CHAPTER TWENTY-SEVEN

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First Encounters with Kismet and Cog

Children Respond to Relational Artifacts

Kismet and Cog, humanoid robots developed at the MIT Artificial Intelligence Laboratory, are "relational artifacts," designed to present themselves as having "states of mind" affected by their "social" interactions with human beings. During the summer of 2001, sixty children, from ages five to thirteen, were introduced to Kismet and Cog. The children's first encounters with the robots provide a window onto how such objects—and in particular, the "sociable" robots of the future—may enter into how children think about life, intentionality, friendship, and what is special about being a person.

Traditionally, researchers in artificial intelligence concentrated on building 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 new kinds of computational objects that Turkle (2001, 2004a, 2004b) has characterized as "relational artifacts." These are objects that present themselves as having "states of mind" that are affected by their interactions with human beings, objects designed to impress not so much through their "smarts," but through their sociability. The humanoid robots Kismet and Cog, designed in the late 1990s at the MIT Artificial Intelligence Laboratory, exemplify such objects (Breazeal 2000, 2002; Scassellati 2002). They are explicitly designed to relate to people in humanlike ways, to "detect stimuli that humans find relevant . . . respond to stimuli in a humanlike manner . . . [and] have a roughly anthropomorphic appearance" (Scassellati 2002, 49).

In the summer of 2001, roboticists Cynthia Breazeal and Brian Scassellati and clinical psychologist and ethnographer Sherry Turkle—all of MIT—introduced a group of sixty children to Kismet and Cog, observed their play, and talked to the children about their experiences.[1] This work was not experimental, but exploratory and qualitative. Our goal was to better understand children's first impressions of this novel form of social intelligence. This essay suggests that even first encounters provide a window onto children's styles of anthropomorphizing relational artifacts and children's evolving discourse about

the "aliveness" of "sociable" robots. Beyond this, relational artifacts are new objects-to-think-with for asking the question, What is an authentic relationship with a robot?[2]

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: virtual creatures, robotic pets, and humanoid dolls. At varying levels of sophistication, these objects give the impression of wanting to be attended to, wanting to have their "needs" satisfied, and being gratified when they are appropriately nurtured.[3]

American children first met relational artifacts with the 1996 introduction of the Bandai Corporation's Tamagotchi, a small virtual creature whose screen is housed in egg-shaped plastic. The instruction book included in every Tamagotchi's packaging presented 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 grow into a cute, happy cyberpet. If you neglect Tamagotchi, it will grow into an unattractive alien.[4]

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 twelve, 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 was the creature's death. In some versions, the dead Tamagotchi could be uploaded to a virtual graveyard. In the United States, the manufacturers decided on a less harsh resolution: a neglected Tamagotchi became an "angel" that was "uploaded to its home planet" and the user could hit "reset" and be presented with a new Tamagotchi. Even with this opportunity for multiple chances, from a child's point of view, every relationship with a Tamagotchi was centered on accepting the role of caretaker. Bandai's website provided moral instruction that linked nurturance and responsibility:

> 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?[5]

Furbies, the toy fad of 1998–99, are small furry creatures with large, prominent eyes and the ability to "speak." Like Tamagotchis, Furbies are presented to children 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 case of Furbies, a child's caretaking responsibility is centered on teaching. In the course of play, Furbies "learn" to speak English. In fact, this learning reflects the unfolding of a program that evolves the Furbies' speech pattern from "Furbish" to a set of simple English phrases. (In other words, no matter what language a child speaks to a Furby, that Furby will begin to speak English.) For most children from five to nine, the illusion works: children come to believe they are teaching their Furbies English by interacting with them. Children also come to believe that a lack of attention to their pet Furbies will have a negative impact on their inner state. Neglected Furbies will feel sad or lonely (Turkle 2001, 2004b).

My Real Baby, introduced by Hasbro in 2000, continues the theme of child-as-parent and presents itself as having inner "emotional" states that a child needs to decipher in order to appropriately nurture the toy. My Real Baby does its part—the toy signals its state with baby sounds, cries, words, and facial expressions. My Real Baby was a descendent of Bit, a robotic doll first developed at the iRobot Corporation. 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, first introduced in 1999 in the shape of a pet 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. AIBO develops different personalities depending on how it is treated by its user. Newer models have facial and voice recognition software that enable it to recognize its "primary caregiver."

