Available online at www.sciencedirect.com
ScienceDirect
Language & Communication 28 (2008) 213–224
LANGUAGE & COMMUNICATION
www.elsevier.com/locate/langcom

Precursors of morality in the use of the symbols "good" and "bad" in two bonobos (*Pan paniscus*) and a chimpanzee (*Pan troglodytes*)

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Abstract

Morality is a concept that is based on value judgments of "right" or "wrong" and "good" and "bad". Three language-competent apes (two bonobos and a chimpanzee) are shown to use the symbols "good" and "bad" in appropriate contexts and to co-construct these values with the humans in their environment, indicating that the specific expression of value judgments is cultural. Their developmental use of these symbols parallels studies in children which suggest that conceptual simplicity and internal development may affect the development of moral precursors. These findings support recent research that has found moral precursors in several species of nonhuman primates.

Keywords: Moral precursors; Primates; Value judgments; Language-competent apes

1. Introduction

Morality is a concept that is most frequently left to philosophers, as there are few direct behavioral measurements that can be made. In nonhumans, the study of morality has gen-

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doi:10.1016/j.langcom.2008.01.006

erally focused on behavioral precursors, such as altruism, cooperation, and fairness (Bekoff, 2004; Katz, 2000), as these allow for direct behavioral evaluation. For example, Brosnan and de Waal (2003) found that brown capuchin monkeys (*Cebus apella*) will reject rewards that they consider "unfair". Indeed, previous research has delineated a suite of moral precursors that are present in nonhuman primates, including empathy, sympathy, and a concept of reciprocity (Flack and de Waal, 2000), but has yet to fully explore the concepts of perception of intention or using/perceiving social norms (Call, 2000), and has not yet touched other concepts that are more linguistically based, such as value judgments.

At its very essence, morality must rely on value judgments. For, if there is no "right" or "wrong", no "good" or "bad", then there is nothing on which to base a morality. There is some discussion by philosophers and scientists about whether humans have an innate concept of morality, and therefore of value judgments, and when said concept would have evolved (e.g., Hauser, 2006; Wilson, 1993). However, specific views and expressions of value judgments vary from culture to culture and are therefore seen to be (at least partially) culturally acquired (also e.g., Wilson, 1993). Certainly, the expression of value judgments as a specific linguistic behavior is measurable and therefore may allow for a more direct glimpse into the development of morality.

Supporting this argument, Lamb (1991) states that "the acquisition of morally relevant words such as good, bad, naughty and nice may reflect" the beginnings of morality. Interestingly, Snow (1987) found that at least one child began by using the term "bad" more frequently in moral utterances than the term "good", but then switched their preference, using "good" more frequently than "bad". Snow (1987) does not discuss this switch in her chapter, but we suggest that children first begin to label inappropriate actions (which are likely more frequently pointed out to them by their caregivers and may therefore be easier to understand) and only after, label themselves or their actions as appropriate ("good") to distinguish them. This interpretation is supported by work in older children in which children initially describe "good" acts as acts absent of "bad" behavior (e.g., "Being good is not breaking windows"), and only later describe both "good" acts in terms of prosocial behavior (Hill and Hill, 1977).

This late development of moral understanding may therefore be driven, not just by cultural acquisition, but by other factors such as the simplicity of the concepts themselves, or more direct internal development. Supporting this possibility, Lamb (1991) found that in children, the use of internal state words, or words that represent internal psychological states, such as happy, tired, and hungry, *preceded* the first stages of moral development, while following the development of "awareness of standards". Contrary to the cultural acquisition theory, however, Lamb found that the caregivers' use of internal state words was rare and did not seem to drive the children's use of these words. However, internal state words did appear at the same time that empathy appeared, and so may be related to the development of empathy, an internally driven developmental path.

Complex symbolic abilities in two bonobos and a chimpanzee allow for a similar linguistic exploration of value judgments in nonhuman apes. Savage-Rumbaugh et al. (e.g., 1986; 1993) have explored symbolic capacities in bonobos (*Pan paniscus*) and chimpanzees (*Pan troglodytes*) in studies that have indicated that, when reared in an environment with English, a keyboard of visual symbols (lexigrams), and cultural emersion, apes can acquire symbolic capacities without explicit training (Brakke and Savage-Rumbaugh, 1995, 1996; Greenfield and Savage-Rumbaugh, 1991; Lyn et al., submitted for publication; Lyn and Savage-Rumbaugh, 2000; Savage-Rumbaugh et al., 1986, 1993, 1980).

