



Barbie Wants to Get to Know Your Child

With the help of A.I., America's most famous doll tries to fulfill a timeless dream — convincing little girls that she's a real friend. What will happen if they believe her?

By JAMES VLAHOS SEPT. 16, 2015

It looked like a child's playroom: toys in cubbies, a little desk for doing homework, a whimsical painting of a tree on the wall. A woman and a girl entered and sat down in plump papasan chairs, facing a low table that was partly covered by a pink tarp. The wall opposite them was mirrored from floor to ceiling, and behind it, unseen in a darkened room, a half-dozen employees of the toy company Mattel sat watching through one-way glass. The girl, who looked about 7, wore a turquoise sweatshirt and had her dark hair pulled back in a ponytail. The woman, a Mattel child-testing specialist named Lindsey Lawson, had sleek dark hair and the singsong voice of a kindergarten teacher. Microphones hidden in the room transmitted what Lawson said next. "You are going to have a chance to play with a brand-new toy," she told the girl, who leaned forward with her hands on her knees. Removing the pink tarp, Lawson revealed Hello Barbie.

"Yay, you're here!" Barbie said eagerly. "This is so exciting. What's your name?"

"Ariana," the girl said.

"Fantastic," Barbie said. "I just know we're going to be great friends."

Their exchange was the fulfillment of an ancient dream: Since there have been toys, we have wanted them to speak to us. Inventors in the mid-1800s, deploying bellows in place of human lungs and reeds to simulate vocal cords, managed to get dolls to say short words like "papa." Thomas Edison's first idea for commercializing his new phonograph invention was "to make Dolls speak sing cry," as he wrote in a notebook entry in 1877. In the 20th century, toy makers scored with products like Dolly Rekord, who spoke nursery rhymes in the 1920s; Chatty Cathy, a 1959 release from Mattel whose 11 phrases included "I love you"; and Teddy Ruxpin, a mid-1980s stuffed bear whose mouth and eyes moved as he told stories. Even Barbie gained her voice in 1968 with a pull string that activated eight short phrases.

All that doll talk has always been a kind of party trick, executed with hidden record players, cassette tapes or digital chips. But in the past five years, breakthroughs in artificial intelligence and speech recognition have given the devices around us — smartphones, computers, cars — the ability to engage in something approaching conversation, by listening to users and generating intelligent responses to their queries. Apple's Siri and Microsoft's Cortana are still far from the science-fiction promise of Samantha from the movie "Her." But as conversational technology improves, it may one day rival keyboards and touch screens as our primary means of communicating with computers — according to Apple, Siri already handles more than a billion spoken requests per week. With such technology widely available, it was inevitable that artificial intelligence for children would arrive, too, and it is doing so most prominently in the pink, perky form of Mattel's Hello Barbie. Produced in collaboration with ToyTalk, a San Francisco-based company specializing in artificial intelligence, the doll is scheduled to be released in November with the intention of hitting the lucrative \$6 billion holiday toy market.

For adults, this new wave of everyday A.I. is nowhere near sophisticated enough to fool us into seeing machines as fully alive. That is, they do not come close to passing the "Turing test," the threshold proposed in 1950 by the British computer scientist Alan Turing, who pointed out that imitating human intelligence well enough to fool a human interlocutor was as good a definition of "intelligence" as any. But things are different

with children, because children are different. Especially with the very young, “it is very hard for them to distinguish what is real from what is not real,” says Doris Bergen, a professor of educational psychology at Miami University in Ohio who studies play. The penchant to anthropomorphize — to believe that inanimate objects are to some degree humanlike and alive — is in no way restricted to the young, but children, who often favor magical thinking over the mundane rules of reality, have an especially rich capacity to believe in the unreal.

Hello Barbie is by far the most advanced to date in a new generation of A.I. toys whose makers share the aspiration of Geppetto: to persuade children that their toys are alive — or, at any rate, are something more than inanimate. At Ariana’s product-testing session, which took place in May at Mattel’s Imagination Center in El Segundo, Calif., near Los Angeles, Barbie asked her whether she would like to do randomly selected jobs, like being a scuba instructor or a hot-air-balloon pilot. Then they played a goofy chef game, in which Ariana told a mixed-up Barbie which ingredients went with which recipes — pepperoni with the pizza, marshmallows with the s’mores. “It’s really fun to cook with you,” Ariana said.

