Encounters with Kismet and Cog:
Children Respond to Relational Artifacts

Sherry Turkle, Cynthia Breazeal, Olivia Dasté, Brian Scassellati

Abstract

Kismet and Cog, humanoid robots at the MIT Artificial Intelligence Laboratory, are “relational artifacts,” objects designed to present themselves as having “states of mind” that are affected by their “social” interactions with human beings. Sixty children, from 8 to 13 were introduced to Kismet and Cog during the summer of 2001. The children’s first encounters with these robots provide a window onto how such objects – and in particular, the robots of the future -- may enter into how children think about life, intentionality, friendship, and what is special about being a person.

Introduction

Traditionally, Artificial Intelligence largely concentrated on engineering systems that impressed through their rationality and cognitive competence – whether in playing chess or giving “expert” advice. The past decade has seen the development of a new kind of computational object: “relational artifacts.” These objects present themselves as having “states of mind” that are affected by their interactions with human beings (Turkle 2001, 2002, 2004). They are designed to impress not so much through their “smarts,” but through their sociability. The humanoid robots Kismet and Cog, designed at the MIT Artificial Intelligence Laboratory, exemplify such objects, explicitly designed to relate to people in human-like ways, to “detect stimuli that humans find relevant… respond to stimuli in a human-like manner… [and] have a roughly anthropomorphic appearance. (Scassellati 2002, 49).”

In the summer of 2001, Cynthia Breazeal (chief developer for Kismet), Brian Scassellati (chief developer for Cog), and Sherry Turkle (a clinical psychologist and ethnographer) – all of MIT – introduced a group of children to Kismet and Cog and closely observed their interactions.[i] This work was not experimental, but exploratory and qualitative, meant to increase understanding of the issues children raise at a first encounter with a novel form of social intelligence. This paper provides an overview of the children’s first responses, suggesting how relational artifacts engage children in powerful ways and may come to affect their views of life, sentience, and relationship.[*]

Overview of Relational Artifacts

Relational artifacts include complex research robots such as Kismet and Cog, as well as a wider set of objects that have found their way into the consumer market: humanoid dolls, virtual creatures, and robotic pets. At varying levels of sophistication, these objects give the impression of wanting to be attended to, of wanting to have their “needs” satisfied, and of being gratified when they are appropriately nurtured.[ii]

American children first met relational artifacts with the 1996 introduction of Bandai’s Tamagotchi, a small virtual creature whose screen is housed in egg-shaped plastic. The instruction book included in the packaging presented the child with a narrative that stressed the creature’s need for nurturance:

> There are a total of 4 hearts on the “Happy” and “Hunger” screens and they start out empty. The more hearts that are filled, the better satisfied Tamagotchi is. You must feed or play with Tamagotchi in order to fill the empty hearts. If you keep Tamagotchi full and happy, it will

[*] Olivia Dasté, Turkle’s research assistant, joined the project in September 2001, at the beginning of data analysis.

> grow into a cute, happy cyberpet. If you neglect Tamagotchi, it will grow into an unattractive alien.[iii]

The Tamagotchi requires that its user determine whether it needs to be cleaned, fed, or amused by assessing its state on a small screen display. If the user, usually a child under 12, successfully reads and responds to the digital creature's state of mind, the toy will be "happy." It will flourish and survive.

In the toys that were produced for the Japanese market, the penalty for not caring adequately for a Tamagotchi is the creature's death. In some versions, the dead Tamagotchi could be uploaded to a virtual graveyard. In the United States, manufacturers decided on a less harsh resolution: a neglected Tamagotchi becomes an "angel" and is "uploaded to its home planet." Additionally, in the United States version, a user can hit the "reset" button and be presented with another creature. Even with the opportunity for multiple chances, from the child's point of view, acceptance of the caretaker role is the crucial step in creating a bond with the inanimate; Bandai's website provided clear moral instruction to link responsibility with nurturance in the relationship with a virtual pet:

> Tamagotchi is a tiny pet from cyberspace that needs your love to survive and grow. If you take good care of your Tamagotchi pet, it will slowly grow bigger, healthier, and more beautiful every day. But if you neglect your little cyber creature, your Tamagotchi may grow up to be mean or ugly. How old will your Tamagotchi be when it returns to its home planet? What kind of virtual caretaker will you be?[iv]

Furbies, the toy fad of 1998-99, are small furry creatures with large, prominent eyes and the ability to "speak." In the case of Furbies, the child's caretaking responsibility is centered on teaching. Like Tamagotchis, Furbies are presented as visitors from another planet. This explains why they only speak Furbish when they are first brought to life: it is the mother language of their planet. In the course of play, Furbies "learn" to speak English. In fact, this learning reflects the unfolding of a program that evolves Furby language to a set of simple English phrases. (In other words, no matter what language a child speaks to a Furby, that Furby will learn English.) For most children 5-9, the illusion works: children believe that they are teaching their Furby by interacting with it. As in the case of Tamagotchis, Furbies demand attention; children understand that a lack of attention will have a negative impact on the toy's inner "state."

Similarly, My Real Baby, introduced by Hasbro in 2000, has inner states that a child needs to decipher (through its baby sounds and baby facial expressions) in order to appropriately "nurture" the toy. My Real Baby was a descendent of a robotic doll first developed by iRobot, known as Bit. Rodney Brooks, the Director of the MIT Artificial Intelligence Laboratory and founder and director of iRobot, describes Bit in terms of its inner states:

> If the baby were upset, it would stay upset until someone soothed it or it finally fell asleep after minutes of heartrending crying and fussing. If Bit…was abused in any way- for instance, by being swung upside down- it got very upset. If it was upset and someone bounced it on their knee, it got more upset, but if the same thing happened when it was happy, it got more and more excited, giggling and laughing, until eventually it got overtired and started to get upset. If it were hungry, it would stay hungry until it was fed. It acted a lot like a real baby. (Brooks 2002, 109)

Although more sophisticated (and more expensive), Sony's Aibo home entertainment robot (in the shape of a dog) participates in the basic narrative of connection through caretaking that characterizes Tamagotchis, Furbies, and My Real Babies. Aibo responds to noises, makes musical sounds to communicate and express different needs and emotions, and has a variety of sensors that respond to touch and orientation. The robot dog develops different personalities depending on how it is treated by its user. Newer Aibo models have facial and voice recognition software that enable the creature to recognize its "primary caregiver."

Cog and Kismet are highly evolved examples of relational artifacts. Cog is an upper-torso humanoid robot, with visual, tactile, and kinesthetic sensory systems. Cog is capable of a variety of social tasks including visually detecting people and salient objects, orienting to visual targets, pointing to visual targets, differentiating between animate and inanimate movement, and performing simple tasks of imitation. Kismet is a robotic head with five degrees of freedom, an active vision platform, and fourteen degrees of freedom in its display of facial expressions. Though the heads sits disembodied on a platform, it is winsome in appearance. It possesses small, mobile ears made of folded paper, mobile lips made from red rubber tubing, and heavily lidded doll eyes ringed with false eyelashes. Its behaviors and capabilities are modeled on those of a pre-verbal infant. (Breazeal and Scassellati 1999, 2000; Breazeal 2002, 5). It gives the impression of looking into people's eyes, can recognize and generate speech and speech patterns, albeit to a limited degree.[v]

Kismet engaged children through its ability to make eye contact, to exhibit facial expressions, to display "affective" states, and to respond to language with utterances of its own, including the ability to repeat a requested word, most often "Kismet." Cog engaged children by looking in their direction and copying their arm motions. Kismet engaged children through its ability to make eye contact, to exhibit facial expressions, to display "affective" states, and to respond to language with utterances of its own, including the ability to repeat a requested word, most often "Kismet." Cog engaged children by looking in their direction and copying their arm motions.

The Study

A major tradition of Human Robot Interaction studies are aimed toward the production of new machines that are able to hold the attention and interest of the user while engaging in "effective" (task-oriented) social interactions. (Bourke and Duffy 2003; Baltus et al. 2001; Breazeal 2002; DiSalvo and Gemperle 2003; Goetz and Kiesler 2002; Kidd 2003). The focus of this report is rather on the fantasies and expressive behavior of the children, in particular on the question of how children situated themselves in social relationships with the robots. What were the children able to express about their sense of these relationships and their meaning, even through brief first encounters?