Among others, two bonobos (*P. paniscus*), Kanzi – a male born in 1980, and Panbanisha – a female born in 1985, and a chimpanzee (*P. troglodytes*), Panpanzee (or Panzee) – a female born in 1986, have demonstrated the abilities to use lexigrams to name objects in double blind studies (Brakke and Savage-Rumbaugh, 1995, 1996; Savage-Rumbaugh et al., 1986), to associate novel English names with novel objects with very few exposures to both object and word (Lyn and Savage-Rumbaugh, 2000), to hierarchically categorize these referents (Lyn, 2007), to utilize imitation in an intentionally communicative context (Greenfield, 1980), to make semantically-based combinations across both lexigram and gestural combinations (Greenfield and Lyn, 2007; Greenfield and Savage-Rumbaugh, 1990, 1991; Lyn et al., submitted for publication), and to comprehend English sentences at least at a similar level to a two-and-a-half year old child tested in the same manner as the ape (Savage-Rumbaugh et al., 1993). Additionally, recent publications have explored the development of a unique ape/human culture at the Language Research Center and now the Great Ape Trust of Iowa (Savage-Rumbaugh et al., 2004). The intensive 24-hour interaction among the apes and humans, sharing daily activities and communicative modes have produced extended spontaneous cognitive and social abilities not otherwise documented in these species, for example, pretend play (Lyn et al., 2006) and joint attention and imitation (Savage-Rumbaugh et al., 2004).

During interactions with the apes at the Language Research Center, and now at the Great Ape Trust of Iowa, human caregivers utilized the terms "good" and "bad" (in English and/or lexigram form) as value judgments as they would in ordinary interactions. For example, "Panzee's being bad" or, "This is a good apple". They would also produce interrogatives that requested value judgments from the apes. For example, "Do you think that's a good idea?" or "Do you know how you've been acting?" Accordingly, within the human and ape culture, the apes have learned to use the "bad" and "good" lexigrams in many diverse contexts.

We propose an exploration into the apes' use of "good" and "bad" lexigrams and the co-construction of these value judgments within a Pan/Homo culture.

2. Methods

2.1. Subjects

Two bonobos (*P. paniscus*) – Kanzi, born April 1980, and his half-sister Panbanisha, born December 1985, and one chimpanzee (*P. troglodytes*) – Panpanzee, born January 1986, served as subjects. All three were reared at the Language Research Center in Atlanta, Georgia in a within- and cross-species communicative environment that included the use of English by human caretakers and a keyboard printed with visuo-graphic symbols (lexigrams) used by several of the apes (including all three subjects) as well as the caretakers. In this environment, all three apes have been shown to acquire symbolic capacities without explicit training (Brakke and Savage-Rumbaugh, 1995, 1996; Greenfield and Savage-Rumbaugh, 1991; Lyn et al., submitted for publication; Lyn and Savage-Rumbaugh, 2000; Savage-Rumbaugh et al., 1986, 1993, 1980). The apes have demonstrated the abilities to use lexigrams to name objects in double blind studies (Brakke and Savage-Rumbaugh, 1995, 1996; Savage-Rumbaugh et al., 1986), to associate novel English names with novel objects with very few exposures to both object and word (Lyn and Savage-Rumbaugh, 2000), to utilize imitation in an intentionally communicative context (Greenfield, 1980), to make semantically-based combinations across both lexigram and

gestural combinations (Greenfield and Lyn, 2007; Greenfield and Savage-Rumbaugh, 1990, 1991; Lyn et al., submitted for publication), and to comprehend English sentences at least at a similar level to a two-and-a-half year old child tested in the same manner as the ape (Savage-Rumbaugh et al., 1993).

