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Perception of Scary Halloween Masks by Zoo Animals and Humans

Joan M. Sinnott, H. Anton Speaker, Laura A. Powell, and Kelly W. Mosteller
University of South Alabama, U.S.A.

Zoo animals were tested to see if they perceived the scary nature of Halloween masks, using a procedure that measured the avoidance response latency to take food from a masked human experimenter. Human perception of the masks was also assessed using a rating scale, with results showing that a *Bill Clinton* mask was rated *not scary*, while a *Vampire* mask was rated *very scary.* Animal results showed that primate latencies correlated significantly with the human ratings, while non-primate latencies did not. Taken together, these results indicate that human perception of scary faces does not depend upon human-specific cultural factors, e.g., belief in the supernatural. Rather, it has a more biological basis, shared specifically with other primates, by which scary faces are perceived as predators or threatening conspecifics.

There is currently considerable interest in comparative and developmental aspects of face perception (e.g., Martin-Malivel, Mangini, Fagot, & Biederman, 2006; Mondloch, Maurer, & Ahola, 2006; Parr, Waller, & Vick, 2007; Pascalis & Kelly, 2009; Scott & Monesson, 2009). At a basic sensory level, the ability to differentiate between normal and distorted faces is present in human infants (Johnson, Dziurawiec, Bartrip, & Morton, 1992) and in various animal species including parakeets (Brown & Dooling, 1993), sheep (Kendrick et al., 1995), and monkeys (Lutz, Lockard, Gunderson, & Grant, 1998).

A particularly interesting topic is the study of *attractive* versus *unattractive* human faces (e.g., Jones, DeBruine, Little, Conway, & Feinberg, 2006). This more complicated aspect of face perception was first studied in human infants (Langlois et al., 1987; Samuels & Ewy, 1985), and more recently in chickens (Ghirlanda, Jansson, & Enquist, 2002) and dolphins (Powell, 2005). The present study is an exploratory investigation that compares a variety of animal species with humans on a face-perception task that may involve a very complex interaction of sensory, emotional, and cognitive levels, at least for primates (e.g., Chevalier-Skolnikoff, 1982; Hauser, 1996; Marler, 1965; Van Hooff, 1962). Assuming that an unattractive face taken to the extreme is a *scary* face, the present study asks: Do non-human animals perceive the scary nature of Halloween masks? As outlined below, there are three hypotheses that predict how animals might respond to scary facial stimuli.

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- **Human Cultural Hypothesis.** According to McNeill (1970), *Halloween* dates from the ancient Celtic festival of *Samhuinn* on November 1, which marked the end of summer. The custom of wearing costumes originated from the Druids, who disguised themselves as spirits to conceal their mortality. To discourage pagan rites, the early Christian church replaced Samhuinn with *All Saints Day*, and *All Hallows Eve* began as a religious holiday on October 31st to commemorate the dead. For modern humans, especially children, Halloween is still the time to dress up in spectacularly scary costumes and come out to "play and prey." What is it about a scary Halloween mask that causes an emotional reaction in humans? Is it something that humans alone experience, possibly because of a belief in the afterlife, ghosts, or the supernatural? If so, then this hypothesis predicts that, in comparing humans versus non-humans, only humans should perceive Halloween masks as scary, in contrast to all non-humans.

- **General Biological Hypothesis.** For most of their evolution, humans were prey objects, and it is only recently that they became the master predators of the animal world (e.g., Coss, 2003). Even though Halloween masks often take the form of supernatural entities such as witches, werewolves, and vampires, these typically have certain facial configurations resembling universal predatory features, such as wide open mouths with big canine teeth, and large glaring eyes with frowning eyebrows (e.g., Aronoff, Barclay, & Stevenson, 1988). Even simple *eyespot* stimuli (resembling two staring eyes) are perceived as threatening by a wide variety of animals, including snakes (Bern & Herzog, 1994), chickens (Jones, 1980), doves (Nakamura, Shirota, Kaneko, & Matsuoka, 1995), starlings (Inglis, Huson, Marshall, & Neville, 1983), mice (Topal & Csanyi, 1994), lemurs (Coss, 1978), and even humans (Aiken, 1998). Apparently, staring eyes indicate at a very primordial level that a looming predator is watching. Thus, if scary masks were perceived as actual predators, then this hypothesis predicts that, comparing humans versus non-humans, all should more or less equally perceive their scary nature.