Participants in our study, from 8-13, all of whose identities are disguised, were drawn from summer after-school programs and community organizations, such as a performing arts summer camp. The research team posted invitations to participate in a study about what children think about robots; families interested in the study initiated the contact. Participants represented a wide range of socio-economic positions, and ethnicities.[vi] Upon arriving at MIT, each child was assigned to a clinical researcher who accompanied him or her through the day. At least one clinical researcher and one roboticist staffed each encounter between child and robot. Interactions with the robots were video recorded and a combination of audio and videotapes were used to document the remainder of the child's time in the laboratory. During the one-on-one visits with the robot, participants were told that they could do whatever they wanted as long as it was not harmful or dangerous either to themselves or the robot. Participants were asked to wear a wireless clip-on microphone, which the clinical researchers explained was being used to assist in recording their conversation in the noisy laboratory room. In addition, Kismet actually used this audio signal to detect word choice and vocal prosody. Cog did not use this information.

Our approach was to interfere as little as possible with each child's encounter with the robot. If necessary, participants were assured that they could approach and touch the robot. If they asked for guidance or seemed anxious, the research team provided a supportive question (i.e., "What do you notice about Kismet right now?") or, if necessary, a more directive request (i.e. "Can you try to get Cog to wave at you?"). Stuffed animals were available in the areas around both robots and children were told that they could use them if they wished. In general, each child had about 20 minutes alone with the robot and was told when they had five minutes remaining in their session. After the session with the robot, children had a conversation with their assigned clinical researcher about their experience. After this interview, children came back for a group session of about 30 minutes with the robot and the roboticist during which they were encouraged to chat with each other, and to ask questions. Each child spent about 50 minutes with the robot. Most interacted with only one robot.[vii]

Sessions with Cog included a special "debriefing" during which Scassellati explained the mechanics of the robot to the children. Each child then was provided the opportunity to "drive" Cog, which meant "turning off" the robot as an autonomous actor and assuming control of its behavior. This explicit debriefing presented a chance to test the limits of the children's perseverance in their "animation" of the robot. Indeed, one of our most striking findings is that children persevered in their animation and anthropomorphization of these humanoid robots even when the robots failed to operate properly and even when there was a determined effort to "demystify" the machine. Children continued to imbue the robots with life even when being shown -- as in the famous scene from the Wizard of Oz -- the man behind the curtain.

Here we describe three major themes that emerged from our study of first encounters.
Children display **perseverance** in their efforts to communicate with the robots, including finding ways to explain and excuse the robots' failures to communicate with them, perseverance that expresses a range of personal styles. A similar range of styles marks children's ways of **anthropomorphizing** the robots. For the most part, children come to see the robots as "sort of alive" because they feel in a social relationship with them and use a range of strategies to overcome disappointments and system failures. Finally, children's stake in preserving a sense of relationship is so strong that they **actively resist any demystification of the robots.** With few exceptions, children were uninterested to the point of unwilling to understand the robots in terms of underlying mechanism.

Theme 1: Perseverance and the expression of personal style: Robot as Rorschach

Kismet and Cog are research robots in a university laboratory environment. In the course of our study, laboratory members were continually working on them. The goal of this work is improving robot performance. Its cost is an unstable platform. At various points during our study, Kismet had difficulties tracking eye movement, responding to auditory input, or vocalizing. And one of Cog's arms was inoperable for the duration of the study, limiting its abilities to imitate motion. Despite these limitations, children persisted in trying to elicit speech from Kismet (with the greatest focus on getting Kismet to say its name) or getting Cog to imitate their arm movements.

> Heather, 7, is energetic and vibrant. She is small and thin, with sparkling blue eyes, and a ready grin. Before meeting Cog, Heather informs the clinical researchers that if she could take a robot home she would treat it "just like a pet." It would sleep outside and she would give it bones to eat. During her session, Heather speaks to the robot directly. Scassellati introduces Cog and demonstrates that the robot can raise its arm by imitating human movement. When she is alone with Cog, Heather performs what she calls "an experiment" where she tries to have the robot raise its arm to model her pointing gesture then attempts to place a stuffed animal on Cog's raised arm.[viii] Heather's goal is to have Cog balance the toy on its raised arm. With each attempt, Heather raises her arm and instructs Cog to do the same. In a typical interchange, Heather says: "Up. Up. Up. Like you are pointing at me. Up! …now steady…." and rushes to place the toy on Cog's lifted arm. Each time she succeeds in balancing the toy, Cog's arm drops. Undeterred, Heather always tries again: "Now let's try that again. Up. Up, robot. Uuuuuuuuup! Thank you. Now steady…." Heather's tone ranges from commanding to pleading as she tries a range of toys in the seeming hope that one or another toy might better hold the robot's attention. She refuses to give up and continues her "experiment" until the very end of her individual session. (Session 17, S52)

Heather's perseverance was typical: like most children, she set a goal for the robot and spent the majority of her session trying to achieve the desired outcome. Although some children became frustrated, most continued to believe in the robot's abilities to perform and respond to them. Not surprisingly, children had different styles of persevering in their work with the robot that reflected individual personality. So, for example, more aggressive children become angry at the robots, while children with gentler natures responded to the robots' "difficulties" with sympathy.

Perseverance through nurturance

Many children, especially female participants, took on parental roles in Kismet's company and attributed to Kismet the persona of a very young child. Children coaxed and cajoled Kismet to speak, trying to reward the robot with kind words or gentle touch. Children interpreted Kismet's interactivity as a sign that it was enjoying their presence and illustrated with their words and gestures that they felt accepted and needed by the robot:

> Marianne, 10, is quiet and thoughtful. Tall and slender, she wears her dark hair in tightly woven braids. She appears removed from the boisterousness generated by the two boys also attending the session. When she sees Kismet, Marianne is immediately engaged: "How are you doing?" she asks. Kismet does not respond; Marianne is undeterred. She repeats her original question with marked gentleness, "How are you doing?" Again, Kismet is silent. Marianne tries again and again, each time with more softness and tenderness, until Kismet finally responds. Kismet's vocalizations are not comprehensible; Marianne says apologetically, "I'm sorry, I didn't hear you" and patiently repeats her questions. This pattern continues. With each attempt she leans in closer, placing her ear near Kismet's mouth. She moves to asking Kismet "What is your name?" and repeats, "I'm sorry…What are you looking at?" She goes on to try getting Kismet's attention with its toys.
>
> As the session goes on, Marianne does not give up or show any sign of frustration. Instead, her voice remains paced and gentle, coaxing Kismet to respond and to play with her. She asks her questions kindly, in a singsong way, as if talking to a baby. Marianne tries to have Kismet join her in singing the ABCs. She asks, "Can you sing for me? Do you want to sing the ABC's? Can you sing it? A…B…C…D…E…F…G… Huh?" Marianne sings the alphabet softly and slowly, trying to encourage Kismet to join in with her. She further entertains Kismet by playing Peek-a-Boo, covering the robot's eyes and then removing her hands and saying "Boo!" Marianne's use of affection in her communications with Kismet conveys her belief that by interacting with Kismet as a child, by nurturing it, Kismet is likely to respond. (S47, Session 15)

* * *

> Trisha, 5, attends the session with her older sister Danielle. Trisha comes to the lab expecting that the robots would be "like animals that live in a cage." When she first meets Kismet, Trisha refuses to come near the robot. She pulls back into a corner and seems genuinely frightened.
>
> After being reassured by the researchers and her sister, Trisha cautiously takes a step towards Kismet and asks, "Are you a nice robot?" A few silent moments later she takes another step and says, "Hello. My name is Trisha." Kismet is silent. She tries again, slowly and gently, "Tri-sha…. What is your name?" Trisha continues looking intently into Kismet's eyes, gently speaking to it, and showing it great physical tenderness by caressing its eyebrows, neck, and base. Finally, Kismet makes a cooing sound; Trisha smiles. Encouraged, she tries again to get Kismet to answer her questions, repeating them softly, slowly pronouncing every syllable, while continuing to caress the robot. Trisha shows Kismet the color segments on a stuffed toy caterpillar, and coaches, "Green… Blue… Orange… Purple… Red… Orange… Yellow…"

Kismet is silent. Trisha pets the space between Kismet's "eyes" and says, "Don't be scared." Before she leaves, Trisha gives Kismet a hug. (Session 10, S30)

Children related to both Cog and Kismet as sentient, but most children saw Cog as a playmate or peer while Kismet tended to evoke the desire to parent. It was common for children to say that Kismet reminded them of an infant or younger sibling. When children played with Kismet, they often urged the robot to pay attention to them, to listen, to try harder.