Cog and Kismet, the humanoid robots used in our study, are highly evolved examples of relational artifacts. Cog is an upper-torso robot, with sensors for sight, touch, and movement. It can detect people as well as objects that it has been programmed to consider salient, turn and point toward visual targets, differentiate between animate and inanimate motion, and perform simple tasks of imitation. Kismet is a robotic head with a vision system, winsome in appearance, with small, mobile ears made of folded paper, mobile lips made from red rubber tubing, and heavily lidded doll eyes ringed with false eyelashes. Its ability to move its head and display a range of facial expressions compels human attention. Kismet's behaviors and capabilities are modeled on those of a pre-verbal infant (Breazeal and Scassellati 1999, 2000; Breazeal 2000, 2002). It gives the impression of looking into people's eyes, and to a limited degree, it can recognize and generate speech and speech patterns.[6] In general, Cog engaged children by turning its body, looking in their direction, and copying their arm motions, while Kismet engaged them through its seeming to make eye contact, its facial expressions, and its response to language with utterances of its own.

The Study

We brought children from ages five to thirteen to spend an afternoon at MIT to interact with the robots and to speak with us about their experience. The children were drawn from the MIT community and from Boston- and Cambridge-area summer after-school programs and community organizations.[7] After a brief introductory conversation, each child met individually with one of the robots. Our approach was to interfere as little as possible in these encounters. If children asked for guidance or seemed anxious, a researcher might provide a supportive question (e.g., "What do you notice about Kismet right now?") or, if necessary, a more directive request (e.g., "Can you try to get Cog to wave at you?"). Stuffed animals were available in the areas around both robots and chil-

dren were told that they could use them if they wished. In general, children had about twenty minutes alone with the robot and were told when they had five minutes remaining in their sessions. After their encounter with the robot, children had a conversation with us about their experience.

Finally, children came back for a second session with the robot of about thirty minutes (usually involving other children) during which they were encouraged to ask any questions on their minds.[8] With the robot Cog, this second session included a special "debriefing" during which Scassellati explained Cog's inner workings. This debriefing presented an opportunity 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 the robots even when they failed to operate properly and even when there was a determined effort to "demystify" the machines. 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 report on three major themes that emerged from our study of first encounters, all related to children's desire to see the robots as appropriate for relationships. Children displayed perseverance in their efforts to communicate with the robots, and expressed this perseverance through a range of personal styles. A similar range of styles marked children's ways of anthropomorphizing the robots. For the most part, children came to see the robots as "sort of alive" and felt social connections with them, using different strategies to overcome disappointments and system failures. Finally, children's stake in preserving a sense of relationship with the robots was so strong that children actively resisted attempts to demystify them. With few exceptions, children were uninterested, indeed unwilling, to approach the robots in terms of underlying mechanism.

Perseverance in Communication

Kismet and Cog are research robots in a university laboratory environment. In the course of our study, laboratory members were continually working on them. Thus, 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) and in trying to make Cog imitate their arm movements.

Heather, seven years old, is energetic and vibrant. Before meeting Cog, Heather informs the 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. 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 and then attempts to place a stuffed animal on Cog's raised arm.[9] Heather's goal is to have Cog balance a stuffed animal on its raised arm. With each attempt, Heather raises her arm and instructs Cog to do the same. In a typical interchange, Heather speaks to the robot directly: "Up. Up. Up. Like you are pointing at me. Up! . . . now steady. . . ." and rushes to place a toy on Cog's lifted arm. Each time she succeeds in balancing a toy, Cog's arm drops. Undeterred, Heather 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, seeming to believe that one or another might better hold the robot's attention. She refuses to give up and continues her "experiment" until the very end of her time with Cog (Session 17, S52).

Heather's perseverance was typical; most children set a goal for the robot they were visiting with and spent most of their time trying to get the robot to accomplish it. Although the robots' performance frustrated expectations, most children believed that the robot with which they were engaged had the ability to perform to their expectations. Children had different styles of persevering, reflecting individual personality. Aggressive children become angry when the robots had difficulties; children with gentler natures responded with sympathy.

Perseverance through Nurturance

Many children saw Kismet as a very young child and took parental roles in its company. They tried to coax Kismet to speak and attempted to reward it with kind words or a gentle touch. When Kismet did interact with them, children took this as a sign that the robot was enjoying their company; children made it clear that they wanted this acceptance and they wanted to feel needed:

> When she first meets Kismet, Trisha, five years old, refuses to approach it. After receiving some reassurance, she takes a step toward Kismet and asks, "Are you a nice robot?" A few silent moments later, Trisha says, "Hello. My name is Trisha." Kismet is silent. Trisha tries again, slowly and gently, "Tri-sha. . . . What is your name?" Trisha looks intently into Kismet's eyes, speaks to it gently, and caresses its eyebrows, neck, and base. Finally, Kismet makes a cooing sound and Trisha smiles. Encouraged, Trishsa returns to her questions, repeats them softly, pronouncing every syllable, while continuing to caress Kismet. 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).
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> Marianne, ten years old, is quiet and thoughtful. She appears removed from the boisterous, atmosphere 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 gently repeats her original question, "How are you doing?" Again, Kismet is silent. Marianne tries again and again, until Kismet finally speaks. Kismet's vocalizations are not comprehensible; Marianne says apologetically, "I'm sorry, I didn't hear you" and returns to her questions. With each attempt Marianne leans in closer, placing her ear near Kismet's mouth. Now she asks Kismet "What is your name?" and when she gets no answer, says, "I'm sorry . . . What are you looking at?"
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> As the session continues, Marianne does not give up or show any sign of frustration. Instead, her voice remains gentle, coaxing Kismet to play with her. She asks her questions in a singsong way, as if talking to a baby. She asks, "Can you sing for me? Do you want to sing the ABC's? Can you sing it?" Marianne sings the alphabet softly. She plays Peek-a-Boo, covering the robot's eyes and then removing her hands and saying "Boo!" Her behavior conveys her belief that the robot is more likely to respond if she nurtures it (S47, Session 15).

Children tended to see both Cog and Kismet as sentient, but most saw Cog as a playmate and Kismet as a child to nurture. When children played with Kismet, they often urged the robot to pay attention to them, to listen, to try harder.

> Mandi, nine years old, says that what she enjoys most is "bothering" her three older siblings and playing with her baby sister. She asks Kismet, "What is your name?" then, "Do you have parents?" Encouraged by a vocal response from Kismet, Mandi asks, "Do you have brothers and sisters?" Kismet does not respond and Mandi repeats her question three times. As the session unfolds, Mandi increasingly speaks of Kismet as a female, treating the robot like a little girl. Mandi thinks Kismet has a birthday, that the robot was born, and has parents as well as brothers and sisters. Mandi asks Kismet, "Do you like ice-cream?" Kismet says something incomprehensible. Mandi responds, "I think she said yes." And then to Kismet, "What flavor do you like?" Mandi asks Kismet about her favorite color, if she goes to school, and if she has any toys. Then Mandi tries to engage Kismet by dangling toys in front of its eyes.

"I think that she [Kismet] is a baby because these toys look like little baby toys." Mandi has a six-week-old sister and likens Kismet to the child.

Mandi says that Kismet is a little bit older than her sister because Kismet speaks better. Mandi says that Kismet might get sad like a baby even if she can't cry. "If you made arms for Kismet she would scribble over the pages of a coloring book and put things in her mouth." Mandi believes that Kismet learns to speak better with every child who comes to visit. She says that "[Kismet] is still little, but it grows up. It looks little, but it still grows up." Mandi believes that Kismet 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 bonds between children and robot. It also reinforced children's belief 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 and kisses, making efforts to entertain it with stuffed animals and rattles. Some tried to amuse it with favorite childhood games and 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.

Adam, six years old, is rather small, but very energetic and articulate. Before the beginning of the session, Adam's father tells us that his son had two questions: Could he take the robot home afterwards, and did it have weapons? According to his father, Adam has been getting into "fighting games" at school, likes rough play, and to be "in charge."

When he first meets Kismet, Adam asks the robot, "Can you talk?" When Kismet does not answer Adam repeats his question with increased urgency. When Adam cannot understand Kismet's response, Adam becomes very frustrated. After a series of "What?" "What?" "What?" Adam tells Kismet to "Shut up!" Adam forces 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).

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Jerome, twelve years old, visits the robot lab with his two younger brothers and is very aggressive towards them. Finally, he turns to Kismet, and half-heartedly asks the robot, "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 shouts, "Say shut up! Say shut up!" Seeming to fear reprimand, Jerome continues with a brusque tone but less hostile words: "Say hi . . ."Say blah!" Suddenly, Kismet says "Hi" back to him. Jerome, smiling, tries to get Kismet to speak again, but when Kismet does not respond Jerome forces his pen into Kismet's mouth and says, "Here! Eat this pen!" Though frustrated, Jerome does not tire of the exercise. The robot is as worthy of aggression as are his siblings, at least for a while (Session 20, S58).

Perseverance through Resourcefulness

Children had very different styles of coping with the robots' lack of responsiveness. Some children nurtured, some cajoled, others reached for alternate means of communication. What seemed constant was the children's assumption that the robots could do

better if they tried harder. So, for example, some children tried to "speak Kismet" language 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.