2.2. Database

The utterance database includes information about the apes' use of the keyboard from November 11, 1985 to January 19, 1997. During intensive study periods (1987–1990), the utterance database included all uses of the keyboard by Kanzi, Panbanisha and Panpanzee, as well as communicative gestures used in combination with keyboard utterances. These were recorded by hand by the caregivers and input into the computer at the end of the day. This procedure provided the researchers with an exhaustive written record of their symbol use. At other times (1985–1987 and 1990–1997), due to caretaker shortages, data recording was more sporadic, including all uses of the keyboard for only certain hours of the day and certain days of the week. At no time were utterances selectively entered into the database. As a reliability check, real-time recording was checked against 4.5 h of videotape. Thirty-seven out of 46 utterances, or 80%, were noted by both the real-time and the video observer and there was 100% agreement on the lexigram that had been used when both observers noted the utterance. Hence, we conclude that our corpus is highly reliable, but an underestimation of quantity.

Each record contained the utterance, date, record number, ape, researcher, codes as to pragmatic force of the utterance, behavioral concordance notes, and a short contextual note. The procedure was similar to observational protocols used in studies of child language which provided the comparative foundation for this study (Bowerman, 1973; Brown, 1973). Several studies have been published utilizing this database (Brakke and Savage-Rumbaugh, 1995, 1996; Greenfield and Savage-Rumbaugh, 1990, 1991; Lyn, 2007; Lyn et al., submitted for publication).

Contextual notes were provided by a second caregiver who functioned as an observer. This contextual description in the utterance database was our basis for coding these combinations as to their semantic meaning. When the ape was with only one caregiver, the data would be excluded from our corpus for lack of contextual information. We estimate that two caregiver/researchers were present with the apes about four and one-half hours per day.

The database contains exhaustive utterance information for Panbanisha and Panpanzee from 1 year of age (1988) through 3 years of age (1990). Kanzi was already over 5 years of age at the initiation of the utterance database. Therefore, all developmental analyses will focus on Panbanisha and Panpanzee.

3. Results

3.1. Use of "good" and "bad"

Kanzi, Panbanisha, and Panpanzee all use the terms "good" and "bad" in appropriate contexts and showed comprehension. The database contained 119 utterances of good and bad by Kanzi, including 100 utterances containing a "good" lexigram and 24 a "bad" lexigram (5 utterances were combinations that included both "good" and "bad"), 860 utterances by Panbanisha, 697 "good" and 174 "bad" (11 with both), and 115 by Panpanzee,

33 good and 83 bad (1 with both). Panpanzee's preference for the "bad" lexigram in contrast to Panbanisha's preference for the "good" lexigram will be further analyzed below. Utterance examples follow (In these and all following examples, all caps indicates the use of a lexigram):

Bad. Panpanzee – Date: 6/12/1988; Record: 14. I declined Panpanzee's PLAY request and continued my litany, saying next "Do you know how you've been acting?" Panpanzee turned to the large faceplate & touched BAD. I agreed that she had been bad & advised her to be GOOD now.

Bad Good. Panbanisha – Date: 10/21/88; Record: 15. Liz and Panpanzee have gone to visit the orangutans in the colony room and Panbanisha very much wants to go also. The experimenter says "NO GO" as Panbanisha is getting her physical now. Panbanisha starts to leave. The experimenter tells her not to be BAD because she said NO GO ORANUTANS. Panbanisha imitates BAD, then comments GOOD.

Some uses of good and bad are harder to interpret than others, but analyses revealed no significant difference in the percentage of utterances that were coded uninterpretable ("unknown" code) or babbling for "good" and "bad" utterances than for all utterances combined (see Fig. 1). However, a significantly lower percentage of "bad" or "good" utterances were coded as requests than were coded for all utterances combined for all three apes (Kanzi – $\chi^2(1833, 1) = 15.10$, $p < 0.001$; Panbanisha – $\chi^2(9779, 1) > 23.9$, $p < 0.001$; Panpanzee – $\chi^2(10{,}219, 1) = 17.39$, $p < 0.001$). Also, a significantly higher percentage of "bad" or "good" utterances were coded as statements or comments than were coded for all utterances combined for all three apes (Kanzi – $\chi^2(1139, 1) > 23.9$, $p < 0.001$; Panbanisha – $\chi^2(6569, 1) > 23.9$, $p < 0.001$; Panpanzee – $\chi^2(6296, 1) > 23.9$, $p < 0.001$).