> Mandi, 9, radiates energy. She tells the clinical researchers that what she enjoys most is bothering her three older siblings and playing with her baby sister. She first asks Kismet, "What is your name?" and subsequently, "Do you have parents?" Mandi is unusually gentle with Kismet. Encouraged by a vocal response from Kismet, she asks, "Do you have brothers and sisters?" Since there is no answer, she repeats her question three times. As the session unfolds, Mandi increasingly speaks of Kismet as a female, using "she" and "her" and seems to treat Kismet as a little girl. Mandi asks Kismet, "Do you like ice-cream? (Kismet says something) I think she said yes. What kind of flavor do you like?" Mandi cycles through different conversation topics, asking Kismet what her favorite color is, if she goes to school, if she has any toys. Mandi plays tries to engage Kismet with its toys, dangling them for Kismet's enjoyment.
>
> Mandi seems to analogize Kismet to her six-week-old sister. Speaking to a clinical researcher, she says, "I think that she [Kismet] is a baby because these toys look like little baby toys." Mandi says that Kismet is a little bit older than her sister because Kismet speaks better. Further, Mandi says that Kismet might get sad just like a baby even if she can't cry and that if the roboticists made arms for Kismet that she would scribble over the pages of a coloring book and put things in its mouth. She thinks Kismet has a birthday and that the robot was born from a stomach. In her post interview, Mandi maintains her belief that Kismet is born and that she has parents, as well as brothers and sisters. Mandi believes that Kismet learns to speak better with every child that comes to visit. She says that "[Kismet] is still little, but it grows up. It looks little, but it still grows up." that she will continue to learn and will mature "inside" even if we might not be able to tell from outside. (Session 16, S49)

Many children believed that they had "taught" Kismet something. The act of teaching, a form of nurturance, reinforced the bond between child and robot. It also gave children the sense that Kismet thinks, remembers, and is sometimes in more of a mood to learn than at other times. The confidence Mandi expressed in Kismet's internality, a common assumption, supported her identification with the robot's learning process. To children, Kismet was like them and although it was having difficulty, it seemed to be "trying." Some children were pleased that Kismet trusted them enough to learn from them. Children were openly affectionate with Kismet, showering it with hugs, kisses, and caresses, making sustained efforts to entertain it with stuffed animals and rattles. Some tried to amuse it with favorite childhood games such as Peek-a-Boo and favorite childhood songs. In one case, a child made clay treats for Kismet to eat. Poignantly, one child told Kismet that he was going "to take care of it and protect it against all evil."

Perseverance through belligerence

Some children showed no less determination to stick with Kismet and Cog in spite of the robots' frustrating behavior, but persisted with anger rather than nurturance. Two boys exemplified this style of engagement.

> Adam, 6, has curly chestnut hair. He is rather small but seems to have twice the energy for his size. Andrew is very articulate and seems competitive, and mischievous. Before the beginning of the session, Adam's father tells the clinical researchers that Andrew had two questions: Could he take the robot home afterwards, and did it have weapons? Adam's father

says that his son has been into fighting games, likes rough playing, and likes to be "in charge" at home and school. In his initial meeting with Kismet, Adam asks the robot, "Can you talk?" When Kismet doesn't answer, Adam repeats his question loudly and with increased urgency. Adam becomes very frustrated when Kismet persists in staring into space. Adam tries to understand Kismet, but soon decides that it doesn't make any sense. After a series of "What?" "What?" "What?" Adam tells Kismet to "shut up!" Adam starts forcing various objects in Kismet's mouth, first a metal object then a toy caterpillar saying, "Chew this!" He becomes increasingly angry at Kismet for not paying attention to him and for not being comprehensible. At no point does he disengage from the robot. (Session 27, S27)

* * *

Jerome, 12, was born in France and moved to the States when he was four. He visits the robot lab with his two younger brothers and begins his time there as very unenthusiastic about the enterprise. He reluctantly answers the clinical researchers' questions and speaks through harsh insults to his brothers, compounded with aggressive behavior towards them. He asks Kismet half-heartedly, "What's your name?" When he does not receive an answer, Jerome covers Kismet's cameras and orders, "Say something!" After a few more minutes of silence he then shouts, "Say shut up! Say shut up!" Seeming to fear reprimand, Jerome continues with less hostile words, but continues with his brusque tone: "Say hi!" and "Say blah!" Suddenly, Kismet says "Hi" back to him. Jerome, smiling, tries to get Kismet to speak again but when Kismet does not respond he forces his pen in Kismet's mouth and says, "Here! Eat this pen!" Though frustrated, Jerome does not tire of the exercise. (Session 20, S58)

Perseverance through resourcefulness

Robot unresponsiveness served as a window onto children's various styles of coping with frustration. Some nurtured; some cajoled; others reached for alternate means of communication, assuming always that the robots were "alive enough" that their failures to communicate could be overcome through increased effort. So, for example, some children tried to "speak Kismet" back to Kismet, repeating the babble they heard from the robot, while others acted hurt and tried to make Kismet feel guilty about not speaking to them. Others tried speaking foreign languages with Kismet, interpreting its difficulties as those that might be encountered by any alien.

Roanne, 12, is very eager to speak with Kismet, but the robot is not answering her questions. Roanne patiently tries to engage Kismet. She asks, "Do you sing? Do you sing? {slower, more articulated speech} Do you sing? Say yes… I think he speaks French. Do you sing? Do you sing? [Kismet speaks] He said he trusts me! Ok!" When it is time to end the session, Roanne says "Adios" to Kismet. Roanne decides that Kismet spoke to her in Spanish. When asked what she thought Kismet might be saying, Roanne replies, "All it said was, I can't remember, but he said 'get lost' stuff like that, and I can't remember the other words. The other words he said in Spanish." The clinical researcher then asks, "Do you think when you said 'Adios' it understood that?" Roanne answers, "Yeah." (S25, Session 8)

* * *

Chi, 6, is a small quiet boy who refers to Kismet as a "she" throughout his session. Kismet's microphone is broken and Kismet is making incoherent sounds instead of words. Chi says that he cannot understand what Kismet is saying but he knows it isn't English. Chi asserts that even thought he doesn't know Korean, he is sure that Kismet is speaking Korean. He says that he wishes Kismet could speak English so that she could speak to him about herself. (S29, session 9)

Still other children tried to cope with the robots' limitations by turning to sign language. In the case of Cog, their logic for using sign language was impeccable: Cog can only see, signing would be the appropriate language for the "deaf" robot just as it would be for a deaf person. And although Kismet was generally able to "hear," on several occasions there were technical problems with its microphone and it was rendered "deaf," again leading children to make the case for signing.

> Mort, 5, has difficulty accepting that Cog does not speak. He is affectionate and curious about the robot, but resolute in his belief that Cog both "thinks" and "wants to talk to me." When he and his friends speak to Cog, they want an answer. When Cog's only response is to raise his arm, Mort offers, "I think he is doing sign language." Mort's friend asks, "Why doesn't he talk?" Mort tells her, "I think he is talking right now. I think he's talking in sign language" (S42, session 14)
>
> * * *
>
> Heather, the seven-year old earlier described for her persistence, was also convinced that sign language would be a good way to communicate with Cog. When Cog fails to follow her instructions she suggests to the researchers, "Maybe he understands sign for things." Later, during her post-interview with one of the clinical researchers, she says that she would like to take Cog home with her where she would teach it sign language. Further, she explains that she would teach it by having it watch a special video made especially to teach people sign language. Heather shows the researchers the sign language that she would teach Kismet, including the signs she know for "house," "eat," and "I love you." (S52, session 17)

Perseverance through the "ELIZA effect"

Children want the robots to be responsive. When the robots were not working perfectly and could not comply, children go to great lengths to "cover" for them and their limitations. Even when they were told that the robot with which they were playing was broken or that a particular function was not working (in other words, when they were given "mechanistic" explanations for robot problems) children created explanations that preserved their image of the robot as sentient and caring about its relationship with them.