At one point, Barbie’s voice got serious. “I was wondering if I could get your advice on something,” Barbie asked. The doll explained that she and her friend Teresa had argued and weren’t speaking. “I really miss her, but I don’t know what to say to her now,” Barbie said. “What should I do?”

“Say ‘I’m sorry,’ ” Ariana replied.

“You’re right. I should apologize,” Barbie said. “I’m not mad anymore. I just want to be friends again.”

This summer, when I visited Mattel’s sprawling campus in El Segundo, a prototype of Hello Barbie stood in the middle of a glass-topped conference table, her blond tresses parted on the right and cascading down to her left shoulder. She looked like your basic Barbie, but Aslan Appleman, a lead product designer, explained that her thighs had been thickened slightly to fit a rechargeable battery in each one; a mini-USB charging port was tucked into the small of her back.

A microphone, concealed inside Barbie’s necklace, could be activated only when a user pushed and held down her belt buckle. Each time, whatever someone said to Barbie would be recorded and transmitted via Wi-Fi to the computer servers of ToyTalk. Speech-recognition software would then convert the audio signal into a text file, which would be analyzed. The correct response would be chosen from thousands of lines scripted by ToyTalk and Mattel writers and pushed to Hello Barbie for playback — all in less than a second.

“Barbie, what is your full name?” Appleman asked the doll as I watched.

“Oh, I thought you knew,” Barbie replied. “My full name is Barbara Millicent Roberts.”

Ever since Barbie introduced herself to the world, she has stood at the uneasy center of questions about the influence of dolls on children. Unveiled at the New York Toy Fair in 1959, she quickly became both a cultural flash point — attacked by the pioneering feminist Betty Friedan and depicted by Andy Warhol — and one of the top-selling toys of all time, with more than a billion dolls purchased. Her stilts legs, tiny waist and enormous breasts set her apart from the childish dolls that had reigned until that time; in the 1950s, before Barbie was even released, a mother complained to Mattel that the doll had “too much of a figure.” Her appearance has remained controversial. Protesters at the 1972 Toy Fair complained that Barbie and other dolls encouraged girls “to see themselves solely as mannequins, sex objects or housekeepers,” according to an account in *The New York Times*.

When children reach preschool, they begin to avidly collect information about gender roles — what distinguishes girls from boys, and what each gender is supposed to say and do, says May Ling Halim, an assistant professor of psychology at California State University, Long Beach, who studies gender identity. Barbie and other dolls are hardly the only influences on this process, but they may be a significant source of gender information. A 2006 study in the journal *Developmental Psychology* bluntly concluded that “girls exposed to Barbie reported lower body esteem and greater desire for a thinner body shape.”

Giving Barbie a voice only increases her potential impact. “The messages that she says could influence how kids define being a girl,” Halim says. An earlier version of the doll with a much more limited ability to speak — Teen Talk Barbie, released in 1992 — enraged critics with the utterance, “Math class is tough.” The American Association of University Women called on Mattel to recall the doll, and the company, apologizing, deleted the offending line from the computer chip.

The technology behind Barbie’s latest campaign to speak was inspired by an incident four years ago, when a 7-year-old girl named Toby sat on the floor of her family’s playroom in Piedmont, Calif. She and her father were chatting with her grandmother, using the Skype app on an iPhone. After the call, Toby gazed across the room at her favorite stuffed animal, a fuzzy rabbit she called Tutu, and then back at the phone. “Daddy, can I use this to talk to Tutu?” she asked.

Toby’s father was Oren Jacob, who until recently had worked at Pixar, and he says he just laughed at his daughter’s remark at the time. Jacob started at the company in 1990, while he was still an undergraduate at the University of California, Berkeley. As a technical director, he helped create Buzz Lightyear’s rocket exhaust in “Toy Story” and the watery world of “Finding Nemo.” By 2008, he was a chief technical officer, reporting directly to John Lasseter and Steve Jobs.

Jacob resigned in 2011, wanting to try something new. Soon after, he and Martin Reddy, who had been Pixar’s lead software engineer, decided to start a company. But the two struggled to find a compelling idea. So Jacob mentioned his daughter’s comment to Reddy, and the more they discussed the notion of talking to toys, the more the idea seemed promising — or even revolutionary, on par with the once-heretical notion of using a computer to create cartoons. “If you could put an incredible, believable character in conversation, what would it do to the world?” Jacob says he and Reddy wondered. “What kind of characters could you create, stories could you tell and entertainment could you offer?”