3.2. Developmental analysis

3.2.1. Good and bad

Both Panbanisha and Panpanzee used "bad" before "good" and, initially, "bad" was used more frequently by both apes (see Fig. 2). Panbanisha showed a strong spike in

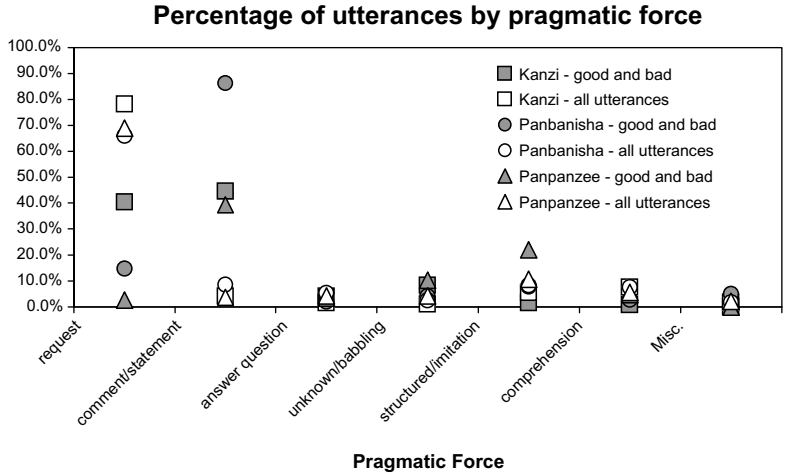

Fig. 1. Percentage of utterances by the three apes that were coded as one of seven categories of pragmatic force.

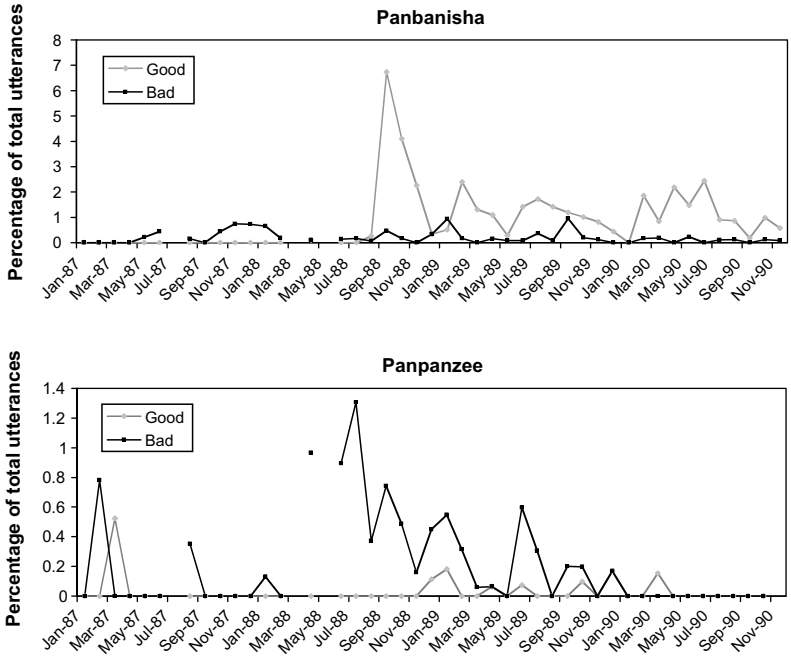

Fig. 2. Panbanisha and Panpanzee's developmental, spontaneous use of "bad" and "good" as a percent of total utterances per month.

the use of "good" in September of 1988, when she was approximately 34 months old, even earlier than a human child showed a similar switch (Snow, 1987). After this month, in only one month did she use "bad" more frequently than "good". Panpanzee showed a similar spike in her usage of "bad", however she only began using "good" more often than "bad" in November of 1989, when she was approximately 46 months old, however, relative to her "bad" usage, her "good" usage increases over the developmental time period. Note, also, that Panpanzee used both "bad" and "good" less frequently (as a percentage of her total utterances), than did Panbanisha.

3.2.2. Internal state words

Panbanisha and Panpanzee share many patterns in word use; during almost every month both apes used "good" and "bad" more frequently than internal state words (happy, mad, hurt, and scared, the only internal state words available on the keyboard during the study period). They also began using "good" and "bad" before their first use of an internal state word. Additionally, both apes showed a spike and subsequent drop off in "good" and "bad" use beginning in the fall of 1988, though Panbanisha's spike was much higher than Panzee's, (8% vs. 2% of all utterances, respectively Fig. 3) and neither ape showed a similar spike and fall off in the use of internal state words.