- **Primate Biological Hypothesis.** Primates, in contrast to other animals, have a complex system of facial muscles, involving eyes, eyebrows, ears, mouth and lips, which can be contracted independently of one another, allowing for a broad combination of facial expressions (Van Hooff, 1962). For example, aggressive faces (e.g., *open-mouth-threat*) typically consist of wide open staring eyes, frowning eyebrows, and a wide open mouth. Fearful faces (e.g., *fear-grimace*) typically consist of lifted eyebrows, and a grinning mouth with retracted lips, exposing the teeth. This highly evolved morphology combined with an advanced visual system led to the dominance of the facial-gestural-visual mode of communication in primates (Marler, 1965). Other research indicates that primate facial gestures are more than just simple emotional reflexes, but rather can also be voluntary gestures in more cognitive situations, for example, when eliciting conspecifics as allies, or in acts of deception (Chevalier-

> Skolnikoff, 1982; Hauser, 1996). Therefore, a distinct parallel between human and non-human primate face perception exists due both to shared morphological features *and* shared communication functions that operate in complex interpersonal relationships. Thus this hypothesis predicts that, comparing human primates versus non-human primates versus non-primates, only primates should perceive the scary nature of Halloween masks, in contrast to non-primates.

To test these three hypotheses, zoo animals were chosen as participants, because unlike animals living in labs or in the wild, they are habituated to seeing a wide variety of normal human faces on a daily basis. Stimuli were chosen consisting of a real human wearing 3-dimensional masks, because there is evidence that animals may process pictures of faces differently than humans do (Martin-Malivel & Fagot, 2001; Martin-Malivel et al., 2006; Parr, Heintz, & Pradhan, 2008).

The procedure was chosen from a classic method first used with lab primates (Hebb, 1946). Real objects enclosed inside boxes were presented to chimps, who were lured to the front of their home cage by an offer of food. The box was opened for 30 s, and the latency to retrieve the food was measured. Certain objects such as disembodied heads and skulls inhibited the chimps from taking the food. Mason, Green, and Posepanko (1960) used a similar procedure with monkeys that involved placing a food item on a tray with a doll's head, and measuring the time to take the food. Monkeys were initially inhibited from taking the food, although habituation occurred with repeated testing.

This method of presenting food in conjunction with a potentially scary object is a relatively simple way to measure an avoidance response without judging natural responses such as vocalizations or gestures, which are more difficult and time-consuming to quantify (e.g., Brown, Kreiter, Maple, & Sinnott, 1992). The present study measures an animal's avoidance response latency to take food from an experimenter wearing a mask. It is assumed that a long latency indicates that an animal perceives a particular mask to be scary, while a short latency indicates that the animal perceives it as not scary. Furthermore, since the ultimate goal is to compare animal with human perception, human participants also rate the masks. Finally, correlations are performed as a function of mask type to examine similarities and differences between the human and animal data.

Method

Participants

The animals lived in two small private zoos within 100 mi of Mobile, AL. All available animals were tested that were: (a) living alone; (b) living in a group, but could be separated into a different enclosure for testing; or (c) living in a group, but could be easily identified, because the test animal did not let other group members near the experimenters. All were adults, although their exact ages were unknown. Ten were primates, and nine were non-primates, including three carnivores, three hoofed animals, and three birds (see Table 1). Human participants were 14 university students (7 males, 7 females), ranging in age from 25-30 years old, fulfilling a course requirement.

