Do Chimpanzees Seek Explanations? Preliminary Comparative Investigations

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Abstract During the past decade, considerable effort has been devoted to understanding whether chimpanzees reason about unobservable variables as explanations for observable events. With respect to physical causality, these investigations have explored chimpanzees' understanding of gravity, force, mass, shape, and so on. With respect to social causality, this research has focused on the question of whether they reason about mental states such as emotions, desires, and beliefs. In the studies reported here, we explored whether the chimpanzee's natural motivation for object exploration is modulated by a cognitive system that seeks explanations for unexpected events. We confronted both chimpanzees and young children with simple tasks which occasionally could not be made to work. We coded their reactions to determine if they appeared to be searching for an apparent cause (or explanation) of the task failure. The results of these preliminary studies point to both similarities and differences in how young children and chimpanzees react to such circumstances.

Résumé Depuis dix ans, des efforts considérables ont été déployés en vue de comprendre dans quelle mesure les chimpanzés arrivaient à raisonner en utilisant des variables non-observables pour expliquer des événements observables. En ce qui a trait à la causalité physique, les études en question ont exploré la compréhension qu'ont les chimpanzés de la gravité, de la force, de la masse, de la forme, et ainsi de suite. En ce qui concerne la causalité sociale, la présente étude s'est centrée sur la question de savoir si les chimpanzés raisonnent au sujet des états mentaux tels que les émotions, les désirs et les croyances. Dans les études ici rapportées, nous avons examiné si la propension naturelle des chimpanzés à explorer les objets était modulée par un système cognitif recherchant des explications à des événements inattendus. Nous avons confronté des chimpanzés et de jeunes enfants à des tâches simples qui, à l'occasion, se révélaient irréalisables. Nous avons codifié leurs réactions afin de déterminer s'ils semblaient chercher une cause apparente (ou une explication) à l'échec dans la tâche. Les résultats de ces études préliminaires signalent à la fois des ressemblances et des différences dans la façon dont les enfants et les chimpanzés réagissent à ces situations.

The human penchant for explanation permeates nearly every aspect of our social, emotional, and physical lives. Our natural language brims with terms of causal explanation, presumably expressing our species' fundamental curiosity about the causal relationships that underlie the physical and social events that cascade around us. Questions about "why?" and "how come?" punctuate our language from a very early age, and this quest for explanation remains firmly in place in adolescence and adulthood. By four or five years of age, children are able to produce explicit explanations for events (Crowley & Siegler, 1999; Wellman & Gelman, 1998), and an understanding of abstract causal relations appears to emerge even earlier (Bullock & Gelman, 1979; Gopnik & Sobel, 2000; Shultz, 1982; Shultz, Altmann, & Asselin, 1986a). The young child's drive for explanation has lead some to liken young children to scientists engaged in theory formation and hypothesis-testing (e.g., Carey, 1985; Gopnik, 1988; Keil, 1987; Wellman, 1990). Indeed, Gopnik and Meltzoff (1997) have turned the analogy around, arguing that scientists are actually like young children: They cling to an environment in which child-like drive for explanation can continue to flourish.

The capacity for explanation may be a universal trait of the human species. Explanation appears in every culture and historical time period that has been studied (although what qualifies as an acceptable explanation for a given event may differ dramatically; for discussions of causal explanations in various cultures see Lewis, 1985; Morris, Nisbett, & Peng, 1985). Gopnik (2000) speculated that explanation is a fundamental drive of our specie's psychological make-up. In short, she argued that causal explanations constitute intrinsically rewarding experiences much like the outcomes of other physiological drives like eating, drinking, and mating (see Gopnik & Meltzoff, 1997). On this view, the human mind can be thought of as being biologically adapted to seek explanations for events they witness (Gopnik & Meltzoff, 1997).