The tendency to work around a computer's relational limitations has long been part of our understanding of computer-human interaction. Joseph Weizenbaum's ELIZA (or "Doctor") program was designed to respond in the manner of a Rogerian psychotherapist (it mirrored a statement – "I'm angry at my mother" and turned it into a solicitous reply: "Why do you say you are angry at your mother?"). The program was seductive, even Weizenbaum's graduate students who "knew" that the program could not "know" or "understand" wanted to converse with it and confide in it. They wanted to be alone with it (Weizenbaum 1976). Weizenbaum himself became indignant, insisting that he had written the program as a joke and was troubled that people wanted to converse seriously with what he estimated to be little more than a parlor trick.

In her studies of people's relationships with ELIZA, Turkle observed that people "helped" ELIZA to seem more intelligent than it actually was. They refrained from making comments or asking questions that might have confused it and asked it questions that would ensure a human-like answer, going to considerable ends to protect their illusion of a relationship with it (Turkle 1984, 40). In The Second Self, Turkle describes a 5-year-old named Lucy who creates dialogues to fit the Speak and Spell's speaking abilities and maintain an illusion of conversation. Lucy would tailor her demands to what the toy could say; she could essentially force the toy to address her. We saw many examples of this "helping" behavior in our study, particularly in relation to Kismet. When all evidence pointed to a broken or malfunctioning robot, children rationalized

Kismet's failings: the robot is deaf, it is too young to understand and respond correctly, it is ill, it is not responding because "he doesn't like me," it makes sense but is speaking another language, it is very shy, and it is not broken but sleeping. What was at stake was not just an image of Cog and Kismet as intelligent and intentional beings. More centrally, children's excuses and helping behavior preserved their sense that the robots cared about them.

> Jonathan, 8 is terrorized by his two older brothers whose favorite pastime is "to beat him up." In contrast to his brothers, Jonathan is talkative, light-hearted, and displays much enthusiasm about being at the lab. He wears an oversized blue tee shirt and shorts. He tells the clinical researchers he wishes he could build a robot to "save him" from his brothers. He says that he wishes he could have a robot as a friend to tell his secrets to and to confide in.
>
> Jonathan says that he is sure Kismet will talk to him. Upon meeting Kismet, he tells the robot, "You're cool!" As Kismet vocalizes, Jonathan interprets Kismet as saying what he wants, first "What are you doing, Harry [one of his brothers]?" and then "I'm going to kiss you. He said, I'm going to kiss you!" Kismet continues incoherently babbling. Jonathan nevertheless smiles and says again, "You're cool!" with a thumbs-up. Though Kismet is not actually repeating Jonathan's suggested words, Jonathan turns to the researchers and says "See! It said cheese! It said potato!" Jonathan says that Kismet is learning and is saying the words he is teaching it to say. At other times, Jonathan would make explanations for Kismet's incoherence. For example, when Jonathan presents the dinosaur toy to Kismet and it utters something like "Derksherk" Jonathan says, "Derksherk? Oh he probably named it [the toy]! Or maybe he meant Dino, because he probably can't say 'dinosaur.'"
>
> When Kismet stops talking completely, Jonathan suggests "Maybe after a while he gets bored." He tries to use Kismet's toy to get its attention, when this fails he says that the toy actually "distracts" Kismet. Jonathan is showed Kismet's voice recognition display, which displays what Kismet is "hearing." Jonathan tries to speak "Kismet language," repeating what he sees on the monitor. When this doesn't work to prompt a response from Kismet he insists, "I don't think it's hearing me so good." Towards the end of the session, Jonathan concludes that Kismet stopped talking to him because it liked his brothers better. (Session 20, S60)

* * *

> Samantha, 6, is extremely excited to meet Kismet. She is very affectionate towards the clinical researchers and has great expectations about what robots can do. She asks Kismet to speak but the roboticist tells her Kismet is having technical problems. Instead of having this break down her experience of being in a relationship, she becomes increasingly active in her efforts to maintain it.
>
> First she sings "Happy Birthday" to Kismet and pretends to make Kismet eat a clay birthday cake she has just sculpted in its honor. When Kismet doesn't answer her questions, such as "Was it good?" she simply answers for it, "Yep!" She asks the researchers if Kismet is having problems hearing but continues her fantasy. Her first comment when hearing Kismet vocalize is "He likes me!" The pattern is that Kismet babbles, she ascribes meaning to its vocalizations, and then engages in a conversation based on her ascription of meaning. She says that Kismet is speaking English just fine and that she can understand perfectly well what it is saying to her. When asked what Kismet is talking to her about, Samantha says that Kismet is answering all her questions. Before leaving Kismet, she tries to have the robot say, "I love you" and "Samantha." She kisses it gently then hugs it goodbye. (Session 18, S54

Theme II. Anthropomorphization: A Range of Styles of Animating the Machine

Kismet and Cog do a great deal to evoke their anthropomorphization. They both are able to track to color and movement. Cog moves its torso and orients its gaze. Kismet moves its neck and head and has facial expression. Its doll eyes give the impression of direct eye contact. Eye contact is crucial in the process of anthropomorphization. As Rodney Brooks writes, “Between people, gaze direction and gaze-direction determination are crucial foundational components of how we interact with each other.”(Brooks 2002)

The tendency for people to attribute personality, intelligence, and emotion to computational objects has been widely documented in the field of human-computer interaction (see for example Weizenbaum 1976; Nass, Moon et al.1997; Kiesler and Sproull 1997; Sproull, Subramani, et al. 1996: Parise; Kiesler et al. 1999; Reeves and Nass 1999). In “Computers are Social Actors: A Review of Current Research,” Clifford Nass, Youngme Moon and their co-authors review a set of laboratory experiments in which “individuals engage in social behavior towards technologies even when such behavior is entirely inconsistent with their beliefs about the machines” (1997,138). Even when computer-based tasks had only a few human-like characteristics, the authors found that participants attributed personality traits and gender to computers and adjusted their responses to avoid hurting the machine’s “feelings.” The authors suggest that “when we are confronted with an entity that [behaves in human-like ways, such as using language and responding based on prior inputs] our brain’s default response is to unconsciously treat the entity as human” (158). And that the more we “like” the object, the more this is likely to “lead to secondary consequences in interpersonal relationships (e.g. trust, sustained friendship, etc.)…” (138).

These laboratory findings are consistent with Turkle’s ethnographic and clinical findings about anthropmorphization in children’s interactions with computational objects. Turkle began working with children and computational objects in the late 1970s. The first objects of her investigation were the first generation of computer toys and games: Merlin, Simon, Speak and Spell (1984). In those cases, even a minimum of interactivity and reactivity provoked children to imagine them as sentient others. Therefore, with robots such as Kismet and Cog (which can draw on the power of the gaze and specifically designed to be actively relational) it would be surprising if children did not imbue them with human-like traits. What was striking, however, was the range of styles of anthropomorphization that was enabled by the robots’ sociable design.

Anthropomorphization through extravagance of detail

One indication of the degree to which children anthropomorphized the robots was that children almost always described the robots as gendered. Turkle notes that earlier computational objects were sometimes treated as gendered, usually referred to as “he,” but that many children used “it” as a default unless asked a question about gender, or moved back and forth between “he” and “it” or between “she” and “it.” In the present study, there was no such slippage. Cog was usually regarded as an adult male and Kismet as a female child, but some children thought both robots were males. Additionally, the machines were consistently thought to be emotional as well as intelligent. Children asked Cog and Kismet how they were feeling, if they were happy, did they like their toys? Children asked if the robots loved them. Children spoke about the robots as if they were persons with minds and feelings.

> Fara, 11, has short chestnut hair and seems particularly mature for her age. Her father is from Egypt and has home-schooled both Fara and her younger brother. She is one of the few children who spends time with both robots. Upon seeing Cog, her first reaction is to exclaim, “Oh, it’s so cute!” when asked to comment on this, Fara says, “He has such innocent eyes, and a soft-looking face” and that this contrast with Cog’s “masculine body.” When Cog raises its arm spontaneously, she exclaims, “I wonder what he’s thinking.” Fara is direct in her efforts to engage Cog. She asks, “What do you want?” “What do you like?” and then, tries to startle Cog. She sneaks up to the robot, jumps out loudly, and noticing Cog’s lack of reaction, says to him, “You don’t get scared, do you?”