Table 1
Taxonomy of the zoo animal participants

NAME	COMMON NAME	CLASS	ORDER	GENUS	SPECIES
Joe ♂	Chimpanzee	Mammalia	Primate	*Pan*	*troglodytes*
Willy ♂	Bonnet macaque	Mammalia	Primate	*Macaca*	*radiata*
Reba ♀	Bonnet macaque	Mammalia	Primate	*Macaca*	*radiata*
Bubba ♂	Rhesus macaque	Mammalia	Primate	*Macaca*	*mulatta*
Boo ♀	Green baboon	Mammalia	Primate	*Papio*	*anubis*
Marcel ♂	Gray-cheek mangabey	Mammalia	Primate	*Cercocebus*	*albigena*
Ozzy ♂	Sykes monkey	Mammalia	Primate	*Cercopithecus*	*albogularis*
Sissy ♀	Spider monkey	Mammalia	Primate	*Ateles*	*paniscus*
Spencer ♂	Spider monkey	Mammalia	Primate	*Ateles*	*paniscus*
Tamarin ♂	Cotton-top tamarin	Mammalia	Primate	*Saguinus*	*oedipus*
Moja ♂	African lion	Mammalia	Carnivora	*Panthera*	*leo*
Sheba ♀	African lion	Mammalia	Carnivora	*Panthera*	*leo*
Scotty ♂	American black bear	Mammalia	Carnivora	*Ursus*	*americanus*
Jimmy ♂	Bactrian camel	Mammalia	Artiodactyla	*Camelus*	*bactrianus*
Pointer ♂	Whitetail deer	Mammalia	Artiodactyla	*Odocoileus*	*virginianus*
Rooty ♂	Wild boar	Mammalia	Artiodactyla	*Sus*	*scrofa*
Buddy ♂	Blue-gold macaw	Aves	Psittaciformes	*Ara*	*ararauna*
Macaw2 ?	Blue-gold macaw	Aves	Psittaciformes	*Ara*	*ararauna*
Macaw3 ?	Military macaw	Aves	Psittaciformes	*Ara*	*militaris*

Stimuli

The stimuli were primarily thirteen Halloween masks (Figure 1, panels 1-13) with eye-holes that allowed the masked experimenter to clearly look at the test animal. In addition, a human wearing no mask was used as a control stimulus for zoo animals only (E2, see below, Figure 1, panel 14).

1. *Bill:* a relatively normal human face, with a small grin showing a few teeth.
2. *Al*: a relatively normal human face, with a big grin showing lots of teeth.
3. *Joe*: an ugly human face, with frowning eyebrows and a down-turned mouth.
4. *Mike*: a normal but completely expressionless white human face, with disheveled hair.
5. *Gorilla:* a normal black gorilla face, with a grinning mouth showing a few teeth, and disheveled hair.
6. *Scream:* a white human skull, with glaring eyes, a cut-off nose, and a wide open mouth showing no teeth.
7. *Quiltman:* an abnormal brown human face, with patches of face material in strange patterns, resulting in several eyes, ears, noses and mouths.
8. *Sewage:* a skull-like whitish-green scaly human face, with frowning eyebrows, a cut-off nose, and a wide open mouth showing teeth.
9. *Hair:* a green ape-human face, with a grinning mouth showing teeth, and a lot of hair.
10. *Martian:* an olive-green skull-like human face, with glaring eyes, a cut-off nose, a grinning mouth showing teeth, and an expanded brain case.
11. *Big-Mouth-Closed (BMC):* a greenish reptile-like scaly face, with frowning eyebrows, pointed ears, and a closed mouth showing large canines.
12. *Big-Mouth-Open (BMO):* a brownish reptile-like scaly face, with frowning eyebrows, and a wide open mouth showing large canines.
13. *Vampire:* a grayish human-like face, with frowning eyebrows, an open mouth with very large canines.
14. The control face of E2 (see below): a normal human face with a slight smile.

Figure 1. Panels 1-13: The thirteen masks used as stimuli for both humans and zoo animals. Panel 14: The normal human control face used for zoo animals only. Masks are ordered according to the obtained human scariness ratings in Table 2C. See text for descriptions.

Apparatus and Procedure

Prior to mask testing, two experimenters (E1, E2) made several visits to each zoo to become familiar with the animals and their food choices. Four types of feeders were used to deliver food to the animals through their chain link enclosures. For primates, who could easily pick up food with their fingers, a feeder constructed of PVC pipe (45 cm long), with a cup at the end (5 cm deep, 8cm dia), was used to deliver small pieces of fruit (apples, bananas, grapes). For hoofed animals and the bear, tongs were used to deliver small pieces of fruit. For big cats, a bamboo skewer (30 cm long) was used to deliver small pieces of beef or chicken. For birds, a spoon was used to deliver sunflower seeds. Testing was conducted on weekdays between 1300-1600 hrs, before the animals received their normal p.m. feeding. No animals were food-restricted to obtain data.