Explanation is clearly an important part of human psychology, but is this psychological disposition unique to humans? Perhaps the most obvious place to turn for an answer to this question is other primate species: Do they exhibit behaviours which suggest that they seek explanations for events they witness? Certainly, nonhuman primates exhibit a drive to explore social and physical relationships. What is less clear is whether they are seeking empirical generalizations (the predictable regularities that exist in the world), or whether they are also learning about underlying causal relations. Recent investigations focusing on nonhuman primates' understanding of both social and physical causality have produced conflicting results. Some researchers argue that chimpanzees, at least, appear to appeal to mental states (i.e., emotions, desires, beliefs) and unobservable causal phenomena (i.e., gravity, force, mass) to account for, or explain, the events they observe (e.g., Boesch & Boesch-Achermann, 2000; Hare, Call, & Tomasello, 2000; Visalberghi, Fragaszy, & Savage-Rumbaugh, 1985). Other researchers have highlighted data which suggests that even in the case of chimpanzees, such sophisticated social behaviour is underwritten by the detection and understanding of the predictable regularities that exist in the world, not inferences about unobservable mental states or causal forces (e.g., Povinelli, 2000; Tomasello & Call, 1997). Because they are our nearest living relatives, the question of whether chimpanzees generate cognitive structures equivalent to human explanations is crucial to developing an understanding of the nature and timing of the evolution of this capacity.

Like other species, chimpanzees clearly learn about the observable features and propensities of the objects and entities they encounter. Given their perceptual and cognitive similarities to us, they might be expected to generate additional concepts related to perceptually nonobvious phenomena – concepts that could provide a unified account of why such regularities exist in the first place. However, in the absence of language, these concepts might be difficult to identify. The current studies were designed to present chimpanzees (and young children) with scenarios in which their efforts to complete a simple task (standing up wooden blocks) were unexpectedly frustrated (e.g., by presenting them with a block that could not stand). In such cases, we sought to determine whether they would engage in behaviours designed to explore the source of the problem. We reasoned that if the chimpanzee's general system for object exploration is modulated by a subsystem that seeks explanations for events, then they could be expected to attempt to diagnose the cause of unexpected events.

Experiment 1

In this experiment, we taught chimpanzees and children to stand up simple oblong blocks in order to receive rewards. However, on crucial probe trials we confronted them with a sham block. This block was nearly perceptually identical to the original blocks except that its ends were slightly beveled so that it could not be made to stand up. Organisms whose general system for object exploration is modulated by a subsystem which seeks explanations for unexpected object events could be expected to inspect the sham block or the platform in an attempt to diagnose the cause. On the other hand, if an organism's general system for exploration of objects is not modulated in this way, and is instead driven by perceptual novelty and contingency detection, it could be expected to repeatedly attempt to produce the desired contingency (e.g., standing the sham block) – even using novel means – without any obvious or directed efforts to search for an underlying cause of the event by exploring the block or the platform.

Chimpanzees

METHOD

Subjects. The subjects were seven adult chimpanzees who were between 9 years and 4 months (9;4) and 10;3 when this study began. The animals had been raised together since birth, and had participated in numerous cognitive studies since they were 2-3 years old (see Povinelli, 2000, for details of their rearing and experimental histories). The subjects lived together in a large, indoor-outdoor compound, but each one was intimately familiar with the process of individually leaving the compound and entering a separate area for testing. This consisted of an outdoor waiting area which was connected to an indoor testing unit by a shuttle door. In the testing unit, the apes were separated from the experimenters by a plexiglas partition that contained several large holes through which the subjects could easily reach.