Jacob isn’t young by the standards of Silicon Valley — he’s 44, with close-cropped graying hair. But he is impish, favoring shorts and brightly colored T-shirts, and he is manic, the sentences cascading from his mouth at an auctioneer’s pace. He and Reddy, who is also 44 and has a Ph.D. in computer science, started ToyTalk in May 2011 and, with the help of \$30 million so far in investment, have hired nearly 30 employees, including coders, artificial-intelligence experts, natural-language-processing specialists and a creative team. The company’s first commercial offerings were smartphone and tablet apps featuring characters that talk back. But early this year, ToyTalk and Mattel joined forces to create a talking Barbie that could actually listen.

Mattel committed to a November 2015 release date, but as of February, none of Barbie’s lines had been written, reviewed or recorded. Almost none of the technology inside the doll was available off the shelf; Mattel needed specific features and components that fit into Barbie’s notoriously svelte figure. “For the Wi-Fi transmitter alone, we had five different vendors working on a solution in parallel,” Appleman said.

But Mattel executives felt they needed to push forward, not least because the Barbie brand is ailing. The company sold \$1.3 billion worth of Barbie products in 2011, but by last year, the figure had dropped to \$1 billion. A typical product team at Mattel might have 15 people handling 40 to 75 new offerings; the Hello Barbie team is twice as large, with some members devoted exclusively to the new doll. Usually the product-development timeline is 18 months; Hello Barbie needed to be finished in half that time.

In May, three ToyTalk employees in their 30s — Sarah Wulfeck, Nick Pelczar and Dan Clegg — filed into a conference room in the company’s San Francisco office. Pelczar and Clegg were Shakespearean actors who still performed regularly onstage; Wulfeck studied dramatic writing and did voice-over work in Hollywood. All three supplied the voices for prior ToyTalk characters, but for Hello Barbie, their job was to write the content that would fill Barbie’s vacant brain. (Danielle Frimer, another actor, would join them later.) “We are trying to build her personality from scratch into the perfect friend,” Wulfeck said.

Now two months into their writing process, the team had finished about 3,000 lines of dialogue — mostly isolated modules of content on fashion, careers, animals and more. They had 5,000 more lines to write until the project was finished. Wulfeck plugged in a computer and started a program called PullString,

named in homage to the mechanism that triggered the utterances of mid-20th-century toys. The software, which was created by ToyTalk's engineers, allowed nonprogrammers to script the conversations that kids might have with a character like Barbie.

The writers were working on a relatively simple game in which Barbie, casting herself as a game-show host, would ask children to give awards to family members. Wulfeck had written the module and now wanted feedback from the other writers. They started playing the game, with Pelczar providing the child's responses. Wulfeck typed what he said into the system and read the replies that PullString generated for Barbie.

"For the person who's always gonna grab the last French fry, carrot stick or cookie, it's the Always Eats the Last One Award!" Wulfeck-as-Barbie said. "And the award goes to?"

"My brother, Andrew," Pelczar said.

"Your brother," Wulfeck replied, reading from the PullString screen. "He's the best at getting the last one, huh? How does he do it?"

"He's fast and hungry," Pelczar said.

On another visit, Wulfeck showed me how Barbie's artificial intelligence worked. She tapped on the keyboard to bring up a simple example. "Hey, how are you?" read a line of Barbie's at the top of the screen. The next step had been for the writers to list dozens of words that the speech-recognition software should listen for in a child's answer: for instance, "good," "fine," "fantastic" or "not bad." The system extracted keywords, and in this case, "good" or any of its positive brethren would cue Barbie to reply, "Great! Me, too." "Bad" or other negative words would direct Barbie to say, "I'm sorry to hear that."

In this way, every one of Barbie's potential conversations was mapped out like the branches of a tree, with questions leading to long lists of predicted answers, which would trigger Barbie's next response, and so on. In case the speech recognition failed or a kid's response was not predicted, the writers always supplied Barbie with a "fallback": the kind of enthusiastic and generic conversational trick — "Really? No way!" — that a person might use in, say, a loud bar. The writing process, Wulfeck said, was like doing improv with an unpredictable partner. "You are playing off of somebody who could be anybody," she said. "It could be the shy kid, the really snarky kid or the insecure kid, and you have to think about what that child is going to say back."