Panbanisha began using internal state words at low percentages in December of 1987 and continued to use them at fairly low levels until the fall of 1989, one year after her spike in "good" and "bad" use, at which point her internal state word usage increased. After this initial increase, her use appears to remain at a relatively higher level. The data for Panpan-

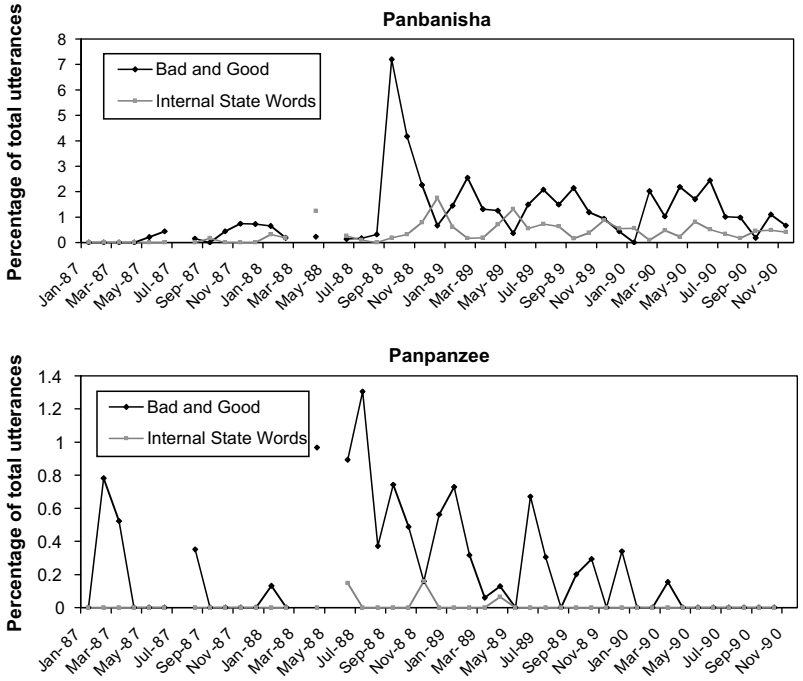

Fig. 3. Panbanisha and Panpanzee's spontaneous use of good/bad and internal state words (happy, mad, scared, and hurt) as a percent of total utterances per month.

zee show a similar increase in the use of internal state words in the spring of 1990, but the pattern is not strong.

3.3. Qualitative findings

The use of "good" and "bad" by the apes seems to be influenced to a large extent by the values placed on events and actions by the humans in the environment. For example, human caretakers are unhappy when the apes break objects and go to the bathroom without using the potty. Both of these activities, of course, are perfectly acceptable in bonobo society.

Bad. Kanzi – Date: 01/10/1987; Record: 12. A minute or two after Kanzi had said GOOD, he said BAD and then started to push the keyboard up underneath the metal pieces for the tool sites. Thus, it seemed that Kanzi had announced that he was going to be bad.

Good. Panbanisha – Date: 12/14/1989; Record: 14. About a minute prior to Panbanisha pointing to GOOD she had almost accidentally broke the pen when she put it in the clipboard. She let me know that she was trying to be good with the pen.

Bad. Panpanzee – Date: 1/24/1988; Record: 12. Panpanzee touched this lexigram, looked at me, and was being kind of squirmy. Panpanzee has been fingering the faceplate idly today, so I was unsure what she meant – however she was communicating something. I agreed "YES it is bad when you run away". As I began to sit Panpanzee down,

Panpanzee began to pee and looked at me again. I think that she chose that lexigram because people tell her she's bad when she doesn't use the potty.

3.3.1. Negotiated meaning of "good" and "bad"

Additionally, some examples of the apes using "good" or "bad" seem to be attempts to negotiate or verify the meaning with the human caretakers.

Bad. Panbanisha – Date: 06/28/1989; Record: 31. After Panbanisha said RIVER and I said "yes", she ran right up on top of lookout point, a place I do not let her go, as though I had given her permission to do so by saying yes to river. However, when I asked her to come down she did so at once, which she would not have done if she were explicitly disobeying. I asked her why it was that she decided to be bad and climb up on top of lookout. She answered that she was BAD, as though she knew what she had done was wrong, but not why. She seemed puzzled and sad.

Monster good. Panbanisha – Date: 06/28/1989; Record: 32. Panbanisha was in the middle of a block of trials when she wanted to use the keyboard. She made this combination and looked at me for my response. I told her I thought monsters were BAD. She then resumed working.