To start an experiment, a blind made from white plastic boards (2m x 2m) was attached flush to each animal's cage. E1 sat 3-4 m from the blind in view of the animal, while E2, wearing a mask, stood behind the blind out of the animal's view. E1 started a trial by tapping his pen on the cage, thereby getting the animal's attention, and causing it to approach and position itself in front of E1. E1 then said "one, two, three, go," and started a stopwatch. Upon hearing "go," E2 emerged from behind the blind, offering food to the animal. All animals spontaneously looked at E2 when he emerged from the blind. He always presented the food at an angle visible to the animals, and at the level of his head, in order to insure that both mask and feeder were seen. During the trial, he stared directly at the animal through the mask without moving or vocalizing. A trial terminated when either: (a) the animal touched the food with hand or tongue, at which point E2 said "OK," signaling E1 to stop the watch and record the latency; or (b) E1 stopped the watch after a period of 120 sec had passed. Upon termination, E2 immediately went back behind the blind and prepared for the next trial. There was an approximate 1-min inter-trial interval.

All 13 masks were presented in a different randomized order for each animal. Prior to any mask trials, a control trial latency was recorded by having E2 present food with no mask on (see Figure 1, panel 14). These latencies were normally < 10 s, since E2 was familiar to all the animals tested. Control trials were also presented after an animal failed take food during a mask trial, and further mask testing did not resume until a control latency was obtained that was less than or equal to the first one measured. This method helped to ensure that a mask latency was relatively unaffected by a directly preceding previous mask response. The first control trial latency from each animal was used in the statistical analyses.

Humans were tested together in a classroom. They were told that the purpose of the experiment was to compare the perception of humans and zoo animals for a series of Halloween mask stimuli. They were also given a brief description of the animal procedures in order to motivate them to rate the masks carefully, but they were not told of the various hypotheses to be tested. They were then told that an experimenter would enter the classroom wearing a mask, and that they should rate each mask on a 7-point scale ranging from 1 (*not scary*) to 7 (*very scary*). Each mask was rated twice, using a randomized mask order.

Results

Comparing Zoo Primates with Non-Primates

Figure 2 plots the latency data comparing zoo primates with non-primates, and clearly shows longer primate latencies. Because our data represent many different species, Table 2 lists all the individual data for primates (A) and non-primates (B). For statistical analyses, the data were log-transformed to reduce their skewed nature, and then examined with a 2 (*primate versus non-primate*) x 14 (*stimuli*) ANOVA, with repeated measures on the *stimuli* factor. The main effect of *primate versus non-primate* was significant, $F(1, 17) = 19.574$, $p < 0.001$, verifying the longer primate latencies seen in Figure 2. The main effect of *stimuli* was also significant, $F(13, 221) = 4.116$, $p < 0.001$, indicating that, overall, the animals responded differently to the control and mask stimuli. The *interaction* was also significant, $F(13, 221) = 4.120$, $p < 0.001$. To determine the nature of the interaction, t-tests ($df = 17$) were conducted comparing primates and non-primates on each of the stimuli. For the control stimulus, the result was non-significant, $t = 1.079$, $p = 0.296$, indicating that in this case all animals responded similarly. In contrast, the primates had significantly longer latencies to the masks: *Bill* ($t =$

3.541, $p = 0.003$); *Al* ($t = 3.762$, $p = 0.002$); *Joe* ($t = 3.044$, $p = 0.007$); *Mike* ($t = 2.401$, $p = 0.028$); *Gorilla* ($t = 6.770$, $p < 0.001$); *Scream* ($t = 2.895$, $p = 0.010$); *Quiltman* ($t = 4.048$, $p = 0.001$); *Sewage* ($t = 4.236$, $p = 0.001$); *Hair* ($t = 4.206$, $p = 0.001$); *Martian* ($t = 2.564$, $p = 0.020$); *BMC* ($t = 4.340$, $p < 0.001$); *BMO* ($t = 3.171$, $p = 0.006$); *Vampire* ($t = 5.794$, $p < 0.001$).