> Chi, six years old, 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. Chi says that he cannot understand what Kismet is saying but he knows it isn't English. Chi asserts that even though he doesn't know Thai, he is sure that Kismet is speaking Thai. He says that he wishes Kismet could speak English so that she could speak to him about herself (S29, session 9).
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> Roanne, twelve years old, 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 researcher asks, "Do you think when you said 'Adios' it understood that?" Roanne answers, "Yeah" (S25, Session 8).

Some children tried to cope with the robots' limitations by turning to sign language. In the case of Cog, the logic for using sign language was impeccable: since Cog can only "see," signing would be the appropriate language for a "deaf" robot just as it would be for a deaf person. And although Kismet was deemed 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, five years old, 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).
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> Heather, the seven-year-old earlier described, was also convinced that sign language would be a good way to communicate with Cog. When Cog fails to follow her instructions she suggests, "Maybe he understands sign for things." After her session with Cog, Heather 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 demonstrates her knowledge of signing, 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 did not respond appropriately, children went 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 both generally competent and genuinely caring in 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 psychothera-

pist (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. People using ELIZA refrained from asking questions that might confuse it and specifically asked it questions that would ensure a humanlike answer, going to considerable lengths to protect the illusion of a relationship with the program (Turkle 1984, 40). In *The Second Self*, Turkle describes how five-year-old Lucy took an early computer toy, Texas Instrument's Speak and Spell, and used the "ELIZA effect" to maintain the sense that she was having a conversation with it, even though the toy had no interactive capability. Lucy did this by tailoring her demands of the toy to exactly match what the toy was able to do. We saw many examples of this "helping" behavior in our study. When all evidence pointed to broken or malfunctioning robots, children rationalized their failings in other ways. So, for example, when Kismet did not speak, children said: 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 is speaking another language, it is very shy, and it is sleeping. What seemed at stake was not just an image of Cog and Kismet as intelligent. Children's excuses and "helping" behavior also preserved their sense that the robots cared about them.

> Samantha, six years old, is excited to meet Kismet and has great expectations. She asks Kismet to speak and when she learns that Kismet is having technical problems, she becomes increasingly active in her efforts to maintain her involvement with the robot.
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> First she sings "Happy Birthday" to Kismet and pretends to make Kismet eat a clay birthday cake she has sculpted in its honor. When Kismet doesn't answer her questions, such as "Was it good?" she simply answers for the robot, "Yep!" Her first comment when hearing Kismet vocalize is, "He likes me!" Kismet babbles, Samantha ascribes meaning to its vocalizations, and then engages in a conversation based on her ascription of meaning. Samantha says that Kismet is speaking English "just fine" and that she can understand perfectly well what it is saying to her. 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).
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> Jonathan, eight years old, tells us that his two older brothers' favorite pastime is "to beat him up." Although he claims to be afraid of them, he is talkative and displays great enthusiasm about being at the lab. He tells the researchers he wishes he could build a robot to "save him" from his brothers. He would like to have a robot as a friend in whom he might confide.
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> Jonathan is sure that Kismet will talk to him and when he meets Kismet, he says, "You're cool!" Kismet vocalizes random sounds, but Jonathan hears what he wants to hear. First he interprets Kismet as saying "What are you doing, Harry [one of his brothers]?" and then, "I'm going to kiss you." Kismet continues babbling, but Jonathan smiles and says again, "You're cool!" with a thumbs-up. Jonathan suggests a list of words for Kismet to say and although Kismet does not repeat any of them, Jonathan turns to the researchers and says, "See! It said cheese! It said potato!"
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> Jonathan says that Kismet is learning, saying the words he is teaching it to say, making explanations for Kismet's apparent incoherence. When Jonathan presents a dinosaur toy to Kismet and it says 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.'"
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> When Kismet stops talking completely, Jonathan suggests, "Maybe after a while he gets bored." Jonathan tries to use Kismet's toy to get its attention; when this fails he explains the failure by explaining that the toy probably "distracts" Kismet. When 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 strategy doesn't prompt a response from Kismet, Jonathan insists, "I don't think it's hearing me so good." Towards the end of his session, Jonathan concludes that Kismet has stopped talking to him because it liked his brothers better (Session 20, S60).

