Tracking Responses Related to Self-Recognition:

A Frequency Comparison of Responses to Mirrors, Photographs, and Videotape of

Monkeys by Cotton Top Tamarins (*Saguinus oedipus)*

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Abstract

The frequency of responses indicative of self-recognition to a mirror was compared to those generated by digitized photographs of tamarins (Experiment 1) and those generated by videotapes of real-time tamarin action or of prior tamarin action (Experiment 2) in cotton top tamarins. Results indicated more attentional responses toward the mirror in both studies, but behavioral indices of self-recognition were not consistently generated by the mirror. The two experiments confirmed that real time self reflection is a condition that generates heightened attention and rare examples of particular mirror-specific behaviors in tamarins.

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The most often cited evidence that some animals possess self-awareness are experiments in which apes appear to recognize themselves in mirrors. Gallup (1970) was the first to expose chimpanzees to a mirror, and noted a change in the subjects' reactions to the mirror image with longer exposure from one indicating the image was perceived as another chimp (i.e., by threats and vocalizations) to one indicating the image was perceived as the self (i.e., by visually inspecting inaccessible parts of the body and making faces). Marking chimpanzees with red dye after 10 days of exposure to a mirror (i.e., the "mark" test) led to an increased rate of touching the marked areas that was much higher than the touching done by marked chimpanzees who were unaccustomed to mirrors, or marked chimpanzees without mirrors.

Further "mark" testing with chimpanzees has yielded less consistent results than originally reported (for a review, see Heyes, 1994, 1995). Specifically, chimpanzees in some studies have shown very low rates of touching in the mirror as opposed to before the mirror condition (e.g., Calhoun & Thompson, 1988; Povinelli et al., 1993). Swartz and Evans (1991) found only 1 of their 11 chimpanzee subjects touched a "mark" during the mirror test, while 3 others used the mirror for self-examination.

Hauser et al. (1995) also found weak positive evidence in the mark test in a new world monkey, the cotton top tamarin. In the original study, subjects demonstrated a higher incidence of mark-directed behavior toward color-dyed hair to a mirror than in the mirror's absence, or than when the dye was white, and thus was changed but not noted by color. Especially salient was the reaction of increased staring to the mirror during the color-marked condition. A recent modified version of this experiment produced no evidence of touching of the mark while looking in the mirror, although there remained increased staring at marked areas (Hauser, 2000).

It seems clear that several psychological sensitivities are necessary to pass the mirror "mark" test, including self-recognition (Gallup, 1975, 1995); salience of the mark (Hauser & Kralik, 1997), understanding of a mirror (Heyes, 1994), prior experience with mirrors (Anderson, 1983), and a particular state of anxiety, attention, and/or arousal during the mirror test. It is possible, then, that some individuals of a "capable" species like chimpanzees, as well as other species, fail Gallup's mark test because of a failure in any one of these other areas or because of a gap in the capacity for self-recognition.

Some investigators have found responses to mirrors that seem self-directed in old world and new world monkeys (pigtailed macaques, Boccia, 1994; Japanese macaques, Platt & Thompson, 1985; pygmy marmosets, Eglash and Snowdon ,1983) , including contingency testing or testing one's movement against the image's movement, body exploration, or the touching of body parts while viewing them in a mirror, and referencing, or looking from the mirror to the environment to make reference to the reflection. Inoue-Nakamara [1997] tested 12 different species of nonhuman primates and found the emergence of contingency testing, a test she called self-image exploration, occurring primarily in old world monkeys and apes, and the emergence of body exploration occurring exclusively in great apes. An accepted conclusion of such experiments is a phylogenetic discontinuity between great apes who show the capacity to become self-aware presumably from these behavioral demonstrations, and the remaining old and new world monkeys, who do not show the capacity in responses to mirrors(Anderson & Gallup, 1997).