Fara first tries to get Cog's attention; then she tries to have the robot raise its arm. Cog is responsive but there is a slight delay for the reactions. Instead of a mechanical explanation, Fara blames Cog's mind for the delay. Addressing Cog she says, "You are kind of slow, aren't you?" and then turns towards the others in the room, "He's slow- it takes him a while to run through his brain." She says this sympathetically, empathetically.

Fara wants to have Cog as a friend and thinks that the best part of being its friend would be to help it learn. She adds that in some ways, Cog would be better than a person-friend because a robot wouldn't try to hurt your feelings, she adds, "It's easier to forgive in a way because it doesn't really understand." She says that she could never get tired of it because "it's not like a toy because you can't teach a toy, it's like something that's part of you, you know, something you love, kind of, like another person, like a baby." (Session 1, S2)

* * *

Imani, 9, loves to talk about hip hop and rap music; she wants to be a model and a doctor when she grows up, "just like the ones I've seen on T.V." Imani is convinced that Kismet will make a perfect friend even before meeting the robot. When she first sits down with Kismet, she says hello, introduces herself, and then offers Kismet some candy. Imani asks Kismet, "Are you a robot? Can you say robot?" She asks Kismet if he has friends and later tells the clinical researchers that he would make a great friend if he spoke to people nicely. Imani explains why Kismet is not moving as "He is sleeping, just like when a person is sleeping."

Imani thinks that Kismet said her name and that it understands her. For her, Kismet is definitely alive because it talks and moves like a person. She says that if she took it home she would take good care of it; she would feed it and give it water to drink so that it wouldn't die, she would give it a Tylenol if it felt sick, and would make Kismet "his own room" where there would be a television for Kismet to see other robots "so it won't miss its family and friends." At the same time, she thinks the robot has its own friends and family.

After her session with Kismet, she draws a picture of a robot. She uses bright colors to draw a robot that wears roller-skates and has multi-colored hair tied up with a ribbon. When asked about the robot, Imani says that the robot is a girl robot and "she" is her friend. Her robot sings and raps, mainly about its mom and about being "different." The girl robot has a family of robots who look exactly like "her" and it knows other little robots outside "her" family. Imani adds that the little girl robot only speaks to herself and her mom because other people make fun of her. The girl robot is her friend and ally. (Session 7, S23)

Anthropomorphization through the Discourse of Aliveness

Children most generally thought that the robots were "sort of alive." This category reflects an increasing blurring of boundaries in the culture between what is animate and what is not and the increasing elaboration of a "kind of alive" that is more than mechanical and that stands between an "animal kind of alive" and a "human kind of alive." This blurring takes place in the context of how successive generations of children have responded to successive generations of computational objects that challenge traditional boundaries. (Turkle 1984, 1995, 2000)

In the mid 1930s, the Swiss psychologist Jean Piaget began his investigations on children's use of objects for constructing their view of how the world works (Piaget 1960). Piaget found that as children matured and their physical theory of the world developed, they gradually came to define life in terms of autonomous motion. Gradually, children refined the notion of "moving of one's own accord" to mean "life motions" of breathing and metabolism.

In the 1970s and early 1980s, computers and first-generation electric toys and games such as Merlin and Simon changed the way children engaged with classic developmental questions and, most notably, disrupted the Piagetian story that children define aliveness in terms of autonomous motion. With these new computational objects, children began speaking about aliveness based on what they perceived as the computer's psychological rather than physical properties. The computer's increased "opacity" encouraged children to see computational objects as psychological machines. The toy's ability to "know" things or the game's ability to "solve" puzzles was what made it seem alive.

In the 1990s, children's discussion of "aliveness" became more complex. Simulation games introduced children to characters/entities/avatars that moved and "lived" on the screen, but that could not be touched. This made for a strange in-between category of more than imaginary and less-than-biological beings. Children found inventive ways to manage this new boundary category. They developed a "cyborg consciousness," a tendency to see computers as "sort of alive." Matters were made more complex by new computational objects that embodied principles of evolution (such as the games in the Sims series). Children still tried to impose order on these objects, but they did so in the manner of theoretical tinkerers or "bricoleurs," constructing passing theories to fit prevailing circumstances. They "cycled through" various notions of what it took to be alive, saying, for example, that robots are in control but not alive; would be alive if they had bodies; are alive because they have bodies; would be alive if they had feelings; are alive the way insects are alive, but not the way people are alive. They said that Sims creatures are not alive, but almost-alive; that they would be alive if they spoke, or if they traveled; that they're alive, but not "real"; that they are not alive because they don't have bodies; that they are alive because they can have babies. (Turkle 1995)

Children place relational artifacts other than humanoid robots (such as Furbies or even the very primitive Tamagotchis) in the "sort of alive" category. But what distinguishes their discussions about their sort of "aliveness" from children's discussion of other computational objects studied since the early 1980s is that children focus not on what the objects can do but on their relationships with the objects. For example, a child says, "My Furby is alive because it loves me. It wants to sleep with me. Something this smart should have arms. It wants to hug me." (Turkle 2001)

When a robotic creature makes eye contact, follows your gaze, and gestures towards you, you are provoked to respond to that creature as though it were a sentient, (and even caring) other (Turkle 2002). Clearly, Kismet and Cog didn't "move of their own accord." Their power sources were in view. Although the robots were "plugged in," this seemed irrelevant to the children. What mattered was the robots' perceived intentionality and desire to communicate. And what mattered most, what was most striking, most novel, was the degree to which children felt themselves in a relationship with these objects.

Anthropomorphization through Mutuality

Relational artifacts evoke a sense that the user and the artifact are in a relationship. Children not only see these objects as alive and sentient, they believe that their feelings for the objects are returned. In studying previous generations of computational objects, Turkle has described the computer as a Rorschach, as a relatively neutral screen onto which people are able to project their thoughts and feelings, a mirror of mind and self But today's relational artifacts make the Rorschach metaphor far less useful. The computational object is no longer affectively "neutral." Relational artifacts do not so much invite projection as demand engagement. People are learning to interact with computers through conversation and gesture. People are learning that to relate successfully to a computer it is not necessary to know how it works. Rather it is possible to take it "at interface value," to assess its emotional "state," much as they would were they relating to another person (Turkle 1984, 2002).

In the past, the power of computational objects to act as relatively neutral screens meant that children could project their own meanings onto them. Relational artifacts take a more active stance. With them, children's expectations that their computational objects want to be hugged, amused, or loved don't only come from the child's projection of fantasy or desire onto inert playthings, but from such things as a digital dolls' crying inconsolably or even saying: "Hug me!" or "It's time for me to get dressed for school!" Such behavior inhibits projection -- something that will have significant implications for the kinds of satisfactions and developmental growth that children can obtain from playing with robots –but unquestionably increases a child's sense that he or she is in a specific relationship.

The psychology of engagement over the psychology of projection was apparent even in children's responses to Furbies, which simulate learning and loving in very limited ways. In following children's responses to Furbies, Turkle found that children's ideas about their affection for Furbies became enmeshed with fantasies about how Furbies might be emotionally attached to them (Turkle 2001). When Turkle asked children, "Do you think the Furby is alive?" their responses were not in terms of what the Furby can do, but how they feel about the Furby and how the Furby might feel about them. Charlie (age 6): "Well, the Furby is alive for a Furby. And you know, something this smart should have arms. It might want to pick up something or to hug me." Beyond being smart and alive, relational artifacts evoke love and friendship.

In our summer 2001 study, children spoke directly about experiencing mutual affection and connection with Cog and Kismet. They also signaled their experience of mutuality by unprompted expressions of affection, and the importance of being recognized, acknowledged, and liked by the robots. Children spontaneously kissed Kismet and hugged Cog. Children sang to them and put on dance shows. When Kismet successfully said one of the children's names, even the oldest and most skeptical children commented that this was proof that Kismet liked them. Likewise, if Kismet said the name of another child when one was trying to get Kismet to say their name, this was taken as evidence that Kismet preferred the other child, often causing hurt feelings as well as lively disputes about who Kismet really preferred. When either Cog or Kismet were unresponsive, this was taken as proof that the robots did not like them. The children did not experience a broken mechanism but a personal rejection.

