent in her comprehension of speech, she, like Kanzi, began to respond vocally during conversation with human caretakers. Therefore, for the first time, two bonobos who were reared in a human enculturated setting were both vocalizing to one another. The vocalizations which Kanzi and Panbanisha exchange sound at times like emulations of human speech and at other time like emulations of Matata's speech, as though they were, so to speak, capable of two spoken languages. Of course they have grown up in a bi-species culture constantly exposed to two spoken languages and if they were human beings, in such a culture they would acquire two spoken languages. So it is possible that something similar has occurred.

When they are engaged in a conversation with a human partner, they vocalize back and forth in a conversational style. That is, they alternate speaker turns and this alternation appears to be co-coordinated in time and informational content. This phenomenon is so reliable that transcriptions of "conversations" can be made in which it is clear that the humans in the context, the human participants, have heard a particular word and responded as though they were being spoken to in English. In addition, preliminary tests suggest that trained multiple observers

can obtain rather high levels of agreement on many of the sounds that are made. Translating by ear is not the only method of attempting to decode the parole of Kanzi or Panbanisha. It is possible to ask them to say certain words and if they are in the correct mood they will do so. As with their drawings, sometimes their responses sound very clear and sometimes they sound blurred, however it remains the case that it is possible to request them to speak certain words.

Regular videotapes have been made and archived of both groups. Members of group A recognize the skill deficits of group B and sometimes attempt to encourage them to use the keyboard by showing them symbols. They will use the keyboard to ask that special foods be given to members of group B. In many cases it appears that members of group A are vocally translating information for members of group B. It is possible, for example, to ask Kanzi or Panbanisha to tell Matata about a special food they are having or a location to which they are going to travel, or that visitors are coming to see them. When these requests are made in English, Kanzi and Panbanisha vocalize to group B and group B replies. In some cases members of Group A can be asked to tell members of group B to move into certain cages and to return needed objects.

Other ape researchers and caretakers often claim that their apes understand English. Apes do quickly learn to respond to routines, and when utterances are routine, it can appear as though they comprehend what is being said. Only through tests with multiple items, studies of novel utterances and studies of dialogue can an accurate picture be developed of what it means to “understand English.” We find clear, consistent, and profound differences between apes that learn what to do in a routine and in those who carry out novel conversations; respond to novel requests; overhear things said about them that they were not to have heard; and know what to do in a new task on the basis of a verbal explanation.

#### Future research

Future research will focus on a more complete documentation and explanation of the skills of group A. This will be made possible by new technologies being put in place at IPLS. In a sense, we will return to some of the computerized aspects of the Lana Project, which proved so successful. All of Lana’s utterances were recorded by the computer, as have been the utterances of other apes. However, with more than one ape, our computer technology has been unable to determine which ape was using the keyboard. In addition, because many of the apes’ communications are made within a particular context, it has been difficult to determine after the fact the intent of what was said without the context. Technology has now progressed to the point where these problems can be readily eliminated. Many new technological aspects of the facility will have to become a part of the bonobos’

lives, including new keyboards with additional capabilities, doors that are automatic, different spatial configurations, different cleaning, housing and moving procedures, the use of time controlled food sites throughout the facility, the use of keyboards in multiple locations to communicate with multiple individuals, regular visitors to the center, access to the outdoors without the necessity for leads, access to large bodies of water with very gentle slopes, electrical boundaries, great seasonal differentials, the ability to travel to “warm safe locations” even when it is very cold outdoors, access to a living greenhouse which will provide high quality low calorie fresh foraging opportunities, and many other special facilities. In contrast to the current facility, which has only one keyboard, multiple keyboards will be located throughout the IPLS facility. This will permit bonobos and humans to communicate with each other while they are in different locations. The computer will also be able to identify each individual user and record the time and the utterance. This will be accomplished through the implantation of a small chip, or the wearing of a lightweight collar. An “in place” video camera that can be activated by the experimenter will provide the context for each utterance. The time will be linked to the time on the tape so that it can easily be located later.

In addition the computer will have an “experimenter mode” so that when the experimenter is utilizing their keyboard outside the bonobo’s area, the keys that the experimenter touches will flash on the bonobo’s keyboard and then be projected on a larger screen. This will permit the bonobo to note the symbol’s location, as well as the symbol itself that is being employed by the experimenter. The need for this type of system is due to the fact that the keyboard utterances are unplanned and cannot be anticipated. Under unexpected conditions the bonobos utilize lexigrams and sequences of lexigrams that are extraordinary and need to be documented, rather than descriptively reported.

Recent genetic evidence is moving increasingly toward the conclusion that environmental variables are acting strongly upon the expression of genetic variables from the moment of conception forward. Slight changes in timing, perhaps as a result of environmental variables, can have a direct effect on phenotypic expression. We believe that we are already seeing this effect on infants born to mothers of different rearing backgrounds at the Language Research Center. Matata’s wild rearing has produced shorter gestation times, smaller infants, shorter labor periods, and a more rapid appearance of lactation after birth. Panbanisha’s human enculturated rearing has produced longer gestation times, higher birth weights, longer labor periods, and a lengthening of the time before lactation following birth. Given that Matata and Panbanisha are mother and daughter, it is highly likely that these changes are the result of environmental variables acting directly upon the phenotype in a single generation.