The current set of experiments further examines a broad range of responses that have been considered self-directed in cotton top tamarins, a new world monkey species for whom such measures have been collected over small samples, at short intervals, and with resulting conflicting conclusions. The study allows for a comparison of frequencies of mirror-specific responses that occurred in the presence of a mirror, and in the presence of a variety of other monkey stimuli, including still photographs, moving videotapes of the self, and moving videotapes of other monkeys.

Experiment 1: Testing Reactions to Still Photographs Against Those to a Mirror

Tamarins were first presented a mirror for 3 full days, and then were exposed to various photographs of buildings and photographs of monkeys, including pictures of themselves. The design was to test stimuli that were extremely different from each other to note differences in frequencies of responses indicative of self-recognition to them.

Method

Participants

A group of 12 cotton top tamarins (Saguinus oedipus) served as participants. The animals were socially housed as one family of 6, and 3 pairs. There were a total of 6 females and 6 males in the study. All participants were nursery-peer reared in lab settings, and had been socially housed.

The family lived in a cage 1.8 X 3.0 X 2.3 m in size, while the remaining pairs were housed in three 0.85 X 1.5 X 2.3 m pair cages located in an adjoining room. The pair cages were visually separated by opaque sheets. The subjects were on a twelve hour light/dark cycle and had free access to water. All animals were maintained on a complete diet consisting of a yogurt & applesauce breakfast, a lunch of Zupreem Marmoset chow, Mazuri New World Monkey dry chow, fruits and vegetables, and a protein snack daily. None of the animals had prior mirror training, or exposure to visual stimuli on screens of any sort.

Apparatus

The study took place in the monkeys' home cages. The mirror used was a parrot toy mirror, 12.5 X 9 cm, which hung by a chain and clip approximately 4 cm in length on the interior side of the cage at a height of 1.8 meters. The mirror could be manipulated by participants, and was reflective on its front and back sides. In the photograph condition, digitized color photographs were projected to a 6 X 8 cm Sony color monitor, which was placed against the exterior of the cage at a height of 1.2 meters. The photographs were projected to the monitor by means of PowerPoint [Microsoft Office application] from a Macintosh 7600/120. The computer's monitor was switched off during the photograph

conditions of the experiment so that the only visual stimulus present was projected onto the small Sony monitor next to the cage of animals being studied.

Animal behaviors were videotaped using two Canon VC-C3 closed circuit cameras and two Sony video cassette recorders. The view from either camera was focussed such that the stimulus was clearly visible [mirror or Sony monitor picture], as was an area approximately .3 m surrounding the stimulus. As participants approached, one could see their head and body positions, as well as glances and body movements. Audio recording was also collected, so that any aggressive barking could be heard readily on the videotape.

Stimuli

The stimulus used in the mirror recognition condition was the reflection from the 12.5 X 9 cm mirror. This captured cage details, toys, and invariably, moving monkeys. Various still color photographs were used, including three digitized photographs of academic buildings and 12 photographs of the tamarins taken with an Apple Quick Take 200 camera, and a digitized picture of Mount Rainier, found on the World Wide Web. The photographs of tamarins captured non-aggressive, front or side facing gazes, and pictured the entire body of the monkey subject as well as cage background. [See Figure 1 for examples.]

Procedure

The recording and computer equipment were placed in the rooms one day prior to recording to allow the animals to habituate to them. One building photograph was visible on the small monitor during the habituation period. Next, a mirror was placed in each cage and the subjects' reactions to the mirror were recorded over three consecutive days, six to eight hours each day. Following the mirror condition, the tamarins' reactions to digitized building and mountain photographs were recorded on videotape for a single session, lasting 6 hours. The point of this condition was to collect baseline data of behaviors toward photographs. It also served as a control to compare with reactions to monkey photographs. A total of 4 digitized photographs of building/mountain scenes were presented serially in 15

minute intervals, with each picture being presented a total of 6 times during the control test.
Finally, the tamarins were exposed to two consecutive 6 - 8 hour sessions of monkey
photograph sets, comprised of single shots of each of the animals being tested [i.e., 6
photographs of the 6 animals in the family, and 2 photographs of the 2 animals in each
pair], and 2 additional photographs [e.g., one female and one male] of monkeys unfamiliar
to the group being tested. Each photograph was presented serially for 15 minutes, and then
PowerPoint advanced to the next photograph without interruption.