Anthropomorphization

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 et al.1997; Kiesler and Sproull 1997; Sproull et al. 1996; Parise et al. 1999; Reeves and Nass 1999). In "Computers are Social Actors: A Review of Current Research," Clifford Nass, Youngme Moon, and their coauthors 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 humanlike 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 (Turkle 1984). In those cases, even a minimum of interactivity in the toys and games provoked children to imagine them as sentient others. Recall that in the case of relational artifacts such as Kismet and Cog, the machines do a great deal to encourage their anthropomorphization. Their ways of being interactive include the ability to locate people and objects and to maintain their focus on things that are moving, colorful, and in Cog's case, animate. Cog moves its torso, is able to point, and orients its gaze. Kismet moves its neck and head, exhibits facial expression, as well as prosody in its speech. Its doll eyes give the impression of direct eye contact. Rodney Brooks writes, "Between people, gaze direction and gaze-direction determination are crucial foundational components of how we interact with each other" (Brooks 2002)[11].

Therefore, it is not suprising, that children imbue Kismet and Cog with humanlike traits. More striking is the range of styles of anthropomorphization enabled by the robots' sociable design.

Children not only saw Kismet and Cog as intelligent but imagined them with emotions and feelings, basically equipped for friendship. Children, and not just the younger ones, asked Kismet and Cog, how they were feeling, if they were happy, did they like their toys? Children asked if the robots loved them and provided a profusion of detail about the robots' inner lives.

Imani, nine years old, 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 TV." Even before meeting Kismet, Imani is convinced that a robot could be a perfect friend. When she first meets Kismet, which she address-

es as a "he," Imani says hello, introduces herself, and offers Kismet some candy. Imani asks Kismet, "Are you a robot? Can you say robot?" She asks Kismet, "Do you have friends," and reports that "Kismet would make a great friend if he spoke to people nicely." Imani explains why Kismet is not moving: "He is sleeping, just like when a person is sleeping."

Imani thinks that Kismet understands her and said her name. With little objective evidence, Imani believes Kismet to be "definitely alive" because "he talks and moves like a person." Imani says that if she took Kismet home she would take good care of it. "I 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."

After her session with Kismet, Imani 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. Imani has made a robot into what she most needs: a protection against loneliness (Session 7, S23).

■ ■ ■

Fara is eleven years old and 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, "You don't get scared, do you?"

Fara tries to get Cog to imitate her by raising her arms. After a brief delay, Cog responds. Fara blames the delay on Cog's mind, on mental "slowness." 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.

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).

Children generally thought that the robots were "sort of alive," a category that captures the increasingly blurred boundaries between what is animate and what is not. Thinking about the "sort of alive" gives children an intellectual space to elaborate the dimensions of a new way of being alive that stands between an "animal kind of alive" and a "human kind of alive." The "sort of alive" category has evolved in the context of successive generations of children responding to successive generations of computational objects (Turkle 1984, 1995, 2001).

When the Swiss psychologist Jean Piaget studied how children reasoned about the question of aliveness, he found that they gradually came to define life in terms of autonomous physical motion (Piaget 1960). Things that moved on their own accord were alive. Gradually, children refined the notion of "moving of one's own accord" to mean the "life motions" of breathing and metabolism.

In the 1970s and early 1980s, computers and first-generation electronic toys and games such as Merlin, Simon, and Speak and Spell disrupted this classical pattern. When children spoke about the aliveness of these new computational objects, their conversation turned to 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. A computer toy's ability to "know" the rules of a game, "solve" puzzles, or even to "cheat" was what made it seem alive.

In the 1990s, children's discussion of aliveness in the presence of computational objects became more complex. Simulation games introduced children to characters/enti-

ties/avatars that moved and "lived" on the screen, but that could not be touched. Some, for example, the objects that inhabited games such as SimLife, were able to "evolve." Children were thus faced with a new, in-between category of more than imaginary and less-than-biological beings and used the category of "sort of alive" as one strategy for managing the new boundary objects. In developing new rationales for why computational objects of the 1990s were "sort of alive," children were not constrained either by the physical explanations they had used when classifying "traditional," that is, non-computational objects, or by the psychological criteria they had used when classifying the early electronic toys and games. They approached complex computational objects 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 creatures from the game of SimLife were not alive, but almost-alive; that they would be alive if they spoke or if they traveled; that they were alive, but not "real"; that they were not alive because they don't have bodies; that they were alive because they can have babies (Turkle 1995).

Not surprisingly, when relational artifacts came on the scene in the late 1990s, children put objects such as Tamagotchis and Furbies in the "sort of alive" category. However, even very primitive relational artifacts changed the discourse about the category. Relational artifacts put a new focus on the quality of the child's relationship with the objects rather than on what the objects can do. So for example, a child of six 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). This "relational effect" was heightened in the case of first encounters with Kismet and Cog.