Many of these instances of negotiated meaning were recorded during the apes' spike of "good" and "bad" usage between July and December 1988:

Good. Panbanisha – Date: 09/12/1988; Record: 23. Panbanisha had started to eat some nuts from Kanzi's bowl. Kelly takes the bowl away from Panbanisha. Perhaps thinking that Kelly thought she was being bad, Panbanisha informs Kelly that she was being GOOD. Kelly assures Panbanisha that she just wants her to eat nuts from her own bowl and gives Panbanisha other nuts to eat besides Kanzi's.

Bad. Panpanzee – Date: 9/28/1988; Record: 17. At Mushroom Trail, I was encouraging Panzee to eat her mushroom instead of spitting it out. Although I was speaking to her in a quiet tone, she seemed to think I might be mad at her. She said BAD and then wanted a hug. I told her I didn't think she was being bad in the least, and that she was being good, and I gave her a big hug.

3.3.2. Variations in context

Even when the same symbol is used and is coded with the same pragmatic force, (for example requests), the precise meaning of the symbol can vary, depending on context. For example, "Good" is frequently seen as above, as a comment on behavior, it can also be used as a comment on food that the apes are eating, and it is also added to other requests – this is frequently seen as a promise to be good, but could be seen as a function word, like please, a politeness that yields a more positive response. Both these interpretations are supported by the fact that very few requests are combined with "bad" (only one for Panbanisha and she indicated both "good" and "bad"). Examples:

Good. Panbanisha – Date: 10/15/1988; Record: 46. Panbanisha was eating a plum and interacting with Karen. She used the plum piece to touch the GOOD lexigram. She was maybe commenting on the plum.

Good Milk. Panbanisha – Date: 1/14/1991; Record: 32. Since Sue would not go to the house with Panbanisha, Panbanisha pleads for more milk, stating that she's being good. Again Panbanisha is told that she'll get milk during SLEEP.

Different meanings are evident even when the exact *combination* is utilized with the same pragmatic force. For example, there are 23 examples of Panbanisha making the com-

bination "Good hug", 12 of these were coded as requests. However, the precise meaning of this combination had several different meanings (including requests for affirmation, shared excitement, or reassurance) as illustrated by the examples below:

Good Hug. Panbanisha – Date: 11/16/1988; Record 24. After finally putting in a puzzle piece successfully (after quite some time had elapsed), Panbanisha came over to me and made this combination. I hugged her and praised her for her efforts.

Good Hug. Panbanisha – Date: 10/20/1988; Record 6. Waiting for the experimenter to put the hammock up and having to sit in a cube with Liz, Panbanisha touches these symbols wanting a hug from Liz, excited and happy about the hammock going up. Liz hugs Panbanisha who has postured for a hug.

Good Hug. Panbanisha – Date: 9/29/1988; Record 22. As we were on the way back to the group room from log cabin, Panbanisha got scared. She pointed to GOOD and HUG. I gave her a hug to reassure her.

3.3.3. Difficult interpretations

Even when an utterance had a clear pragmatic force, the exact referent of the utterance can be hard to interpret. For example,

Good. Kanzi – Date: 8/9/1988; Record: 45. Kanzi said GOOD as he ate his potato. He was also vocalizing happily about the potato, so I wasn't sure if he was commenting on the potato's taste or on his good behavior.

Also, caregivers frequently interpreted the use of "bad" or "good" as a statement of the apes intent to act "bad" or "good", however, the utterances could also be interpreted as an indictment of caregivers' behavior (e.g., ape says "bad" after caregiver responds "no" to a request). Examples:

Bad. Panpanzee – Date: 1/11/1989; Record 11. I had refused to take Panpanzee to the observation room when she had first asked for M & M's. She had persisted in trying to get me to "go" there by asking me to say "yes" to her going. She then pointed to QUESTION M & M and BAD while monitoring my facial expression. When she had pointed to the M & M lexigram I had looked at her with a negative reply. That's why she went on to point to "bad". She ran off without my permission immediately afterwards.

Bad. Panbanisha – Date: 8/3/1987; Record 5. As Steve and I were talking, Panbanisha tugged on his arm several times trying to get his attention. When she was unsuccessful she looked over at me and pointed to the BAD lexigram. She seemed to be telling me that she was going to be bad if I didn't stop talking so that she could have all his attention. I sternly told her "You had better not be bad!".