> Jazmyn, 9, is wearing a bright multi-colored tank top over a white tee shirt. She is bubbly, very friendly and enthusiastic. Jazmyn's favorite extracurricular activity is dance; she says that she takes step, hip-hop, jazz, and Latin dance classes. Jazmyn immediately connects with Cog. Scassellati is there with her and they have the following dialogue:
>
> Scassellati: What have you seen the robot do so far?
> Jazmyn: Look at me and raise his hands. Maybe it's trying to shake my hand or something.
> Scassellati: Did you try shaking its hand?
> Jazmyn: Yeah
> Scassellati: What did it do?
> Jazmyn: Shook my hand.
>
> Later, Jazmyn asks if the roboticists were planning on making a mouth for Cog. She says that Cog probably "wants to talk to other people… and it might want to smile." Jazmyn expresses her desire for Cog to relate, to reach out to make contact with her; this is similar to Charlie's wishing that the Furby would hug him back.
>
> As Jazmyn continues her conversation with Scassellati, there is another striking moment.
>
> Scassellati: What do you think the new version of Cog should be able to do?
> Jazmyn: Dance.
> Scassellati: Should it just dance for you or should it be able to dance with you?
> Jazmyn: Dance with it!
> Scassellati: Do you want to dance with the robot?
> Jazmyn: Yeah!
> Scassellati: What kind of dancing would you do?
> Jazmyn: Any kind!
>
> Speaking to one of the clinical researchers, Jazmyn looks pensive and says, "If his other arm could move, I think that I would teach him to hug me." Jazmyn talks about her desire to take Cog home where they would play together, dance together, talk together, and eat dinner

together. Later she dances *for* Cog and says that Cog really enjoyed her performance and thought that it was very interesting. She adds, “I liked that the robot was at first by itself and that it looked at me when I was dancing. I liked that the little circles and squares followed movement while I was moving.” (Session 13, S41)

* * *

Eugene, 8, is thin with large friendly eyes and a ready grin. His mother informs the clinical researchers that Eugene has been playing with LEGOS since he was 2 and that they are his favorite toys. Eugene wanted to bring his remote control car to the robot session so he could ask the engineers at MIT how it works. Eugene is visibly excited in the anticipation of meeting Kismet. Kismet is temporarily broken, and so the roboticist explains how Kismet works. Eugene asks many questions: what is Kismet made of, how does it work, and how long did it take to build the robot. When told that the robot is called Kismet, Eugene responds that this is an unusual name for a child. He seems quite surprised when the roboticist tells him that Kismet’s parts are made and not grown. Eugene thinks that Kismet’s cables are its hair.

When he encounters the robot, Eugene sees Kismet as a male. Eugene says that Kismet is not broken but “just sleeping… he’s sleeping with his eyes open just like my dad does.” Eugene places his arm around Kismet and declares, “He will make a good friend.” Eugene says he can tell Kismet will be a good friend because of its smile. He says that Kismet “looks like a normal good friend.” Before leaving Kismet for the first time, he hugs it and tells Kismet he will see him soon.

Eugene and his sister, 6, are asked what they would do with Kismet. Eugene says, “play baseball” and “eat ice-cream together,” his sister simply says, “Love it.” Eugene says that Kismet would enjoy playing video games and would probably beat him. Eugene and his little sister extensively hug and kiss Kismet and tell the robot how much they love him.

Eugene’s last few minutes with the robot are especially moving. Kismet is babbling nonsense syllables and Eugene is trying to teach Kismet, to have him speak, “Say I love you. Kismet, say I love you.” Eugene tries again and again with a kind voice. Kismet is silent and Eugene looks like he could cry. A few minutes later, Kismet speaks and Eugene decides with what can only be called intense relief, “He said I love you.” Eugene and his sister then proceed to try to have Kismet say their name and are overjoyed when they hear Kismet utter their name. It is time for them to leave, the children look sad. Eugene hugs Kismet gently, his sister kisses Kismet. Eugene looks at Kismet as if indeed he was leaving a friend, and caresses him one more time before a final embrace. (Session 18, S53)

Another sign of mutuality in children’s sense of the relationship was children’s pleasure when Kismet succeeded in speaking or Cog finally raised its arm, a response that exceeded expressions of pleasure children always have when they get a toy to “work.” Children reflected on Kismet and Cog’s having made an effort, or having performed a “job well done.” This pleasure was more akin to parental pride. As children assumed the parental role, they made it clear that their encouragement had been decisive for the robots. When a robot succeeded, children took this as evidence that their patience had borne fruit or that a particular learning strategy had worked. They made the robot’s success into their success.

Theme III. Resistance to Demystification

Even in the very brief encounters with robots, children were drawn into relationships that seemed to matter to them, relationships in which the robots’ behavior affected their state of mind and self-esteem. Our team explicitly discussed the ethics of such encounters and the possibility that the development of such feelings should be tempered by presenting children with a "realistic" or "engineering" perspective on the robots behavior. We found, however, that children's sense that the robots were alive, the degree to which they anthropomorphized them, and their sense of consequence from the interactions with the robots were little if at all affected by learning more about how the robots "worked," i.e. their "mechanical" nature.

In our fieldwork, we explicitly tried to experiment with the effects of methodically "demystifying" the robots, with the idea that such honesty might make the relationship between person and machine more authentic. We used strategies for making the robot "transparent" to the users (in terms of underlying mechanism) with both Kismet and Cog, but were most systematic in addressing this issue with Cog. Scassellati had a particular interest in developing "responsible pedagogy" in robotics. He was committed to showing children the machine behind the "magic," feeling that it was inappropriate for children to leave the laboratory under the illusion that Cog was an animate creature. In our study, 30 children first had an individual play session with Cog, then were joined by Scassellati who proceeded to explain to the children exactly how Cog worked, giving a real-time demonstration of how it processes information. Children were shown the computers that helped to run Cog, the monitors that showed what Cog saw, and were encouraged to ask any questions they might have about how the robot functioned. Finally, and most importantly, children were allowed to "drive" the robot, meaning that they had a chance to control the robot's movements and behaviors. Metaphorically, they got to see the robot "naked."

When Scassellati first suggested giving children a "reality check" by putting them in touch with the robot as a transparent mechanism, there was much discussion about its possible impact. Researchers hypothesized that the demonstration would alter children's sense of Cog as sentient. Turkle has studied people's relationships with increasingly opaque computers and charted a trajectory from a culture of calculation (based on the idea that the computer could be understood in mechanical terms) to a culture of simulation (here, computers have become objects that present as opaque and people are asked to take them "at interface value" (Turkle, 1995, 1997). As the focus shifted to interaction with an opaque surface, people increasingly related to the machine as a psychological entity. Now, we were intrigued by the possible effects of didactically insisting on a transparent view of an otherwise opaque robot. Would the robot, now presented as mechanical, systematically stripped of its extraordinary powers, and more relevantly, of any illusion of its autonomy, seem less likely to serve as a companion, seem less "worthy" of relationship?

In the event, stripping the robot of its powers and making it "transparent" had very little visible effect.[ix] *It seemed akin to informing a child that their best friend's mind is made up of electrical impulses and chemical reactions. Such explanations (on a radically different level from the one at which relationships take place) are treated as perhaps accurate but irrelevant to ongoing relationship. They might be helpful in explaining a friend's bad mood just as Scasselatti's debriefing might be helpful in explaining why Cog might be having a bad day. It was not that the explanation was not welcome; it was received as interesting, some children even found it compelling. But it did not interfere with the sense of relationship. The result here is similar to what we observed when the Kismet and Cog malfunctioned during a play session. At those times, children did not treat the robots as broken mechanisms but as ailing social creatures. It seems that once children understood that these particular robots were capable of sociability, the machines were treated as social creatures no matter what their immediate state. Once defined as social, any lack of particular competencies is treated as an unfortunate disability for which the robot deserves empathy. The following vignette exemplifies the irrelevance of understanding the mystery behind the machine for most children:*

> Blair, 9, wears a red tee shirt and shorts to the session; she is tall and looks slightly older than her age. She is the most assertive, and at times, defensive and aggressive of the group of children participating in the session. She says she believes that Cog can be her friend and says that taking it home would be "like having a sleepover!" She also believes that robots, like people, can dream and have nightmares. When asked if she thinks Cog has feelings she says that she thinks it certainly does and adds, "maybe he was shy because he kept putting his arm out to us…"

During her first independent session Blair says that she thinks Cog "trying to greet her" and that it is "happy now" because "it keeps moving its arm up and down." She also tells the clinical researchers that "It's trying to see what this thing is (a stuffed toy). It keeps looking at it. It seems like it really likes this toy because it keeps looking at it." When asked what she thought of Cog, Blair says that she thought the robot was "cool" and that "it was happy to meet so many new kids."