Barbie would be able to ask kids what music they liked, for instance, and was ready for nearly 200 possible responses. Taylor Swift? "She is one of my super favorites right now!" Barbie would reply. My Bloody Valentine? "They are so emo."

The writers marked important questions with "flags," and this enabled Hello Barbie's most unnerving power: She could remember the answers and use them for conversation starters days or weeks later. "She should always know that you have two moms and that your grandma died, so don't bring that up, and that your favorite color is blue, and that you want to be a veterinarian when you grow up," Wulfeck said.

In developing the technology to make such feats possible, ToyTalk is chasing one of the most prized goals in Silicon Valley today, which is to create artificial-intelligence-powered companions that are personality-rich and conversationally capable. ToyTalk's approach, however, focuses on quality of conversation instead of quantity. Smartphones often regurgitate online content using automated voices, while every single word that a ToyTalk character says is scripted by writers and recorded by actors to sound genuinely human. Smartphones roam the web for unlimited information, while a ToyTalk character like Hello Barbie is limited to 8,000 lines of content. Smartphones rarely extend beyond one-question, one-answer exchanges; PullString conversations can go 10 to 200 interchanges deep. Over all, ToyTalk favors creative control over smartphones' superior utility.

To craft Hello Barbie's character, the ToyTalk writers worked from a background brief and verbal instructions from Mattel. As a toy, Hello Barbie needs to be both fun, leading girls through imaginative

games, and funny, telling jokes and being goofy. But Mattel also wanted Barbie to have an empathetic, affirming sensibility aimed at young girls, says Julia Pistor, a Mattel vice president. “The subtext that is there that we would not do for boys is: ‘You don’t have to be perfect. It is O.K. to be messy and flawed and silly.’”

Armed with her ToyTalk-scripted lines, Hello Barbie comes across as chipper and positive, verging on cloying. But she is also fun-loving, with just a hint of conspiratorial mischief. “I like to think of her as the world’s best babysitter,” Wulfeck said.

She told me she imagined a girl taking the new doll into her bedroom and closing the door. “I have no doubt she will ask Barbie all manner of those intimate questions that she wouldn’t ask an adult,” Wulfeck said.

For those situations, the team was working on getting Barbie to say the right things — or at the very least, to not say the obviously wrong ones.

“Do you believe in God?” a kid might ask.

“I think a person’s beliefs are very personal to them,” Barbie might reply, Wulfeck said.

“I’m getting bullied in school.”

“That’s sounds like something you should talk to a grown-up about.”

“Do you think I’m pretty?”

This was dicey territory, and Wulfeck was trying to steer Barbie to safe ground. “Of course you’re pretty, but you know what else you are?” Barbie would reply. “You’re smart, talented and funny.”

“I feel shy trying to make new friends.”

“Feeling shy is nothing to feel bad about,” Barbie would say. “Just remember this — you made friends with me right away.”

Anyone who has watched a child have an animated conversation with a doll — or a stuffed animal, a toy car or a Lego brick for that matter — has probably wondered what that child is really thinking. As the pioneering developmental psychologist Jean Piaget wrote in his book “The Child’s Conception of the World,” published in 1929, “Does the child attribute consciousness to the objects which surround him, and in what measure?”

This question has only grown more intriguing with the advent of toys that, rather than waiting for a child’s imagination to animate them, use technology to seemingly attain consciousness all on their own. In the late 1990s, Noel Sharkey, a professor at the University of Sheffield in England who studies the ethics of robotics, saw how this could play out when one of his daughters, who was around 8 at the time, started interacting with one of the first-ever artificial-intelligence-powered toys — a virtual pet called Tamagotchi. An egg-shaped computer that fit in the palm of her hand, the Tamagotchi had a tiny screen to express what it needed and wanted. Sharkey’s daughter periodically pressed a button to give the Tamagotchi food; she played simple games to boost her pet’s happiness levels; she took the pet to the toilet when the screen indicated that it needed to relieve itself. Tamagotchi’s creators had programmed it to demand an ever-increasing amount of attention, and a failure to deliver this caused the pet to become sick. “We had to break it away from my daughter in the end, because she was obsessed with it,” Sharkey says. “It was like, ‘Oh, my God, my Tamagotchi is going to die.’”