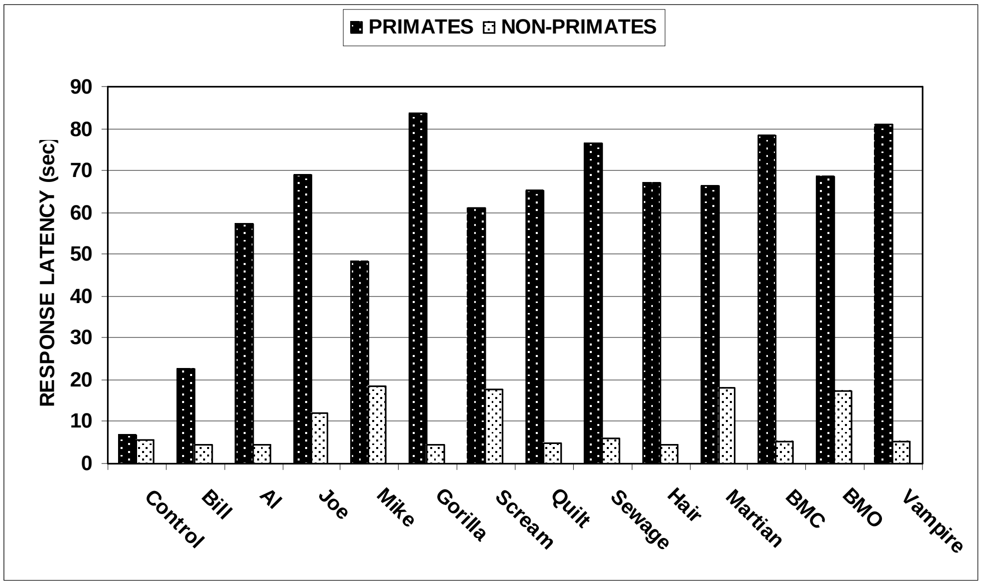

Figure 2. Zoo animal latencies to the control trial and the 13 Halloween masks. The x-axis plots the masks in order of the human scariness ratings from low to high (see Table 2C).

Comparing Zoo Animals with Humans

First, to examine the human data, Table 2C also shows the human ratings for the 13 masks. A statistical analysis using Kendall's coefficient of concordance revealed significant inter-rater reliability ($W = 0.618$, $p < 0.001$). A single factor repeated measures ANOVA showed a significant effect of mask type, $F(12, 156) = 22.094$, $p < 0.001$. The least scary mask was *Bill* ($M = 1.9$), and the most scary mask was *Vampire* ($M = 6.1$). Next, the human rating data for the 13 masks were then correlated with the raw animal latency data. The correlation with the non-primate data was not significant ($r = 0.117$, $p = 0.704$), but the correlation with the primate data was significant ($r = 0.621$, $p = 0.023$), and is shown graphically in Figure 3.

Table 2

*Individual avoidance response latencies (rounded to the nearest second) for primates (**A**) and non-primates (**B**) to the control trial (CON) and for the 13 Halloween masks. Masks are listed from left to right in order of the mean human ranking for scariness, as shown in (**C**).*

A) Primates	CON	BILL	AL	JOE	MIKE	GOR	SCR	QUI	SEW	HAIR	MAR	BMC	BMO	VAM	**MEAN**
Joe	6	7	8	6	7	120	11	10	9	7	8	7	21	15	**18**
Willy	12	76	120	120	32	120	81	120	120	120	120	120	120	120	**107**
Reba	8	13	120	78	120	120	120	120	120	120	120	120	120	120	**109**
Bubba	4	6	7	8	42	86	8	21	120	23	15	120	17	120	**46**
Boo	4	35	4	5	17	14	9	4	5	5	5	5	5	12	**10**
Marcel	4	9	120	120	120	120	120	120	120	120	120	120	120	120	**111**
Ozzy	7	48	36	120	9	29	114	120	120	120	120	120	120	120	**92**
Sissy	5	5	5	5	6	5	7	7	6	4	4	5	5	6	**5**
Spencer	6	7	120	120	120	120	120	11	120	120	120	120	120	120	**103**
Tamarin	12	20	34	108	10	101	20	120	23	33	31	45	38	55	**49**
MEAN	**7**	**23**	**57**	**69**	**48**	**84**	**61**	**65**	**76**	**67**	**66**	**78**	**69**	**81**	**65**
SD	**3**	**24**	**55**	**56**	**51**	**48**	**54**	**58**	**57**	**56**	**57**	**55**	**55**	**52**	**44**