Scassellati then proceeds to show Blair how Cog "sees" and how Cog works. Scassellati turns on the LCD that corresponds to Cog's cameras and has try to determine what Cog will "look at" next. Blair is very excited about her discoveries, especially when she correctly guesses that Cog is looking at her because of her brightly colored shirt. She then controls Cog's different movements from one of the computers. When the clinical researcher asks Blair what she thinks about her second session, Blair does not hesitate, "I liked it better when I got to control it because I got to see what I could do when you got to control it by yourself." We ask Blair what she learned about Cog's mobility, she answers "that it likes to move its arm." Blair then speaks to the clinical researcher about Cog's broken arm and says "I bet it probably hurt when it noticed (that its arm was broken)" Clinical researcher: "You mean it hurt him like it felt bad or that it hurt? " No. Like it hurt his feelings. Like, why did you have to take my arm off?"

We ask Blair "did you think it was alive?" She says "yes." With gentleness, we raised the issue of an apparent contradiction. ("What made it alive this time since you said before that it was alive because it moved on its own? This time you were moving it.") Her reply illustrates that her beliefs about aliveness are not as related to formal categories as to her sense of being in a relationship with Cog, and that relationship can be a helping relationship. She replies, "This time it felt more alive. . . . maybe because this time I got to move it. It just felt more real." Blair's sense of Cog's aliveness was actually strengthened by controlling Cog, despite the fact that she based her first assertion of Cog being alive on his being able to move on his own. (Session 13, S38)

Blair's case dramatizes that the experience of being with a relational artifact dominated any intellectual understanding of what stands behind the robot's behavior. No matter how much we showed children the insides of the machine, if they felt a connection to a robot as a sentient and significant other, that sense of relationship remained intact, and at times even strengthened.

Discussion: Strong Silent Robots and Cute Chatty Ones

With both Cog and Kismet, children try to understand the robots' states of mind in order to be in a conversation with them, the essence of the "holding power" of a relational artifact. At the same time, Cog and Kismet are very different robots with different styles of appeal. Cog, with its large motor responses, tended to encourage more physical give and take; children related to it as a friend and protector. Kismet, with its emphasis on the modeling of affect and speech, encouraged children to treat it as an infant, a smaller creature that they could parent; children talked about "growing it up."

Cog, with its large size, visible steel rod structure, and silence, seemed to children the more "masculine" robot whereas Kismet, with its high-pitched vocalizations, attractive features, and smaller size, seemed more "feminine." Boys preferred Cog, which they quickly associated with Robocop and Battle Bots. Boys described Cog as "cool" because of its stature and arm mobility. If needed, children incorporated imaginary weapons into their play with Cog. Kismet, more doll-like and requiring "teaching" in order to speak, had more appeal for girls, although girls found much in Cog to nurture, referring to the robot, which had lost one of its arms prior to our study, as "wounded."

Cog evokes ascriptions of sentience through its humanoid shape and movement, its ability to turn its head toward a person and imitate their arm movements. Kismet too, evokes sentience by its appearance and actions, but also provides additional social cues. Its eyes not only track motion, but give the appearance of meeting a person's eyes, a powerful mechanism that intensifies the feeling that there is a conscious being on the other side of the interaction. When functioning most fluidly, Kismet is continually responding to its environment. It looks into your eyes, listens, pays attention, repeats names and simple phrases, and shows a facial expression that supports how you would "expect" it to feel if it were a young human child. And Kismet's ability to repeat a child's name or say its own was compelling: children seemed to feel "recognized," satisfied when they heard the robot speak their name.

In the case of both robots and despite their different styles of engagement, children felt part of social encounters even when the robots were not functioning optimally. A broken My Real Baby, a broken Aibo, a broken Furby does not give children the feeling that the toy is still able to connect with them. Kismet and Cog do. Children look at the "wounded" Cog and appreciate how it is supposed to move; they look at the "deaf" Kismet and see how it is supposed to relate. Even broken or babbling or moving its head in non-meaningful ways, the robots signal the capacities it would be able to have if fully functioning. Children understand and respond to the capacity for relational cues and experience these cues as the capacity for relationship. They do not treat the robot as a broken object, but rather as a disabled creature. And when faced with a relational robot that does not have a particular human capacity, children are willing to attribute the lack not to the "permanent" design of the robot but to its being perhaps temporarily indisposed. So, for example, faced with Cog's inability to respond to speech, Fara, 11, does not question that Cog is smart enough to hear or speak, but sees him as disabled the way a human might be. She says that being with Cog felt like being with a deaf or blind person "because it was confused, it didn't understand what you were saying, and like a blind or as a deaf person, they don't know what you are saying, so it didn't know what they were saying or it knew when I was trying to get its attention to see, he was just like staring, and I was just like 'Hello!' because a blind person would have to listen." (Session 1, S2)

When children met both Kismet and Cog, they fantasized about hybrid species, in particular grafting Kismet's head on Cog's body. Children felt that Kismet would be "happier" with arms, but they were more focused on Cog not having "the head it deserved." This was perceived as the more immediate need.

In sum, children were tenacious in their efforts to obtain a response from the humanoid robots we studied. They personified Kismet and Cog with extravagant detail, and developed a range of novel strategies for seeing the objects not only as "sort of alive," but also as capable of being friends and companions. Children went to great lengths to maintain the sense that they were in a mutual relationship with these objects, that the objects recognized them and cared about them. Children preferred to see these robots as disabled creatures in need of nurturance rather than of broken machines in need of repair.

In the warm welcome that children extended toward the robots as partners and companions, there were come expressions of reticence about how far the relationship could go:

> Steven, 13, says, "I have two tight friends, my girlfriend and my dog." Steven seems very engaged with Cog, and says that Cog was reaching out to him and trying to say "hi" when lifting his arm towards him. Also present during Steven's encounter with Cog are Steven's camp counselor Rory, 19 and Steven's friend, Philip, 12. Rory says that he would like to have a robot as a friend, if it was smart enough. Steven immediately expresses reservations, "It wouldn't have as strong feelings (as a human friend) because it doesn't have a heart and so couldn't feel pain. I'm sure you could make it feel bad, but say it had a girlfriend and breaks-up with its girlfriend, it might feel bad but it doesn't have strong emotions. It could be a friend but not a good friend." His friend Philip has been listening and agrees, "Yeah, it could have a broken eye, but not a heartbreak." (Session 12, S37)

For Steven and Philip, depth of emotion, framed for Philip as the ability to have a broken heart, is what separates robots from humans. Turkle has noted that since the beginning of children's immersion in the computer culture through their involvement with electronic toys and games, computational objects have been an essential element of how children talk about what is special about being a human. The computer appeared in the role of "nearest neighbor" – people were distinguished by what made them different from the machines. Through the mid-1990s, in large measure, children made these comparisons between computers and people by focusing on what computers could do. In contrast, in the company of relational artifacts, children's conversations about what makes people special contrasted the *relational competencies* of computers and people. It became a discourse not about technical competencies but about relational competencies (Turkle 1984, 1990, 2000, 2004). Among the ideas about relational competencies that came to the foreground is the notion that humans are special because of their imperfections. This study of first encounters offered poignant testimony to the way that a certain vulnerability and frailty become valued as a defining trait for people. A ten-year-old who has just played with Kismet says, "I would love to have a robot at home. It would be such a good friend. But it couldn't be a best friend. It might know everything but I don't. So it wouldn't be a best friend." She further explains that a robot is "too perfect" and that it might always need to correct her. Friendship is easier with your own kind.

In the end, our look at first encounters between children and relational artifacts left us with confidence that the future of human-computer interaction will have children seeing robots as alive (at least in their way), and feeling an emotional as well as intellectual connection with them. The children and computers will be in relationship, but the self reflection evoked by these involvements invite new and complex questions, perhaps most centrally, "What is a relationship?"