Clearly, Kismet and Cog didn't "move of their own accord." In the study reported here their power sources were in view at all times, yet this did not seem relevant to how children discussed their aliveness. What did seem relevant were the robots' gazes and the quality of their expressions and gestures. When children felt the robots were making eye contact and were responding to the children's gestures, they saw the robots as not only alive but as sentient and caring. What mattered most for the discourse of aliveness was the degree to which children felt in relationship with creatures that cared.

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 (Turkle 1984). Today's relational artifacts make the Rorschach metaphor less useful than before. Relational artifacts do more than invite projection. They demand engagement (Turkle 2004b), creating a sense that the user and artifact have a mutual connection.

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 do not only come from children's projection of desire onto inert playthings, but from such things as digital dolls crying inconsolably or even saying: "Hug me!" or "It's time for me to get dressed for school!" Such behavior on the part of dolls inhibits projection—something that has implications for the kinds of psychological satisfactions that children can obtain from playing with digital dolls (and presumably the more advanced robots of tomorrow)—but unquestionably increases children's sense that they are in specific relationships.

In our summer 2001 study, children spoke about feeling a sense of mutual connec-

tion with Cog and Kismet. Unprompted, children expressed the importance of being recognized by the robots and being liked by the robots. Unprompted, children made it clear how important it was to show the robots affection. Children spontaneously kissed Kismet and hugged Cog. Children sang to the robots and put on dance shows. When Kismet successfully said one of the children's names, there were comments (even by some of the oldest children) that this was evidence of Kismet's affection. If one child was trying to get Kismet to say his or her name and Kismet said another child's name, this was sometimes taken as evidence that Kismet preferred the other child, often causing hurt feelings. When either Cog or Kismet were unresponsive, children were more likely to experience this as personal rejection than as broken mechanism.

Eugene, eight years old, wanted to bring his remote control car to the robot session so he could ask the engineers at MIT how it works. Eugene is excited about getting to play with robots. He seems surprised to learn that Kismet's parts are made and not grown. Eugene thinks that Kismet's cables are its hair. When Kismet has some technical difficulties, Eugene asks many questions: What is the robot made of? How long did it take to build?

Eugene sees Kismet as male and 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 the robot and tells it, "I will see you soon."

Eugene and his sister, six, 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.

When it is almost time to leave, Kismet is babbling nonsense syllables and Eugene is trying to teach Kismet to speak. Eugene says: "Say I love you. Kismet, say I love you." With patience, Eugene tries again. Kismet is silent; Eugene is sad. A few minutes later, Kismet speaks and Eugene says with relief, "He said 'I love you.'" Eugene and his sister then try to teach Kismet to say their names and are overjoyed to report success. When it is time for them to go, they hug and kiss the robot goodbye and each says "I love you" (Session 18, S53).

■ ■ ■

Jazmyn, nine years old, is bubbly and enthusiastic. Jazmyn's favorite extracurricular activity is dance; she says that she takes step, hip-hop, jazz, and Latin dance classes. Brian Scassellati is there with her when she meets Cog and they have the following conversation:

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 Scassellati if he is planning on making a mouth for Cog. She says that Cog probably "wants to talk to other people . . . and it might want to smile." In these comments we hear Jazmyn's wish that Cog make contact with her. Their conversation continues:

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! [she starts to dance]

Scassellati: Do you want to dance with the robot?

Jazmyn: Yeah!

Scassellati: What kind of dancing would you do?

Jazmyn: Any kind!

Later, speaking with another researcher, Jazmyn comments about Cog: "If his other arm could move, I think that I would teach him to hug me." Jazmyn talks about wanting to take Cog home where they could play together, dance together, talk together, and eat dinner together. Later she dances for Cog and says that Cog enjoyed her performance. 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" [The circles and squares are representations of Cog's attention pattern on a visual display] (Session 13, S41).

Children gave evidence of feeling in a mutual relationship by the way they showed pleasure when Kismet said a particular word or Cog imitated a particular gesture. Children's responses to the robots' successes were akin to parental pride—in reference to the robots, children spoke of a "job well done." And as children assumed the parental role in relation to the robots, they also made it clear that their encouragement of a robot had been decisive in that robot's success. When a robot did well, it was not uncommon for children to take 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.

Resistance to Demystification

Even in their very brief first encounters with Kismet and Cog, children were drawn into interactions that seemed to matter to them: the robots' behavior seemed to affect the children's state of mind and self-esteem. Our research team explicitly discussed the ethics of the encounters we were facilitating and the possibility that the development of children's feelings toward the robots should be tempered by presenting children with a "realistic" or "engineering" perspective on the robots' behavior.