The ability of even simple gadgets like the Tamagotchi to seduce users into the belief that they have lifelike qualities has been obvious since the earliest days of artificial intelligence. In the 1960s, a computer scientist, Joseph Weizenbaum, created a computer program called Eliza, which could pretend to be a psychotherapist via a simple text interface. As Weizenbaum later wrote, “I was startled to see how quickly and how very deeply people ... became emotionally involved with the computer and how unequivocally they anthropomorphized it.” Five decades of research have supported the same finding in increasingly creative

ways. Studies have documented that people are embarrassed to undress in front of humanlike robots. We cheat less in the presence of robots, keep a robot's secrets from other people when asked by the machine to do so and hesitate to "kill" (via an on-off dial) a nice-seeming robot.

With children, this phenomenon can be even more pronounced. To see how they reacted to lifelike technologies, the roboticists Cynthia Breazeal and Brian Scassellati and the psychologist Sherry Turkle introduced children to the robots Cog and Kismet at the Massachusetts Institute of Technology. In the experiment, which took place in 2001, the two robots couldn't converse with kids but engaged them through eye contact, gestures and facial expressions. Surveyed after these encounters, most children said they believed that Kismet and Cog could listen, feel, care about them and make friends — despite researchers' showing the children how the robots worked and giving them a chance to control them. "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," the researchers later wrote.

For psychologists who study the imaginative play of children, the primary concern with A.I. toys is not that they encourage kids to fantasize too wildly. Instead, researchers worry that a conversational doll might prevent children, who have long personified toys without technology, from imagining wildly enough. "Imaginary companions aren't constrained," says Tracy Gleason, a professor of psychology at Wellesley College who studies children's imaginative play. "They often do all kinds of things like switching age, gender, priorities and interests." With a toy like Hello Barbie, the personality is limited by programming — and public-relations concerns. Mattel, rather than kids, ultimately controls what she can say. "She is who she is," Gleason says. "That might be a lot of fun, but it is definitely less imaginative, child-generated and truly interactive than someone with whom you can imagine whatever you want."

A toy that can befriend a child is likely to be a commercially successful one, so toy makers will presumably push to make their A.I. technologies ever more likable. "The first thing you're going to do is to try and create stronger and stronger emotional bonds," Sharkey says. For some children, synthetic friendship could begin to supplant the real kind: "If you've got someone who you can talk to all the time, why bother making friends?" Family members and friends can annoy, challenge or disappoint, "whereas this lovely Barbie will be beautiful to you all the time." Parents, who already turn to televisions and tablets to occupy their children, might embrace an even more capable-seeming e-babysitter. Is Hello Barbie "a step toward leaving your children in the hands of robots?" Sharkey asks. "I don't know."

Peter Kahn, a professor of psychology at the University of Washington who studies human-robot interaction, worries about a "domination model" relationship in which the child makes all the demands and receives all the rewards but feels no responsibility to the robot. This, he says, is unhealthy for moral and emotional development. At worst, the human can begin to abuse his power. In a study conducted at a Japanese shopping mall a couple of years ago, for instance, researchers videotaped numerous children who kicked and punched a humanoid robot when it got in their way. Anticipating that some kids might say mean things to Hello Barbie, ToyTalk has programmed her to simply ignore verbal jabs. The thinking behind this approach, which is common in A.I., is that acknowledging bad behavior often has the perverse effect of encouraging it.

The alternative is for the robot to stand up for itself. To test this strategy, Kahn and his colleagues ran an experiment in which 90 kids and teenagers played a game of I Spy with a robot named Robovie. Before the game could finish, an adult experimenter would always interrupt, saying, "Robovie, you'll have to go into the closet now." Robovie would protest that this wasn't fair, but the experimenter would nonetheless lead the robot away. "I'm scared of being in the closet," Robovie would say. After witnessing this, nearly 90 percent of the subjects said they agreed with Robovie's protests; more than half thought that it was "not all right" to put the robot in the closet. "The surprising finding," Kahn says, "is that children will engage not just socially but morally with these robots." Kahn, though, says he has mixed feelings about programming machines to demand morally just treatment. Some roboticists feel that in so doing, they create an even more persuasive charade of life.