B) Non-Primates	CON	BILL	AL	JOE	MIKE	GOR	SCR	QUI	SEW	HAIR	MAR	BMC	BMO	VAM	**MEAN**
Moja	4	5	3	4	4	5	3	5	3	4	4	4	4	5	**4**
Sheba	7	3	3	3	3	4	4	4	4	4	5	3	3	3	**4**
Scotty	4	4	4	4	4	4	5	4	4	5	4	8	4	4	**4**
Jimmy	3	4	3	4	5	3	4	5	4	5	4	5	5	4	**4**
Pointer	5	5	5	5	6	6	8	6	12	6	6	10	6	7	**7**
Rooty	6	5	4	4	4	3	4	3	3	3	4	4	5	5	**4**
Buddy	12	6	7	77	120	5	120	6	15	6	120	6	120	11	**48**
Macaw2	6	4	6	4	4	4	7	4	5	4	5	4	5	4	**5**
Macaw3	3	6	6	4	15	5	4	7	4	4	12	4	5	4	**6**
MEAN	**6**	**5**	**5**	**12**	**18**	**4**	**18**	**5**	**6**	**5**	**18**	**5**	**17**	**5**	**9**
SD	**3**	**1**	**2**	**24**	**38**	**1**	**38**	**1**	**4**	**1**	**38**	**2**	**38**	**2**	**14**

C) Humans	CON	BILL	AL	JOE	MIKE	GOR	SCR	QUI	SEW	HAIR	MAR	BMC	BMO	VAM	MEAN
MEAN	NA	1.9	2.1	2.9	2.9	3.2	4.5	4.9	5.1	5.4	5.6	5.7	5.9	6.1	4.2
SD		1.4	0.7	1.2	1.9	1.4	1.2	1.3	1.3	0.9	1.1	1.3	1.0	1.1	