In our study, we explicitly experimented with demystifying the robots, with the idea that this might make the relationship between person and machine more authentic in a certain sense. We used strategies for making the robots "transparent" to the children (by giving some sense of underlying mechanism) with both Kismet and Cog, but were most systematic in addressing this issue with Cog. Scassellati has a particular interest in developing responsible pedagogy in the field of robotics. At the time of our study, he was committed to showing children the machine behind robotic "magic," not wanting children to leave the laboratory under the illusion that Cog was an animate creature. Thirty children had an individual play session with Cog, followed by a session with Scassellati during which he took children through a real-time demonstration of how the robot processes information. Children were shown the computers that ran Cog and the monitors that demonstrated what Cog "saw." Scassellati demonstrated how Cog's program works and how its different functions could be turned off. Finally, children were allowed to "drive" the robot. This meant that they had a chance to control the robot's movements and behaviors—to be the robot's "brains."

When Scassellati first suggested giving children this "reality check" by putting them in touch with the robot as a transparent mechanism, there was considerable discussion within our research team about how the demonstration might alter children's view of this and other robots. Turkle has studied people's relationships with increasingly opaque computational objects and charted a trajectory from a culture of calculation (in which the computer is understood in mechanical terms) to a culture of simulation (here, the computer itself disappears—the user interacts with an opaque screen to be taken "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 perhaps more relevant, of any illusion of autonomy, seem less worthy to serve as a companion, seem less worthy of relationship?

In these sessions, our didactic presentation of a transparent, mechanical Cog had almost no effect either on children's attitudes toward the robot or on their feelings of being in a relationship with it.[10] 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. They might be helpful in explaining a friend's bad mood just as Scassellati's debriefing might be helpful in explaining why Cog might be having a bad day. His explanation was not necessarily unwelcome; it was received as interesting—some children even found it compelling. But it did not interfere with children's sense of being in a relationship with Cog. This result from Scassellati's formal debriefing with Cog is similar to what we observed less formally when 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 feel that these robots are capable of sociability, the machines are treated as social creatures no matter what their current state (on, off, not in working condition). Once defined as social, any lack of particular competencies is taken as an unfortunate disability for which the robot deserves sympathy. The following vignette illustrates how children communicated that understanding the mystery behind the machine was irrelevant to their concerns:

> Blair, nine years old, is assertive, indeed, sometimes aggressive in her dealings with the other children in her group. When she meets Cog, she says she believes that Cog can be her friend and says that taking it home would be "like having a sleepover!" She believes that robots, like people, can dream and have nightmares.
>
> Alone with Cog, 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 thinks it is exploring its toys: "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 thinks of Cog, Blair says that the robot is "cool" and "happy to meet so many new kids."
>
> Scassellati shows Blair how Cog works. He turns on the LCD that corresponds to Cog's cameras and has Blair 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. Blair has strong opinions about the debriefing session: "I liked it better when I got to control it [Cog] because I got to see what I could do when you got to control it by yourself." But the session takes little away from Blair's sense of Cog's inner life. She speaks of Cog's broken arm: "I bet it probably hurt when it noticed (that its arm was broken)." A researcher responds (inadvertently introducing the pronoun "him," which Blair then picks up without comment), "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, "Do you think Cog is alive?" Blair says "Yes." There is a conversation about the 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." Blair's reply illustrates that her beliefs about aliveness are not as related to formal categories as much as they are to her sense of being in a relationship with Cog, a relationship that was not compromised when she was put in temporary control of Cog's functioning. She replies, "This time [when she was in control of the robot] 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 its being able to move on his own (Session 13, S38).

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

What is a Relationship?

With both Kismet and Cog, children try to understand the robots' states of mind in order to better communicate with them. When children sensed the robots were vulnerable (since they could not perform so much of the time), children tried to understand their states of mind in order to better take care of them. Thus, at the heart of the "holding power" of both Kismet and Cog is that they call forth the human desire for communication, connection, and nurturance. Kismet and Cog had this in common with each other, and with all relational artifacts. At the same time, Kismet and Cog are very different in their abilities and thus their 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 a baby or a small creature to parent. Children seemed to feel very deeply recognized when they felt Kismet had spoken their names or they had taught it to say its own.

Cog, with its large size, visible steel-rod structure, and silent demeanor, 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, describing it as cool and quickly associated it with Robocop and Battle Bots. 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."