Behavioral Coding

Two undergraduate raters prepared for coding by viewing a short instructional
video[1] that contained examples of each behavior excerpted by the faculty investigator from
actual test data. The principle investigator also described and discussed the behaviors with
the raters. Raters also referred to a definitional list of the 8 behaviors during coding
sessions. Both raters were first asked to code behaviors for 1 session in each condition
(mirror, building, and monkey photographs) for 4 different subjects.   Rater agreement was
calculated across behaviors for each of the conditions and for each subject, and was found
to be, on average, 85.9% for the amount of time spent in each of 8 activities, and 86.7% for
counting behavioral incidents of the 8 behaviors, with ranges for the behaviors from 72%
(looking nonaggressively) to 100% (body exploration) across the two raters. A single
rater's ratings were used in the subsequent analyses.

Aggressive barking, was coded when the rater heard loud high-pitched vocalizations
accompanied by the showing of teeth directed at the mirror or the monitor. If a bark
occurred but was directed at another monkey housed in the cage and not at the mirror or
monitor, it was not coded as aggressive barking toward the stimulus.

Looking was noted when a subject directed his/her gaze at the mirror or the monitor
for a time period greater than 2 seconds. Looking was coded as non-aggressive or
aggressive. *Aggressive Looking* was counted if the monkey was barking or displaying its

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[1] The instructional video was constructed by another undergraduate student, Leah Janus.

teeth while looking at the mirror or monitor. *Nonaggressive Looking* was defined as a > 2 second directed gaze at the stimulus without any indication of aggressive barking or teeth display.

   Peeking was defined as a short "glance" toward the mirror or monitor which lasted 2 seconds or less.

   Manipulation was noted when a subject caused the perceptible movement of the mirror by touching it or by attempting to reach behind or touch the small monitor.

   Contingency testing was noted only if multiple swooping head movements occurred toward the mirror or monitor, or multiple movements of a limb were observed by the subject while the subject directed its gaze toward the mirror or monitor. This was differentiated from movement for entry and exit, which was not coded but occurred any time a subject engaged in activity toward the mirror or monitor.

   Referencing was coded only if a subject first looked at the mirror, then looked directly behind itself at background material reflected in the mirror, then the subject directed its gaze back at the mirror again. If the rater could see the object in the mirror the participant was referencing, e.g., another monkey, toy, or branch, then the rater noted the direction of gaze toward said object and required checking back and forth [real vs. reflected image] to count the existence of referencing.

   Body exploration included looking in the mirror or at the monitor at a body part normally inaccessible to view without the mirror while touching that body part, or trying to use the mirror or monitor to visually examine parts of the body not readily accessible to view. The most common examples of such behaviors included showing the tongue while watching it in the mirror, or manipulating the mirror in order to observe one's genitalia.

Results

   The 12 subjects performed a total of 4,537 incidents of the 8 behaviors. The mirror condition generated a total of 3,898 behaviors. The photograph conditions generated a total

of 276 behaviors in the building condition, and 363 behaviors in the monkey photograph condition.

Table 1 presents the absolute frequencies of each of the 8 coded behaviors per subject per condition. Because several conditions were run for multiple sessions, a dependent variable was calculated for comparison in a Friedman's ANOVA as a total frequency of the behavior for each subject, averaged for a single session, for each condition. The distribution of frequencies across the three conditions for an averaged single session were significantly different from expected values for the following behaviors: looking nonaggressively (median for mirror = 25.33, medians for buildings and monkeys were 8 and 3, respectively), peeking (median for mirror=12.67, medians for building and monkeys were 10 and 4.5, respectively), manipulation (median for mirror = 9.33, medians for buildings and monkeys were 0), contingency testing (median for mirror = 3.33, medians for buildings and monkeys were 0), and referencing (median for mirror=0.33, medians for buildings and monkeys were 0). Nonsignficant frequency distributions were indicated by Friedman's ANOVA's for the following behavioral categories: body exploration, looking aggressively, and barking. A number of attentional and self-directed behavioral measures generated significantly higher frequencies of behavior to the mirror than to the other still photographs in this study. The aggressive measures of barking and looking aggressively were not elicited at higher rates to the mirror than to the photographs. While rare examples of body exploration ONLY occurred to the mirror in this study, and never to the photographs, the effect was not significant by a Friedman's ANOVA.