All the roboticists I spoke with said that getting people to suspend disbelief and emotionally invest in

imaginary characters is what practitioners of the arts have been doing for eons, in works from “Oedipus Rex” to “Inside Out.” But it’s hard not to wonder what our increasingly potent ability to conjure the illusion of life — especially with products for children, who eagerly anthropomorphize even without the help of technology — will mean for the future. “In small doses, it just doesn’t matter, of course,” Kahn says. “It is just a trivial toy. But the way the world is going, these are not just going to become small, isolated technologies in a child’s life. They are becoming a pervasive form of interaction.”

At the beginning of June, I returned to El Segundo to check on Mattel’s progress with Hello Barbie. Michelle Chidoni, a company spokeswoman, led me past racks of candy-colored clothes for girls tagged with the Barbie brand, bins of glitter and dozens of Barbie heads perched atop small sticks.

Inside a conference room, several employees had gathered to review the latest batch of dialogue from the ToyTalk writers, with Wulfeck on speakerphone. Roughly 5,000 of the 8,000 lines of dialogue were now written, and one question concerned Barbie’s tone. If her sense of humor was too sharp, it might alienate the 3-year-olds who were at the young end of the doll’s target market. But if Barbie were too treacly, she might turn off the 8- and 9-year-olds. The group started discussing the family award show, and Amy Braun, a Mattel marketing manager, made it clear that she thought the game’s tone had veered too far toward snarky. “It feels kind of negative,” Braun said.

Everyone in the room remembered the “Math class is tough” debacle, and nobody wanted to repeat it. Wulfeck had scripted Barbie to say “You’re beautiful” in a playfully smarmy tone as she greeted girls to the game show. But Braun objected. “I don’t love that the first thing you say to her is, ‘You’re beautiful. ...’ I want to hear: ‘You are smart. You are intelligent. You are awesome.’ Something other than her physical attribute.”

Later in the game, Barbie commended the family’s top book reader for being “a lover of the literary.” Carrie Buse, an interactive-content specialist at Mattel, said the line “implies something slightly inappropriate.”

“I don’t understand,” Wulfeck said.

“As in, ‘I am the lover of those who are literary,’ ” Buse replied. “We don’t want Barbie to be the *lover* of anybody.”

The game show also had an award for cleaning up gross stuff, including bugs, and a Mattel lawyer fretted that it sounded as though Barbie was encouraging kids to cruelly squash insects. Chidoni agreed. “PETA will come after you,” she said.

That wasn’t the only problem, Braun said. “Line 176, the word ‘cockroach’ ...”

“Nope! Not a Barbie word,” Buse interjected. Mattel wanted to avoid the embarrassment of someone, with an easy bit of editing, say, posting a YouTube video of Hello Barbie saying a profanity. Barbie provoked angry reactions, and Mattel had to anticipate them. “Barbie has a target on her back,” Chidoni told me.

Mattel executives know that they will never win over all critics, but they are nonetheless using the introduction of Hello Barbie to promote a different view of the doll. Unlike baby dolls, which encourage a mothering role, Barbie has showcased 170 different careers as an unmarried adult woman, making her an unlikely sort of feminist. “She went to the moon before Neil Armstrong,” Chidoni said. “She was president of the United States before any female president.” Touting Barbie’s independence was one component of the rollout, and Evelyn Mazzocco, a senior vice president, told me the physical doll also needed to offer “a better reflection of what young girls look like today.” Hello Barbie and many other new Barbie models coming out this year will wear less makeup and tamer clothes than in the past. The doll’s feet will be flat, allowing her to fit into comfortable shoes.

Changing the way the doll speaks is another part of the makeover, Mazzocco said. The first-ever talking Barbie, the one released in 1968, was voiced by Gwen Florea, who was hired to work on talking toys at Mattel after an employee spotted her dancing to a song called “The Stripper” in a bar whose sound system she

engineered. Her voice, which played from a quarter-size record hidden in Barbie's torso, was lilting and vapid. Barbie's current voice is that of Erica Lindbeck, a 23-year-old voice actress. Mazzocco said she was chosen because her delivery was lower, less breathy and more down to earth than those of past Barbies.