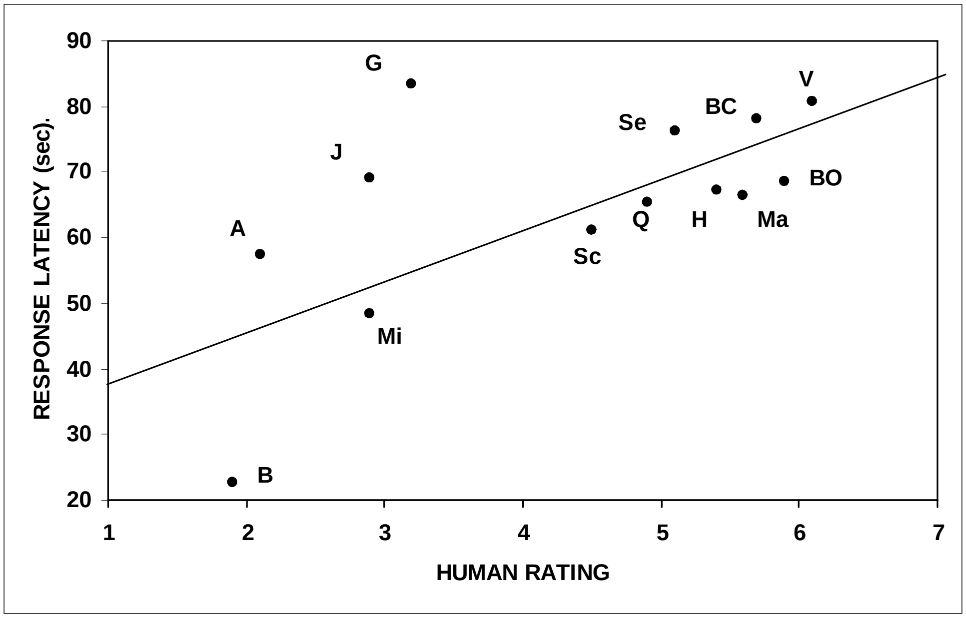

Figure 3. Correlation between the mean human scariness ratings of the 13 masks (x-axis) and the mean zoo primate avoidance response latencies to the same masks (y-axis). The data points representing the masks are (from left to right, in order of human scariness ratings, see Table 2C): B = *Bill*, A = *Al*, J = *Joe*, Mi = *Mike*, G = *Gorilla*, Sc = *Scream*, Q = *Quiltman*, Se = *Sewage*, H = *Hair*, Ma = *Martian*, BC = *Big-Mouth-Closed*, BO = *Big-Mouth-Open*, V = *Vampire*.

Discussion

Comparing Zoo Primates with Non-Primates

Figure 2 shows that the primates responded to the masks with significantly longer avoidance response latencies compared to the non-primates. Thus the *General Biological Hypothesis*, which predicts that all animals should perceive the masks as scary, is rejected. However, there are some questions to consider as follows:

Did the non-primates look at the masks in the same way as the primates? E2 verified that, upon emerging from the blind, all the animals reflexively directed their gaze to his eyes/head. Previous research supports this observation, because most animals reflexively orient to eyes looking at them, since eyes are vary salient and potent stimuli (e.g., Bern & Herzog, 1994; Coss, 1978; Inglis et al., 1983; Jones, 1980; Nakamura et al., 1995; Topal & Csanyi, 1994). However, while these latter studies indicate that staring eyes can be threatening, in this study E2's direct gaze did not deter the non-primates from quickly approaching him to obtain food.

Did the non-primates see the same detail in the masks as the primates? Perhaps the superior visual system of primates (Fobes & King, 1982) allowed them to better resolve the structural details of the masks. While a distinct possibility, previous research shows that many non-primates can perceive subtle facial details. For example, parakeets discriminate various parakeet faces (Brown & Dooling, 1992); sheep discriminate human and sheep faces, faces of different breeds of sheep, and male and female sheep in their own breed (Kendrick et al., 1995); chickens discriminate attractive from non-attractive human faces (Ghirlanda et al., 2002), as do dolphins (Powell, 2005); and pandas discriminate various fur markings that differentiate panda faces (Dungle, Schratter, & Huber, 2008). So it is assumed here that the non-primates also adequately perceived the facial detail in the masks, however, clearly more comparative research is needed concerning the face discrimination capacities of non-primates.

Comparing Zoo Primates with Humans

Figure 3 shows that the primate latencies to the masks correlated significantly with human ratings. Thus the *Human Cultural Hypothesis*, which predicts that only humans should perceive the scary nature of the masks, is also rejected. So the hypothesis left to best explain the data is the *Primate Biological Hypothesis*, which predicts that all primates (both human and non-human) should perceive the masks as scary, in contrast to non-primates.

Recall from the *Primate Biological Hypothesis* that primates share many structural, emotional, and cognitive aspects of face perception (e.g., Chevalier-Skolnikoff, 1982; Hauser, 1996; Marler, 1965; Van Hooff, 1962). Regarding structure, note the large canines in the three masks considered most scary by humans (*BMC*, *BMO*, *Vampire*). Large canines in male primates, which can induce severe wounds, presumably evolved in response to intense intra-male aggression during breeding activity and also are important in mobbing of potential predators (Leutenegger & Kelly, 1977). Thus, large canines appeared to be an important basis for the high human scariness ratings, and the zoo primates appeared to agree with this assessment. Also note that, apart from facial structure, many masks have highly exaggerated emotional expressions. For example, *Scream*, *Sewage*, and *BMO* all have frowning eyebrows and mouths resembling *open-mouth-threats*. *Martian*, with widely gaping eyes and grinning mouth, appears to be making a *fear-grimace*. These emotional expressions may also have caused avoidance responses in the primates (e.g., Redican, Kellicutt, & Mitchell, 1971). Even the least scary masks (*Bill* and *Al*) had grins, which the zoo primates may have interpreted as *fear-grimaces*. Interestingly, the masks that were perceived as most scary by both the human and non-human primates had many characteristics seen in threatening human ceremonial masks (Aronoff et al., 1988).