Experiment 2: Testing Moving Images Against the Mirror

The fact that less of many of the behaviors were generated toward the photograph conditions and more occurred to the mirror could be a result of recognition of the "self" in the mirror condition. Alternatively, the low frequencies could be a result of habituation, since the photograph conditions were presented last. Still another explanation for the low rate is the lack of dynamic change in the photographic stimuli. Movement itself could have

generated more behaviors, including contingency testing and manipulation behaviors, toward the mirror than toward still photographs.

The following moving image conditions were conducted in single sessions in Experiment 2 in this particular order: 1) on-line video of subjects' image, 2) off-line video of the subjects, taped on a prior day, 3) off-line video of unfamiliar monkey subjects, and 4) the mirror condition. By presenting the mirror condition last, any habituation of behaviors should lead to a decrease in their occurrence, and this should lead to a low incidence of them toward the mirror in the last condition. All other conditions showed video images that included dynamic elements. A difference in reactions toward moving but not reflective images of the monkeys with that towards a mirror was measured.

<div align="center">Method</div>

<u>Participants</u>

A total of 6 of the group of 12 cotton top tamarins from Experiment 1 served as participants. There were 4 females and 2 males in the study. The group was housed together in a family cage, and was tested with all present for each session. Care, feeding, and housing were the same as described in Experiment 1.

<u>Apparatus</u>

A Canon VC-C3 camera was mounted on a wood platform measuring 22.5 cm in height by 28 cm in width. The camera was 18 cm above the top of a 6 X 8 cm Sony color monitor, which displayed the output of the camera to the monkey subjects for the on-line self condition. For the other conditions described below, video feed from videotapes previously recorded were displayed on the same Sony monitor. The entire monitor/camera apparatus was fixed to a Wilson mobile television cart at a height of 1.2 m from the ground. A VCR was wired to present tapes to the monitor for the two off-line control conditions. The cart, monitor, and camera were placed directly against the exterior mesh of the cage. The distance between the monkey subjects and the monitor and camera, when monkeys moved directly in front of the apparatus, was approximately 4 cm.

The subjects' behaviors were recorded via another Canon VC-C3 camera mounted on the wall opposite the Wilson mobile cart at a height of 1.8 meters. The recorded image was from behind the subjects, and included the reflection in the monitor or mirror, the animal in question, and approximately 0.75 meters of area around the monitor and subject.

In the mirror condition, the same mirror described in Experiment 1 was placed outside the cage at an approximate height of 1.2 meters from the ground and at a location close to the location of the monitor when it was used.

Stimuli and Procedure

Four different conditions were conducted in the fixed order presented below, and each condition was conducted for 1 3-hour session. Subjects' behaviors were recorded continuously throughout each 3-hour presentation, and two undergraduates independently coded the video tapes using the 8 behavioral categories described in Experiment 1.

On-line Self Condition. The camera/monitor apparatus was positioned against the mesh of the cage and the camera was focused on the 20 cm squared area directly in front of the monitor in order to approximate for any approaching subject a "reflection". The "reflection" was a true reflection in the sense that it was an automatically focussing clear real time reflection of any subject who approached. The "reflection" was not veridical in that the horizontal display was flipped (i.e., movement to the right appeared as movement to the left in the monitor). The camera's output was also recorded, so that a video tape of these subjects' reflections captured by the camera in front of them could be used in the off-line familiar condition.