In the case of both Kismet and Cog, children felt part of social encounters even when the robots were not functioning optimally. It is notable that Kismet and Cog signal the capacities they would be able to have if fully functioning. Children understand these signals as indicating the robots' capacity for relationship. Children were able to look at the body of the "wounded" Cog and appreciate how it was supposed to move and they were able to look at the face of the "deaf and dumb" Kismet and appreciate something of how it was supposed to relate emotionally. As already noted, even when the robots are not at their best, children do not treat them as broken mechanisms but as disabled creatures.

Put in more general terms, when children face a relational artifact that does not have a particular human capacity, children seem willing to attribute what is missing in the artifact to its being temporarily indisposed or temporarily incomplete in its design.[1] So, for example, faced with Cog's inability to respond to speech, Fara, eleven years old, 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 . . . (Session 1, S2).

Children were tenacious in their efforts to obtain a humanlike response from the humanoid robots we studied. They anthropomorphized Kismet and Cog with extravagant "back stories" and developed a range of novel strategies for seeing the robots not only as "sort of alive," but as capable of being friends and companions. Children went to great

lengths to maintain the sense that they were in a mutual relationship with the robots, preferring to see them as disabled creatures in need of nurturance than as broken machines in need of repair.

In the warm welcome that children extended toward the robots, there were some expressions of reticence about how far the relationships could go:

> Steven, thirteen years old, says, "I have two tight friends, my girlfriend and my dog." Steven seems very engaged with Cog, and reports that Cog was reaching out to him and trying to say "hi" when Cog was lifting his arm toward him. Also present during Steven's encounter with Cog are Steven's camp counselor, Rory, nineteen-years-old, and Steven's friend, Philip, twelve. Rory, the counselor, says that he would like to have a robot as a friend, if it was smart enough. Steven immediately expresses his own reservations about a robot as a friend, "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." Philip has been listening and agrees, "Yeah, it could have a broken eye, but not a heartbreak" (Session 12, S37).

It is notable that in this encounter, Philip is willing to grant that the robot might have a certain form of biology—the kind of broken eye that might be painful for a robot. But what the robot will not have is the kind of pain that comes from broken emotions. Only human beings can have a broken heart.

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 person. 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 and could not do. In contrast, in the company of Kismet and Cog, when children spoke about what was special about being a person, they focused not on what the machines could do, but on the machine's potential for relationship. In this study, children often reflected that one thing that made people special was their imperfections. This study of first encounters offered poignant testimony to how a certain vulnerability, even frailty, can become valued as defining traits for people. A ten-year-old girl 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.

Our look at first encounters between children and relational artifacts made it clear that in the not-distant future, children will consider themselves in relationships with computational companions, relational artifacts that will provide a sense of mutual connection. However, these involvements will invite new and complex questions, perhaps most centrally, "What is a relationship?"

NOTES

1. 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 authors and do not necessarily reflect the views of the National Science Foundation, nor of the Mitchell Kapor Foundation. Breazeal, Scassellati 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. A version of this paper was first presented at Humanoids 2004, Santa Monica, California, November 10 2004.

2. Olivia Dasté, Turkle's research assistant, joined the project in September 2001, at the beginning of data analysis.
3. 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. Group 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)
4. Bandai instruction booklet, "Happiness and Hunger Status Check." http: //virtualpet.com/vp/faq/instruct/-tam2.gif. Accessed 10/1/2001.
5. Tamagotchi Planet, "General Tamagotchi Information," quote from Bandai http://www.mimitchi.com/html/q1htm. Accessed 10/1/2001.
6. Kismet's "cuteness" is not accidental. In Kismet's design, 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: "For our purposes as robot designers, it seems reasonable to construct a robot with an infant-like appearance, which could encourage people to 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. On this point, see also DiSalvo and Gemperle 2003.
7. The research team posted invitations to participate in a study about what children think about robots; families interested in the study initiated contact with us. Participants represented a wide range of socioeconomic and ethnic backgrounds, including children of African American, Iranian, Haitian, Korean, and French ethnicity. All the participants' identities are disguised.
8. While not an experiment, our study had a formal structure: When participants arrived at MIT, usually in groups of four, they were directed to a conference room and given a brief description of what they would do and see during their time with us: a group introduction to a robot would be followed by a private session with the robot, a conversation about the experience, and then a final visit with the robot. The conversation with each participant was used to encourage each to talk about anything relating to the experience while also gathering information on a standard list of issues, including those raised by the following questions:

   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?

   In all cases, we were more interested in the child's conversation about an issue than the child's "yes or no" opinion about any question. At least one ethnographer 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. For thirty children who visited with Cog, the final visit included a "debriefing" about Cog's inner workings.

   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 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.
9. 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.

10. 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.

11. When children met both Kismet and Cog, they sometimes 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.

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