Apparatus. The apparatus consisted of two simple platforms and several oblong wooden blocks (see below) that could be stood upright on the platforms. During testing, each platform was covered with a thick, rough mat. A circular hole was cut into each mat, providing a flat, smooth location in which the blocks could be

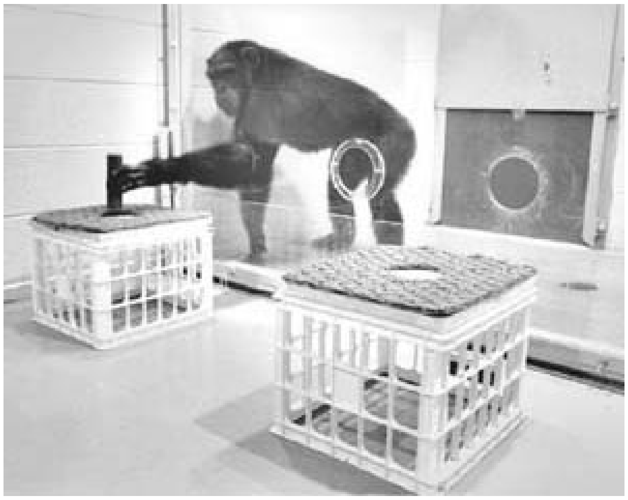

Figure 1. Setting and materials for Experiment 1 with chimpanzees (see text for details).

stood upright (see Figure 1). A set of cylindrical blocks was used in training and a second set of square blocks was used in testing. In addition, one sham block was created which was identical to the testing blocks except that both ends were slightly beveled so that the block could not be made to stand upright.

Procedure. Initially, *in training* the apes were taught to enter the test unit, reach through the plexiglas partition, pick up a block that was placed on the floor, and stand it upright on a platform. When they placed it correctly, they received half of an apple (or its equivalent) from an experimenter who sat facing them. A variety of informal techniques were initially used to teach the apes how to do this. Six of the subjects learned to perform the basic task in about 20 sessions, which were administered intermittently over a 6-month period. (We were effective almost immediately in teaching the apes to pick up the block and set it on the table, but it was more difficult to teach them to stand it upright on every trial.) One subject (Mindy) required considerable additional training. Once the subjects had demonstrated a proficiency on this simple task, they were introduced to trials in which multiple platforms and blocks were placed in front of the test unit. The subjects' task was to set each block on each platform before receiving a reward.

In the final preparation for testing, the apes were trained to a criterion using the following procedure. Two platforms were placed 25 cm from the plexiglas panel (on the experimenter's side) and two rectangular blocks were placed on the floor midway between the platforms. The platforms were spaced 90 cm apart, each directly in front of a hole in the plexiglas partition. The apes were required to stand both blocks and then move to the far hole and gesture to an experimenter who was seated there. If necessary, the protocol called for the experimenter to verbally encourage the apes and gesture in the general direction of the blocks from their seated position, without directly interacting with either the apes or the blocks. If the apes successfully stood both blocks within 2 minutes of entering the test unit, they were handed a food reward by the experimenter. Subjects were tested in sessions of three trials each. To meet criterion, the apes were required to stand both blocks on every trial across four sessions (12 consecutive trials) within the 2-minute trial duration. All subjects met criterion within the minimum four sessions that were required.

Testing consisted of four sessions of four trials each. Three of the trials per session were identical to the trials in the criterion training sessions and are hereafter referred to as functional trials. One trial in each session (randomly assigned as either trial 2 or 3) was a probe trial in which one of the two blocks was replaced with the sham block that could not be made to stand up. This design resulted in a ratio of sham to functional blocks of 1:3. The position of the sham block was counterbalanced across trials so that the sham block was on the left and right an equal number of times. Subjects were rewarded only if they stood up both blocks within the 2-minute duration of the trial; this meant that they were virtually never rewarded on the probe trials because the sham block was nearly impossible to stand up.

Videotape coding. All trials from the testing phase of this and all subsequent studies were videotaped from two perspectives for coding. A set of standardized, written instructions was administered to a main rater, who coded all trials (N = 112), and a reliability rater, who coded a random sample of two of each of the subject's trials (n = 56). The instructions asked the raters to record the following information: (1) "Did the chimp inspect a block with his/her fingers and/or bring the block towards themselves to smell, taste, and/or closely visually inspect the block?" (2) "Did the chimp switch a block to the opposite [platform] and attempt to stand it up?" (3) "Did the chimp succeed in standing one or both blocks at any point during the trials?" For any positive answers, the raters indicated which block or blocks were relevant. Cohen's kappas (κ) of 1.00, 0.84, and 1.0, were obtained for each question, respectively. The data from the main rater was used for all analyses. In addition, a main rater and a reliability rater separately recorded the duration of time the apes spent manipulating the sham block on each probe trial. Pearson's correlation yielded a coefficient of determination, r^2, of 0.998.