Off-line Familiar Condition. The camera/monitor apparatus was again positioned against the exterior mesh of the cage, but only the monitor was used. A videotape was constructed from two repeated 16-minute and 9-minute segments of "reflection" of these subjects when they approached the camera/monitor apparatus in the on-line condition. The segments were looped to produce a 3-hour tape of a continuous focussed, frontal view of a

monkey which did not show the occurrences that were happening in real time, but rather showed the subjects themselves on a prior day.

Off-line Other Condition. A videotape of continuous "reflective" behavior was constructed on a prior day by positioning a camera close to a cage in another room and recording two unfamiliar monkeys' behaviors. The unfamiliar monkeys were lured over to the camera often by the researchers in order to generate a high frequency of monkeys' images directed toward the closed circuit camera, and the monkeys were reinforced off-camera for this behavior. A total of 18 minutes of behavior which appeared to be these monkeys looking at their reflection by the camera was looped to construct a 3-hour tape of a continuous "reflective" dynamic stimulus which was not in real time nor of one of the animals in the study.

Exterior Mirror Condition. The mirror used in Experiment 1 was connected so that it hung outside the cage and in a location similar to the location of the Sony monitor in the other control conditions.

Behavioral Coding

Behavioral coding consisted of counting the 8 behaviors using the same criteria for classification as in Experiment 1. The same undergraduate coders performed the coding. Averaged reliability across behavioral categories ranged 67.5% agreement (peeking) to 100% agreement (manipulation, body exploration).

Results

The 6 subjects exhibited a total of 310 behaviors across the 4 conditions, with 38 exhibited to the on-line self condition, 51 exhibited to the off-line familiar condition, 84 exhibited to the off-line other condition, and 137 exhibited toward the exterior mirror. Clearly the mirror condition generated the most behaviors, even when presented last and predicted to be least reactive based on habituation.

Table 2 shows the absolute frequencies of each behavior for each subject in each condition. A series of Friedman ANOVA χ^2 analyses of the total frequencies across the

conditions for each behavior revealed a trend in the different distributions of frequencies for looking nonaggressively (χ^2(3), N=6: 6.35, p= 0.096). For this attentive index, the mirror condition generated the highest frequency of behavior, with a median of 9.5. Medians for the other moving image conditions were 5.5 to the video capturing unfamiliar monkeys, 3.5 to the video of familiar monkeys, and 0.5 to the on-line video condition. All other differences in frequencies in the behaviors, including peeking, manipulation, contingency testing, body exploration, referencing, barking and looking aggressively, were not significantly different across the moving images conditions, including the mirror condition. However, it is important to note that these other behaviors were extremely rare in the 3-hour sessions. Body exploration was only demonstrated once, and then to the mirror. Contingency testing only occurred to the on-line video condition, which mimicked a mirror, and the mirror condition. The socially aggressive behaviors of barking and looking aggressively were only emitted once each, and then only to videotapes of unfamiliar others. Referencing, or looking behind oneself to check the display, only occurred once, to the videotape of unfamiliar others. And, manipulation occurred at a very low rate in 3 of the 4 conditions.

General Discussion

Hauser & Kralik (1997) proposed that if their tamarin subjects recognized themselves in a reflection, and if they were attending to a mark on a salient part of their body as part of the recognition, there would be increased longer looking, or staring. The presumption was that the self is a salient attention-getting stimulus. The most consistent finding in this set of experiments is that the mirror generated significantly higher frequencies of looking, and these remained high in comparison to look rates to digitized photographs of monkeys, in comparison to look rates to moving images of monkeys, and when the mirror was presented last and thus should have generated less interest than the other displays. Clearly, the image of the self reflected in a mirror generates more attention in this species than anything else that represents monkey, including moving monkeys.