Resources

G. BALTUS, D. FOX, F. GEMPERLE, J. GOETZ, T. HIRCH, D. MAGARITIS, M. MONTEMERLO, J. PINEAU, N. ROY, J. SCHULTE, S. THRUN (2001). Towards Personal Service Robots for the Elderly. In *Proceedings of the Workshop on Interactive Robotics and Entertainment* (WIRE). Computer Science and Robotics, Carnegie Mellon University.

J. BOURKE, B.R. DUFFY (2003). *Emotion Machines: Projective Intelligence and Emotion in Robotics*, IEEE Systems, Man & Cybernetics Workshop (UK&ROI Chapter), September.

C. BREAZEAL and A. FOERST (1999). *Schmoozing with Robots: Exploring the Boundary of the Original Wireless Network*. Presentation at the Third International Conference on Cognitive Technology (CT August 1999).

C. BREAZEAL, B. SCASSELLATI (1999). *How to Build Robots that Make Friends and Influence People,* presented at the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS-99), Kyongju, Korea.

C. BREAZEAL (2000). *Sociable Machines: Expressive Social Exchange Between Humans and Robots.* MIT Ph.D. Dissertation, MIT. Department of Electrical Engineering and Computer Science.

C. BREAZEAL, B. SCASSELLATI (2000). Infant-like Social Interactions Between a Robot and a Human Caretaker, *Adaptive Behavior*. 8(1).

C. BREAZEAL (2002). *Designing Sociable Robots*. Cambridge: MIT Press.

R. BROOKS (2002). *Flesh and Machines: How Robots Will Change Us.* New York: Pantheon Books.

C. DISALVO, F. GEMPERLE (2003). From Seduction to Fulfillment: the Use of Anthropomorphic Form in Design. *Proceedings of DPPI '03 : Designing Pleasurable Products and Interfaces*, Pittsburgh, PA. ACM press.

J. GOETZ, S. KIESLER (2002). Cooperation with a Robotic Assistant. *In Conference on Human Factors In Computing Systems* (CHI 2002), (Minneapolis, MN, USA).

C. KIDD (2003). *Sociable Robots: The Role of Presence and Task in Human-Robot Interaction.* Master's Thesis, MIT. Program in Media Arts and Sciences.

S. KIESLER, L. SPROULL (1997). Social Responses to Social Computers, in B. Friedman, *Human Values and the Design of Technology*, CLSI Publications.

C. NASS, Y. MOON, J. MORKES, E-Y KIM, B.J. FOGG (1997). Computers are Social Actors: A Review of Current Research in B. Friedman (Ed.) *Human Values and the Design of Computer Technology*. Stanford, CA: CSLI Press.

J. PIAGET (1960). *The Child's Conception of the World.* trans. by Joan and Andrew Tomlinson. Totowa: Littlefield, Adams.

R. PICARD (1997). *Affective Computing.* Cambridge: MIT Press.

S. PARISE, S. KIESLER, L. SPROULL, K. WATERS (1999). Cooperating with Life-like Interface Agents, *Computers in Human Behavior*, 15, 123-142

B. REEVES, C. NASS (1999). *The Media Equation: How People Treat Computers, Television, and New Media Like Real People and Places*. Cambridge: Cambridge University Press.

B. SCASSELLATI (2002). *Foundations for a Theory of Mind for a Humanoid Robot*, Ph.D. Dissertation, MIT. Department of Computer Science and Electrical Engineering.

L. SPROULL, R. SUBRAMANI, S. KIESLER, J. WALKER, K. WATERS (1996). *When the Interface is a Face Human-Computer Interaction, 11, 97-124 (Reprinted in Friedman (1997) Human Values and the Design of Technology*, CLSI Publications).

S. TURKLE (1984). *The Second Self: Computers and the Human Spirit*. New York: Simon and Schuster.

S. TURKLE (1995). *Life on the Screen: Identity in the Age of the Internet.* New York: Simon and Schuster.

S. TURKLE (1997). Seeing Through Computers: Education in a Culture of Simulation. *The American Prospect*, no. 31, March-April.

S. TURKLE (2001). *Relational Artifacts*. Proposal to the National Science Foundation SES-01115668.
.
S. TURKLE (2002). Whither Psychoanalysis in the Computer Culture. *Bulletin of the Freud Museum*.

S. TURKLE (2004) *Relational Artifacts*. Final Report on Proposal to the National Science Foundation SES-01115668.

J. WEIZENBAUM (1976). Computer Power and Human Reason: From Judgment to Calculation. San Francisco: W. H. Freeman.

---

[i] This research was funded by a NSF ITR grant "Relational Artifacts," (Turkle, 2001) award number SES-0115668 and by the Mitchell Kapor Foundation through its support of the MIT Initiative on Technology and Self. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation nor of the Mitchell Kapor Foundation. Breazeal, Scasselatti and Turkle participated in data collection, discussion of the findings, and oversight of the summer project; Turkle and Dasté took responsibility for the analysis of the data and redaction of this text. Study participants also include Jen Audley, research coordinator during summer 2001, and research assistants Robert Briscoe, Anita Chan, Tamara Knutsen, and Rebecca Hurwitz.

[ii] Indeed, at MIT, there is an "affective computing," research group that undertakes to develop computers capable of assessing their users' emotional states and of responding, in turn, with

appropriate “emotional” states of their own. Its leader, Rosalind Picard, writes: “I have come to the conclusion that if we want computers to be genuinely intelligent, to adapt to us, and to interact naturally with us, then they will need the ability to recognize and express emotions, to have emotions, and to have what has come to be called ‘emotional intelligence’.” (Picard 1997, x)

[iii] Bandai instruction booklet, “Happiness and Hunger Status Check”, http://virtualpet.com/vp/faq/instruct/-tam2.gif. Accessed 10/1/2001.

[iv] Tamagotchi Planet, “General Tamagotchi Information,” quote from Bandai http://www.mimitchi.com/html/q1htm. Accessed 10/1/2001

[v] Kismet’s big blue doll-like eyes, bright red lips, mechanical yet sweet voice, long dark eyelashes, big pink ears, and mobile furry eyebrows all served to remind children of a range of cute characters, little animals, and babies. Kismet’s “cuteness” is not accidental. Breazeal took into account Eibl-Eibelsfeld’s “Kindchenschema” or Baby-scheme, which established that there is a biological explanation for human responses to “cuteness,” meaning big eyes, round head, small bodies, big floppy ears, with caring and tender behavior. Breazeal notes, “People tend to react emotionally to someone or something “cute “in this way; a natural behavior that it exploited by doll and toy- producers as well as Hollywood designers. For our purposes as robot designers, it seems reasonable to construct a robot with an infant-like appearance, which could encourage people switch on their baby-scheme and treat it as a cute creature in need of protection and care.” (Breazeal and Foerst 1999) Kismet, from the onset of its design, was meant to draw out a nurturing response.

[vi] Participants included children of African American, Iranian, Haitian, Korean, and French ethnicity.

[vii] Each session was divided into four segments: an introductory segment, a brief group introduction to the robot, a one-on-one period with the robot, and an individual interview. Our study was not an experiment but it had a formal structure: When participants arrive, they were directed to a conference room and given a brief description of what they will do and see. The participants were told that following a group introduction to the robots, they will each get to spend twenty minutes with the robot and that following that time, they will have a conversation about their thoughts about the robot, and will then get a chance to play with the robot again. Immediately following their interactions with the robot, the participants were interviewed individually about their experience. Researchers used this time to allow participants to talk about anything relating to the experience while also gathering information on a standard list of topics, including:

- Is there anything that you would like to change about the robot? Why?
- Was there anything about the robot that was different from what you expected?
- Would you like to have this robot at home? Why?
- Do you think this robot is alive? Why?
- Could this robot be a friend? Why?

[viii] The toys given to the children to play with Cog included a stuffed bear, a slinky, a stuffed frog, a stuffed caterpillar, beanie babies, and a Mickey Mouse sorcerer. Heather tried each one of these in turn with Cog when carrying out her experiment.

[ix] Certainly, the few children who initially related to Kismet or Cog structurally, as an object to be understood, were reinforced in their stance when Scassellati unveiled the robot’s structure and mechanism.