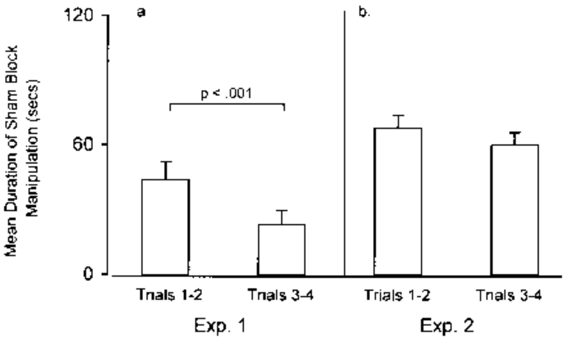

Figure 2. Mean total duration of available time (120 s) chimpanzees spent attempting to stand up the sham blocks in Experiments 1 and 2.

TABLE 1
Percentage of Functional and Sham Blocks That Were Examined by Chimpanzee Subjects in Experiment 1

	% of Blocks Examined			
	Functional Blocks		Sham Blocks	
subject	n	%	n	%
APO	28	0	4	25
KAR	28	0	4	25
CAN	28	0	4	25
JAD	28	0	4	0
MEG	28	0	4	25
BRA	28	0	4	0
MIN	28	0	4	25
M =		0		17.9
SD =		0		12.2

RESULTS

Throughout testing, the apes were highly interested and motivated to stand the blocks correctly. First, and as expected, the apes succeeded in standing up 99% of the functional blocks during the testing sessions (in contrast to only a single case in which one of the apes (Apollo) successfully stood up a sham block by balancing it against the edge of the mat which covered the surface of the platform). Second, the apes exerted considerable effort attempting to stand the sham block. Figure 2a displays the mean percent of time that the apes spent trying to stand the sham block in blocks of two trials. Averaged across trials 1-2, the subjects spent 44 (SD = 21.6) of the 120 seconds attempting to stand the sham blocks, versus 23.2 (SD = 16.8) averaged across trials 3-4, a decline that was statistically significant, $t(6) = 6.551$, $p < .001$. Third, as predicted, the apes switched the blocks from one platform to the other on more trials containing a sham block (32.1%) than on functional trials (4.8%), although this trend was not statistically reliable, $t(6) = 1.872$, one-tailed, $p < .06$.

The main results of the study are presented in Table 1, which shows the percent of functional and sham blocks examined by each subject. There was not a single case in which subjects examined the functional blocks. In contrast, on average, the subjects examined 17.9% of the sham blocks. (Because the subjects never examined the functional blocks, a direct statistical comparison between the frequency of functional and sham block examinations was not possible.) More importantly, perhaps, five of the seven subjects (71%) were each coded as having examined one sham block. Two of these examinations occurred in session 1, two occurred in session 2, and one occurred in session 4.

The five instances of block inspections were microanalyzed to provide a more detailed description of the inspection process. It was difficult to distinguish between close visual inspection and sniffing. Thus, two categories were delineated: sniffing/close visual inspection and visual inspection alone. Four of the apes engaged in an instance of sniffing/close visual inspection of the blocks (Apollo, Mindy, Candy, Kara), and two apes exhibited an instance of close visual inspection alone (Kara, Megan). Megan also exhibited a bout of backing up and visually scanning between both blocks as they sat on their respective platforms. Kara exhibited a single bout of visually examining the bottom of the *functional* block after she had previously successfully stood it upright. Interestingly, this occurred immediately after an unsuccessful attempt to stand the sham block. Mindy was the only ape who (at least arguably) engaged in a bout of tactile inspection; she put the block into her mouth after her bout of sniffing/close visual inspection.