A second important finding was that responses that have been coined self-directed, including body exploration, referencing, contingency testing, and manipulation, occurred at significantly higher rates to the mirror than to digitized photographs, but some also occurred at similar rates to moving image conditions and the mirror in Experiment 2. Body exploration only occurred to the mirror in both studies, but at such a rare rate that it is not statistically testable nor reliable to entertain a conclusion based on the paucity of data that supports it. In general terms, tamarins emit responses coined self-directed at incredibly low rates, more often to a mirror, but sometimes to a moving image. Their attention, as indexed by look rates, tells a more stable story of the appeal of the self image.

Previous authors have claimed a sequential emergence of mirror-related behaviors in humans and chimpanzees, starting with social behaviors, extending to exploration, and finally to self-awareness, typically indexed by the exploration of body parts normally inaccessible to view while looking in a mirror (Amsterdam, 1972; Lin, Bard & Anderson, 1992). In this study, a new world monkey species seemed prompted initially by a dynamic stimulus display (i.e., a mirror) to show increased attention, approach behaviors like touching, and tests of the dynamic realm, like contingent movement. Aggressive reactions were not elicited more to the mirror in early or later exposures, but were still offered at a low rate to moving images of unfamiliar monkeys. Look rates were generated at higher frequencies to a mirror reflection than to any other image of moving monkeys, familiar or unfamiliar.

The method of collecting a broad range of behaviors defined as self-directed in a broad range of stimulus conditions, including mirror conditions, still photographs, and dynamic real-time and off-line displays allows for a more complete assessment of response rates in this species. The strong result is that attention is peaked to self-images, but that other behavioral indices of self-recognition do not follow at a high nor consistent rate to mirrors.

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Author Note

Table 1. Absoulute Frequencies of Behavior in Experiment One

Looking Nonaggressively

Participant	Mirror	Building	Monkey
Caitlin	38	16	3
Mac	349	42	79
Oprah	830	4	5
Fozzy	31	2	2
Zhivago	41	17	8
Ophelia	76	11	21
Dante	113	5	3
Olympia	43	7	1
Seb & Viola	41	7	6
Rolo	233	12	43
Yohoo	267	8	54

Friedman's ANOVA $\chi^2(2)$N=11:**14.73, p=0.0006**

Peeking

Participant	Mirror	Building	Monkey
Caitlin	17	10	4
Mac	380	18	9
Oprah	286	5	3
Fozzy	34	0	0
Zhivago	38	5	9
Ophelia	30	25	22
Dante	38	17	10
Olympia	28	29	7
Seb & Viola	19	15	8
Rolo	168	7	20
Yohoo	179	6	31

Friedman's ANOVA $\chi^2(2)$ N=11: **7.95, p = 0.02**

Manipulation					Contingency Testing			
Participant	*Mirror*	*Building*	*Monkey*		Participant	*Mirror*	*Building*	*Monkey*
Caitlin	4	0	0		Caitlin	2	1	0
Mac	137	2	1		Mac	16	0	0
Oprah	134	2	1		Oprah	30	0	0
Fozzy	0	0	0		Fozzy	0	0	0
Zhivago	4	0	0		Zhivago	9	0	0
Ophelia	30	0	1		Ophelia	10	0	2
Dante	36	0	0		Dante	19	1	0
Olympia	2	0	0		Olympia	0	0	0
Seb & Viola	5	1	0		Seb & Viola	0	0	0
Rolo	28	0	5		Rolo	13	0	1
Yohoo	43	0	0		Yohoo	13	0	4

Friedman's ANOVA χ^2(2) N=11: **13.68, p = 0.0011**

Friedman's ANOVA χ^2(2) N=11: 6.68**, p = 0.035**

Body Exploration			
Participant	*Mirror*	*Building*	*Monkey*
Caitlin	0	0	0
Mac	25	0	0
Oprah	4	0	0
Fozzy	0	0	0
Zhivago	0	0	0
Ophelia	0	0	0
Dante	2	0	0
Olympia	0	0	0
Seb & Viola	0	0	0
Rolo	0	0	0
Yohoo	0	0	0