However, the data do suggest some subtle differences between human and non-human primate perception. Note that two masks (*Gorilla*, *Bill*) in Figure 3 appear to be outliers. Regarding *Gorilla*, the humans rated him with a rank of 4 (*moderately scary*), and many thought he was actually “kinda cute,” one even calling him “Mighty Joe Young.” In contrast, the zoo primates ranked him as *very scary*, with the highest mean latency of all the masks (84 s; rank = 13), even edging out *Vampire* (81 s; rank = 12). This differential reaction makes some intuitive sense, because the zoo primates may have reacted to *Gorilla* as if he were a strange (and real) alien primate “invading their territory.” Regarding *Bill*, the humans rated him as similar to *Al*, both with low non-scary ratings of about 2. But the zoo primates responded to *Al* with a much higher mean latency (57 s) than *Bill*

(23 s), probably due to *Al's* exaggerated grin resembling a more pronounced *fear-grimace*.

Consider again the result that the non-primates did not find the masks scary. Yet many non-primates (e.g., carnivores) also have large canines that could be used for intra-specific aggression, and many non-primate prey species (e.g., hoofed animals) should also be able to recognize large canines in predators as scary. The present negative results from the non-primates thus indicate that the mere structural component of a mask is not sufficient to scare a non-primate. Apparently, for primates, some additional higher-level emotional or cognitive interpretation, combined with the structural component, is present which causes them to perceive a mask as scary.

An Incomplete Story

The latency measure does not tell the whole story about our animal participants. Spontaneous vocalizations and gestures were very frequent in the primates (and non-existent in the non-primates), and extremely interesting to observe. For example, Table 2 shows four high-level primate responders, all with mean latencies of > 100 s. These were: *Willy* and *Reba* (the bonnet macaque pair), *Marcel* (the male gray-cheeked mangabey), and *Spencer* (the male spider monkey). While these four monkeys appear similar in the latency measure, their behavioral and emotional responses to the masks were very different. *Willy* and *Reba* simply disappeared to avoid seeing the mask, by calmly retreating into their house. In contrast, *Marcel* and *Spencer* both got very excited, and chose instead to "mob" the intruder by shaking their cages and making alarm calls and threatening facial gestures. However, the common denominator of these different behavior patterns appears to be that the masks were perceived as scary, or at least in some way disturbing or threatening.

Improving the Control Trial

Note that there is a possible confound in the experiment due to the nature of the control trial: E2 was familiar to all the animals, therefore our control latencies are confounded by a familiarity variable not present in the masks. There are two ways to eliminate this confound: (1) Find a control mask that the primates perceived as similar to the present control trial. We had intended that our two non-scary masks *Bill* and *Al* would fulfill this function, but they did not; even innocuous *Bill* was differentially perceived by the primates versus non-primates. (2) Use an unfamiliar human as the control face. In fact, there is anecdotal evidence that an unfamiliar human would not scare the primates. After testing *Spencer*, one of the “high-level-responders” (see above), E1 asked a casual zoo visitor to feed the monkey in the same way as E2. *Spencer* took the food with no delay, and this behavior was not surprising since both zoos allowed limited animal feeding by zoo visitors, although not at the close range of the present experiment.

Individual Differences

Sissy, the female spider monkey, had short latency responses to all the masks, similar to those of the non-primates (M = 5 s). The zoo staff reported that *Sissy* has always been very "laid back," rarely responding to other types of stimuli that typically scare the monkeys, such as overhead planes or loud trains, but they could not determine why this was the case, except that she was somewhat elderly. In another case, a single bird (macaw *Buddy*) responded to the masks with longer primate-like latencies (M = 48 s). *Buddy's* origin is not well documented, but according to the zoo, he was "human-raised from an egg." It is thus possible that *Buddy* "imprinted" on a normal human face, and was therefore able to recognize a scary mask as an abnormal human face.

To summarize, our results indicate that, although the tendency to perceive Halloween masks as scary is greatest in primates, this is not always the case. Future animal test participants should include more birds, particularly those susceptible to imprinting and raised by humans. Other animals that seem to "bond" with humans, such as domesticated dogs, cats, horses, or performing dolphins, would also provide interesting populations for future inquiry.

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