Children

METHOD

Participants. The participants were 48 preschool children recruited from the Lafayette, Louisiana area, whose parents gave their written, informed consent for their participation. There were 16 three-year-olds (36-47 mos), 16 four-year-olds (48-59 mos), and 16 five-year-olds (60-71 mos). The children were primarily from working- and middle-class families of Caucasian, Black, Hispanic, and Asian descent. In addition to the final 48 participants, the data of two five-year-olds were discarded because of an experimental error in recording their sessions.

Apparatus. Three cylindrical blocks were decorated as trees. Two of these blocks could stand upright whereas one (the sham block) could not. A flat rectangular box served as the platform. As with the apes, most of the surface of the box was covered with a thick, irregular mat upon which the trees could not be made to stand. However, the platform contained three circular areas in which the blocks could be stood.

TABLE 2
Number (and Percentage) of Children Who Visually or Tactilely Examined the Bottom of the Sham Tree in Experiment 1

		Examinations			
Age group	*n*	Visual	Tactile	Both	Either
3-year olds	16	5 (31%)	3 (19%)	3 (19%)	5 (31%)
4-year-olds	16	4 (25%)	4 (25%)	4 (25%)	4 (25%)
5-year-olds	16	9 (56%)	7 (44%)	6 (38%)	10 (62%)

Procedure. After a warm-up period with the experimenter, the children were separately ushered to a testing area where they were introduced to the trees and the platform. The children were told that they were going to play a game in which they could build a forest with the trees, and were then shown how to stand up the blocks. The children were encouraged to stand up all three trees without any direct assistance from the experimenter. After they did so, they were rewarded with brightly coloured stickers. After a brief distraction, during which the experimenter took the trees down, the children were encouraged to stand up the trees for a second time, and were again rewarded with stickers. Finally, while the children were distracted, the experimenter covertly replaced one of the three functional blocks with the sham block. The children were again told to build the forest. This third trial lasted a maximum of 120 s, during which time the experimenter appeared distracted (reading a book) to discourage the children from seeking direct assistance. If the children insistently appealed to the experimenter, her verbal responses took the form of general encouragement and support (e.g., "Can you get the trees up?", "You're doing a great job!", "Hey, look at that!"). After the 120 s had elapsed, or as soon as the children refused to try any further, the experimenter picked up the sham tree and asked them, "Why won't it stand up?"

Videotape coding. The tapes were coded by a main rater (who coded all of the children) and by a reliability rater (who coded 25% of the children) after reading a set of written instructions which asked the following: "Did the child look at the bottom of the [sham] tree?", "Did the child touch the bottom of the [sham] tree?", "Did the child switch the [sham] tree to another white circle?" (all κs = 1.00). The main rater also produced a transcript of all of the spontaneous utterances of the children during the trial. Two additional raters independently coded each of these transcripts for whether the children (a) described the ongoing state of affairs (i.e., "It keeps falling down"), (b) asked "Why?", (c) used mentalistic terminology to describe the tree ("It doesn't want to stand up"), and/or (d) offered a physical cause as an explanation for the sham block's failure (i.e., "Because that's flat and this is down and this is up"). Kappas for these measures ranged from 0.86 to 1.00.

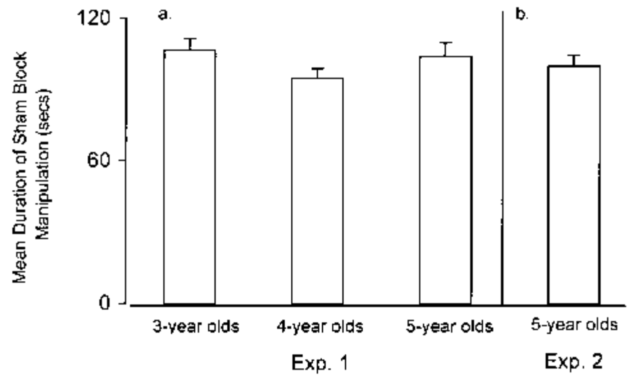

Figure 3. Mean total duration of available time (120 s) children spent attempting to stand up the sham blocks in Experiments 1 and 2.