Friedman's ANOVA χ^2(2) N=11: **1.23, not significant**

Referencing			
Participant	*Mirror*	*Building*	*Monkey*
Caitlin	0	0	0
Mac	9	0	0
Oprah	14	0	0
Fozzy	0	0	0
Zhivago	1	0	0
Ophelia	1	0	0
Dante	1	1	0
Olympia	1	0	0
Seb & Viola	0	0	0
Rolo	3	0	0
Yohoo	2	0	0

Friedman's ANOVA χ^2(2) N=11: **6.86, p = 0.032**

Barking			
Participant	*Mirror*	*Building*	*Monkey*
Caitlin	0	0	0
Mac	3	0	0
Oprah	0	0	0
Fozzy	0	0	0
Zhivago	1	0	0
Ophelia	2	0	0
Dante	5	0	0
Olympia	0	0	0
Seb & Viola	0	0	0
Rolo	0	0	0
Yohoo	0	0	0

Friedman's ANOVA $\chi^2(2)$: 2.18, **not significant**

Looking Aggressively			
Participant	*Mirror*	*Building*	*Monkey*
Caitlin	0	0	0
Mac	2	0	0
Oprah	0	0	0
Fozzy	0	0	0
Zhivago	1	0	0
Ophelia	2	0	0
Dante	5	0	0
Olympia	0	0	0
Seb & Viola	0	0	0
Rolo	0	0	0
Yohoo	0	0	0

Friedman's ANOVA $\chi^2(2)$: **2.18, not significant**

Table 2. Absolute Frequencies of Behavior in Experiment Two

Looking Nonaggressively:

	On-Line Self	Videotape: Familiar	Videotape: Unfamiliar	Mirror
Caitlin	1	1	6	12
Ophelia	6	5	22	40
Dante	0	2	2	5
Olympia	6	5	4	0
Sebastian	0	4	7	7
Viola	0	3	5	20
Total:	**13**	**20**	**46**	**84**

Friedman's ANOVA χ^2 (3) N=6 : 6.35, p = 0.096

Peeking

	On-Line Self	Videotape: Familiar	Videotape: Unfamiliar	Mirror
Caitlin	1	3	2	9
Ophelia	4	10	13	17
Dante	1	4	2	1
Olympia	6	9	4	1
Sebastian	3	0	8	5
Viola	7	4	3	13
Total:	**22**	**30**	**32**	**46**

Manipulation

	On-Line Self	Videotape: Familiar	Videotape: Unfamiliar	Mirror
Caitlin	0	0	0	0
Ophelia	0	0	1	0
Dante	0	0	0	1
Olympia	0	1	0	0
Sebastian	0	0	0	0
Viola	0	0	2	3
Total:	**0**	**1**	**3**	**4**

Contingency Testing

	On-Line Self	Videotape: Familiar	Videotape: Unfamiliar	Mirror
Caitlin	0	0	0	0
Ophelia	1	0	0	1
Dante	0	0	0	0
Olympia	2	0	0	0
Sebastian	0	0	0	0
Viola	0	0	0	1
Total:	**3**	**0**	**0**	**2**

Body Exploration

	On-Line Self	Videotape: Familiar	Videotape: Unfamiliar	Mirror
Dante	0	0	0	1
Other 5 subjects[1]	0	0	0	0
Total:	**0**	**0**	**0**	**1**

Referencing, Barking and Looking Aggressively

	On-Line Self	Videotape: Familiar	Videotape: Unfamiliar	Mirror
Ophelia	0	0	1[2]	0
Other 5 subjects[3]	0	0	0	0
Total for each:	**0**	**0**	**1**	**0**

[1] The 5 other subjects never emitted the behavior in any condition.

[2] For each behavior, Ophelia expressed 1 instance in the Unfam. Condition.

[3] The 5 other subjects never emitted these behaviors in any condition.

Figure Captions

<u>Figure 1.</u> Monkey photographs used in the study, of the following monkeys [starting from top left and preceding right, and then down]: Mac, Oprah, Viola, Fozzy, Zhivago, Ophelia, Caitlin, Rolo, Yohoo, Dante, Sebastian.