4. Discussion

Here we present evidence that three language-competent apes use the symbols "good" and "bad" in appropriate contexts, suggesting that the capacity for making value judgments evolved before the human line split from our common ancestor 5–7 million years ago (Byrne, 1995). However, the contexts in which the apes use "good" and "bad" are heavily influenced by the value judgments of their human caregivers, strongly suggesting that the specific expression of value judgments is mainly cultural. For example, it would be hard to imagine a situation in bonobo society in which the breaking of objects would be considered "bad". However, in the Pan/Homo culture in which the apes were reared, breaking objects is "bad", and therefore, to these apes, it is labeled "bad".

This use of the "good" and "bad" lexigrams and the corresponding English words by their caregivers initially informs the apes' the perception of the meaning, however, there is evidence that the terms "good" and "bad" are co-constructed, or negotiated between the apes and the caregivers. They do not simply respond with pre-rewarded (stimulus–response) judgments, in contrast, they request clarification, suggest values, and engage in discourse surrounding the use of the terms "bad" and "good". This indicates that the apes are active participants in the value construction, and are not simply responding to values assigned by their caregivers.

The apes' active participation in value judgment construction is also suggested by the developmental spike in Panbanisha and Panpanzee's use of the terms "good" and "bad". During these spikes, many of the examples of "good" and "bad" use seem to be attempts to negotiate or verify the meaning of the symbol, indicating that the apes were attempting to "work out" the various meanings and contexts for the use of "good" and "bad". This "exploratory" period is also suggested by Panbanisha and Panpanzee's relatively higher levels of use of "good" and "bad" after the spike.

Apart from these cultural aspects of value judgment acquisition, our data suggest that acquisition of value judgments in apes may be affected by two other factors that also affect this acquisition in humans – the simplicity of the concepts, and purely internal development.

Panbanisha and Panpanzee's use of "bad" before "good" and their initial more frequent use of "bad" parallels the findings of a analysis of a young child's conversations reported by Snow (1987) as well as findings that suggest that older children's initial conceptions of "good" are mainly a description of what is not "bad", and only later become more fully formed (Hill and Hill, 1977). All these findings suggest that "bad" is a more basic concept than "good" and is, therefore, easier to learn, affecting the acquisition of these two value judgments.

Internal development may drive the acquisition of value judgments in apes as it does in humans, although our data are less clear. In humans, Lamb (1991) found that the use of internal state words in children preceded the first stages of moral development, but was associated with the internal development of empathy, suggesting that empathy could first drive the acquisition of internal state words and then, value judgments. However, Lamb also reported that the increase in the children's use of internal state words occurred after an increase in the *awareness* of standards (as measured nonlinguistically). Both Panbanisha and Panpanzee spontaneously used "good" and "bad" as value judgments *before* they used internal state words (in contrast to the findings in children), however, this use of "good" and "bad" suggests an awareness of standards, which did precede the use of internal state words in children. Additionally, the use of internal state words by the apes followed not only the first spontaneous use of value judgments, but the exploratory spike in usage, as well, suggesting that the apes first explored the "standards" or value judgments and, only after, began to use internal state words. This suggests that the developmental track of "awareness of standards" before internal state words is the same in apes and humans. Our data do not specifically speak to the role of empathy in the development of value judgments in apes, and additional research into this question could help to further delineate these developmental processes.

The use of "good" and "bad" as value judgments in a chimpanzee and two bonobos suggests that the basis for values and therefore a precursor of morality was likely extant in our common ancestors 5–7 million years ago. These findings, combined with the recent

findings in fairness, altruism, and cooperation in primates, including some monkey species (Bekoff, 2004; Brosnan and de Waal, 2003; Katz, 2000), support the idea that the foundations for human morality were possibly in existence even further back in evolution.

Acknowledgements

The authors wish to acknowledge the contributions of the staff of the Language Research Center, Atlanta, GA in collecting these data. This research was supported by a grant from the Campaign for Forgiveness Research to E. Sue Savage-Rumbaugh and the Great Ape Trust of Iowa, Des Moines, IA. All applicable guidelines for animal care and use were followed throughout this study. The authors declare that they have no professional or financial affiliations that may be perceived to have biased this study.

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