RESULTS

The children stood up every functional tree on every occasion. In contrast, they were never successful in standing up the sham tree, although they spent nearly all the available time attempting to do so (see Figure 3a). Most of the children attempted to switch the sham tree from one location to another, and this increased with age (63% of the 3-year-olds, 75% of the 4-year-olds, and 81% of the 5-year-olds), although this trend was not statistically reliable (chi-squared test for trend, n.s.). The children displayed both tactile and visual inspections of the bottoms of the sham trees during the test trial (see Table 2). The youngest two age groups did not differ from each other in the total number of children who displayed either type of examinations. Therefore, these age groups were collapsed and were compared to the 5-year-olds. A significant effect of age was detected, with a greater proportion of the 5-year-olds exhibiting examinations than the younger children, χ^2 [1, N=48] = 5.270, $p < 0.03$.

Finally, Table 3 provides the percentage of children in each age group who offered (a) descriptions of the ongoing state of affairs, (b) asked "why?", (c) used mentalistic terminology, or (d) offered a physical reason for why the block would not stand up.

DISCUSSION

There were both similarities and differences in the manner in which the children and the chimpanzees responded to the unexpected failure of the sham block. Both the apes and children persisted in attempts to

TABLE 3
Number (and Percentage) of Children who Produced Various Kinds of Verbal Descriptions and Explanations of the Sham Tree in Experiment 1

		Examinations			
Age group	n of Affairs	Describe State Description	Ask "Why?" Physical Cause	Mentalistic	Offer
3-year olds	16	13 (81)	0 (0)	3 (19)	3 (19)
4-year-olds	16	15 (94)	2 (12)	3 (19)	1 (6)
5-year-olds	16	15 (94)	3 (19)	2 (12)	5 (31)

make the sham block stand (and in the case of the apes, both ends were tried), and both sought novel means to make it stand by switching the sham block from one location to another. Finally, both species examined the sham block. Of the apes we tested, 5/7 (71%) examined the block (and each did so once). This is comparable to the percentage (62%) of 5-year-old children who examined the sham block. With respect to the children, it is of interest to note that a significantly greater proportion of 5-year-olds conducted examinations of the sham block than did the 3- and 4-year olds, suggesting a possible developmental aspect to the drive to seek explanations across these age ranges. It is also possible that this age-related finding reflects more superficial motivational differences. However, it should be noted that this seems less likely given that the younger children were as motivated as the older children to interact with the sham block (at least as measured by the total amount of time they spent trying to make it stand up; see Figure 3).

At least two interesting differences may be present between the two species, however. First, the apes did not exclusively focus their inspections upon the end of the block that had made contact with the apparatus, whereas the children clearly did so. However, this difference is difficult to interpret because, unlike the blocks used by the apes, the children's blocks were (unfortunately) decorated on the top, rendering any direct comparison problematic. Second the apes' inspections were predominantly olfactory/visual in nature, whereas the children never smelled the blocks, but rather limited their examinations to relevant sensory systems (visual, tactile). In the contexts of their examinations of the sham blocks, the chimpanzees did not touch the bottoms of the blocks with their fingers or their mouths (except for the single instance with Mindy).

The major limitation of this study was that the sham blocks encountered by both the children and the chimpanzees possessed a visually detectable feature (the beveled bottoms) that differentiated them from the functional training blocks. Thus, it is possible that the inspections in one or both species were motivated not by attempts to search for a causal mechanism, but rather their detection of this feature as the result of intensely focusing their attention while repeatedly attempting to stand the sham block. Once having noticed this new feature, they may have then been drawn to it simply due to its novelty. Clearly, a more discriminating test could be conducted with sham and functional blocks that were otherwise visually identical. The next experiment sought to create a system in which there would be no detectable difference between the functional and nonfunctional objects, except the inability of the sham block to stand upright.

Experiment 2

Chimpanzees

SUBJECTS AND METHOD

This study involved the same seven chimpanzees and was conducted four months after Experiment 1. We confronted the apes with a new block-standing task. The blocks were in the shape of an oblong inverted-L and the subjects were taught how to stand the blocks in the inverted position on two platforms similar to the ones used in Experiment 1. The main difference between this experiment and Experiment 1 was that the functional and sham blocks were visually identical. In order to create the two different types of blocks, small lead weights were placed inside each block. In the case of the functional blocks, the weights were positioned over the long axes of the blocks so that they would easily stand in their inverted orientation; in the case of the sham block, the weight was positioned so that the block was unstable. Similar to the previous studies, the apes were first trained to criterion to stand up the functional blocks, and were then tested across eight sessions of two trials each. Every other session contained a trial in which one of the functional blocks was replaced with a sham block. The ratio of sham to functional blocks across testing was therefore 1:3.

The same procedures for coding the videotapes were used. The raters were asked to code for whether the apes examined the blocks (κ = 1.00), whether the apes switched the blocks from one platform to another (κ = 0.81), and whether they were successful in standing the blocks (κ = 1.00). Two raters also coded for manipulation durations of the sham blocks (r^2 = .998).

RESULTS

As before, the apes were highly interested in these problems. They were successful in standing 99% of the functional blocks, in contrast to only a single case (Kara) in which a sham block was successfully stood. Further, as reflected in Figure 2b, on trials 1-2 the apes spent on average over half (67.7 s, *SD* = 15.9) of the available time (120 s) trying to stand up the sham blocks, and only slightly less during trials 3-4 (59.8 s, *SD* = 15.2). As in Experiment 1, the percentage of trials in which the apes switched the blocks from one platform to the other was greater on the trials which contained a sham block (14.3%) as compared to functional trials (3.6%), although this difference was not statistically significant. In contrast, there was only a single instance in which an ape (Brandy) was coded as having either visually or tactilely examined a block (by putting it in her mouth). Further, even in this case, the rater indicated that it appeared that "she did so to get a better grip with her hand," as she switched the block from the right to the left platform.

Children

PARTICIPANTS AND METHOD

The participants were 18 five-year old children (60-71 mos) recruited from the Lafayette, Louisiana area, whose parents gave their written, informed consent for their participation.

Three inverted L-shaped blocks identical to those used with the apes were minimally decorated to look like animals when stood in the inverted position. As with the apes, one of these blocks was weighted so that it could not be made to stand up. Two flat, rectangular crates were used (separated by 90 cm), and the top surfaces of these crates were completely covered with a rough, uneven mat except for a small square area in the centre of each one. This area was large enough for the base of the block only when it was stood in the inverted position.

After warming up with the experimenter, the children were led to a testing area where they were introduced to the blocks and the platforms, and were shown how they could stand up the animals (functional blocks) in the inverted position. While the children put stickers on their sticker page, the experimenter took down the blocks and placed them alongside their respective crates. The children were then asked to set up the blocks on three separate trials, with each trial separated by the experimenter praising them and giving them stickers. Just before the third trial, the experimenter covertly replaced one of the functional blocks with the sham block (hidden under the crate). The children were then told to set up the animals a third time. This third trial lasted a maximum of 120 s, during which time the experimenter appeared distracted (arranging stickers) to discourage the children from seeking direct assistance. If the children insistently appealed to the experimenter, her verbal responses took the form of general encouragement and support (e.g., "Can you stand them up on their feet?", "Hey, look at that!"). After the 120 s had elapsed, or as soon as the child refused to try any longer, the experimenter picked up the sham block and asked them "Why won't it stand up?"

All trials were coded by two raters after they read a set of written instructions which asked the following: "Did the child look at the bottom of the sham block?", "Did the child touch the bottom of the sham block?", "Did the child switch the [sham] block to another (square area)?", and "Did the child attempt to place the sham block outside the (square area)?" (all κs between .85 and 1.00). Both raters also produced a transcript of all the spontaneous utterances of the child during the trial. An additional rater independently coded each of these transcripts for the same spontaneous verbal descriptions outlined in Experiment 1.

RESULTS

The children easily stood up every functional block on every occasion. In contrast, although the children spent nearly all of the available time attempting to stand up the sham block (see Figure 3b), only two children succeeded in doing so (by balancing them against the edge of the rough mat around the square area). Many of the children tried to either switch the sham block to the other square area (5/18 children, 28%) and/or stand it on some other surface such as the top of the table (6/18 children, 33%).

The most important results concern the children's bouts of visual and/or tactile inspection of the bottom of the sham block. Sixty-one percent (11/18) of the children engaged in at least one visual inspection of the bottom of the sham block, 50% (9/18 children) engaged in at least one tactile inspection, 50% engaged in both, and 61% engaged in at least one tactile or visual inspection.

Finally, coding of the children's verbal responses indicated that 89% (14/18) described the ongoing state of affairs (e.g., "This one keeps falling"), 22% used mentalistic terminology to describe the block, 11% (2/18) asked "Why?" at some point during the trial, and 11% offered a specific physical cause for why the block would not stand up.

DISCUSSION

Again, there were both similarities and differences in the manner in which the apes and the 5-year-old children manipulated the sham blocks. Both the children and the apes spent most of the time available attempting to stand up the sham block, and made a number of attempts to switch the sham block to the other location. This would seem to reflect a motivation in both species to pursue the task to its completion. However, whereas 61% of the children engaged in at least one form of inspection of the bottom of the sham block, and 50% engaged in both visual and tactile inspections, there were no instances in which the apes performed either – nor were there any instances in which the apes unambiguously inspected the blocks by some other means (e.g., orally). Thus, when there were no detectable perceptual differences between the sham blocks and the functional blocks, only the children inspected the sham blocks. One obvious limitation of this research is that the same chimpanzees were used in both experiments, whereas different children were used. However, it should be noted that (a) four months elapsed between Experiment 1 and 2, and (b) the chimpanzees' interest in attempting to stand the sham blocks was not negatively affected; indeed, if anything, they displayed greater motivation in Experiment 2 than in Experiment 1 (see Figure 2).

GENERAL DISCUSSION

The results of these preliminary experiments point to an important potential difference in the way in which humans and chimpanzees think about and explore the world. Our data suggest (in a preliminary manner) that although chimpanzees are motivated to explore even small, perceptually novel features of objects when their attention is drawn to them (see Experiment 1), this may not reflect a drive for explanation as much as a drive for general object exploration (perhaps by already well-understood mechanisms related to the orientation to perceptual novelty; e.g., Pavlov, 1927; Sokolov, 1963). In contrast, they may not exhibit such explorations in situations where an explanation is clearly warranted (from a human perspective), but no perceptual novelty is present.

In contrast, humans may develop a kind of explanatory drive (see Gopnik, 2000) that has evolved in parallel to more ancient psychological systems that support object exploration and manipulation (see Povinelli, 2000). Thus, although many species (especially chimpanzees and certain other nonhuman primates) may display robust evidence of an intrinsic interest in the functional and perceptual properties of the objects they encounter, it may be that our species alone develops an intrinsic interest in why objects have the properties that are apparent to the primary senses. Indeed, we have previously proposed that precisely such a human psychological specialization – although subtle in its overt manifestation in spontaneous behaviour – could account for what may turn out to be fairly profound differences in how humans and other primates understand both the social and the physical world (Povinelli, 2000).

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This research was supported by NSF Young Investigator Award SBR-8458111 and a James S. McDonnell Centennial Fellowship to DJP. Our deepest appreciation to the parents and children who participated in these studies. We thank James E. Reaux, Laura Theall, Conni M. Castille, and Anthony Rideaux for assistance in testing the children and chimpanzees, and for discussions concerning the studies.

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