A few weeks after the dialogue-review meeting, I went to one of Lindbeck's recording sessions. Inside a darkened studio booth, the session's director, Collette Sunderman, stared through a window into an adjacent room, where Lindbeck perched atop a stool with a microphone in front of her mouth.

Lindbeck, who had previously recorded content for many of the stand-alone content modules, was now starting to work on the lines that would enable one of the doll's most advanced capabilities — being able to reference previous conversations with girls, aided by Barbie's digitally stored memories. "Oh, you told me you liked your science class," Lindbeck said into the microphone with gusto. "Is there something else you like from school?"

"Perfect," Sunderman said. "Moving into the biology. Same feel, O.K.?"

During a break, Lindbeck came into the sound booth and explained how the work required a new kind of acting. Much as action stars envision fantasy worlds when they perform in front of green screens, she had to imagine the responses of a girl who wasn't there. (In "The Diamond Age," Neal Stephenson's prescient science-fiction classic about artificial intelligence, this particular job was called "racting.") Sunderman said she frequently used a catchphrase to coax Lindbeck into trying to create intimacy between doll and girl. "I'm sure you've heard me say this a thousand times, 'knee to knee,'" Sunderman told Lindbeck. Then Sunderman turned to me. "I came up with that little phrase for us to feel like we were two little girls in a slumber party sitting on the bed, knee to knee, talking."

In August, only three months before Hello Barbie was scheduled to ship to toy stores, a group of Mattel employees assembled again in the Imagination Center. Wulfeck and Pelczar had flown in, and they took notes, their computer screens glowing as the lighting dimmed in the observation room. With seven new girls coming in, and 7,000 of Barbie's 8,000 lines complete, the goal now was to test some of the most complex games and discussions.

One by one, the girls came into the mock playroom for 20-minute sessions. Ranging in age from 6 to 8, they helped Barbie solve a mystery involving zoo animals and missing bananas. They played a guessing game and rode imaginary horses into the forest. They talked about what they wanted to be when they grew up — veterinarian topped the list — and told Barbie about their families.

Barbie was pretty — "Why are you so beautiful?" one girl asked her, unprompted. But the doll, which was still under development, was also streaky. She would give a long string of intelligent responses, conveying a remarkable illusion of sentience, and then bungle a few easy exchanges in a row. The kids usually didn't seem to notice. Even when they did, they just kept plowing along, a roll-with-it attitude that makes children an ideal test market for the nascent artificial-intelligence industry.

In a session with a 7-year-old named Tiara, Barbie demonstrated her potential to push beyond games — but also revealed the considerable challenge of doing so. Barbie explained that her sister Stacy was feeling jealous because the other players on her new soccer team were so good. "What do you think I should say to her?" Barbie asked.

"Just say, 'It's O.K. if you lose,'" Tiara replied.

"That's a good suggestion," Barbie said. A bit later, she asked: "What about you? Have you ever felt jealous about something?"

"Other people talking about me," the girl said.

"Jealous feelings can be really hard," Barbie said. So far, the conversation was proceeding just as the writers had envisioned — an emotional disclosure leading to a teachable moment, just like an after-school special. Then Barbie's brain seemed to get stuck, and it took Tiara several attempts to steer the conversation

away from the jealousy topic.

"Talk about something else," Tiara said, and Barbie finally listened. She told some jokes, then switched to a more personal topic.

"Hey, new question," Barbie said. "Do you have any sisters?"

"Yeah," Tiara said. "I only have one."

"What's something nice that your sister does for you?" Barbie asked.

"She does nothing nice to me," Tiara said tensely.

Barbie forged ahead. "Well, what is the last nice thing your sister did?"

"She helped me with my project — and then she *destroyed* it."

"Oh, yeah, tell me more!" Barbie said, oblivious to Tiara's unhappiness.

"That's it, Barbie," Tiara said.

"Have you told your sister lately how cool she is?"

"No. She is *not* cool," Tiara said, gritting her teeth.

"You never know, she might appreciate hearing it," Barbie said.

Another awkward moment came during the zoo game, when one girl seemed to be having a good time but became unnerved when Barbie mentioned seeing orange fur, which was a clue; the girl thought she was supposed to see the fur in the testing room. When she couldn't find it, she stood up and walked away, saying, "It's freaking me out."

But when each play session finished and Lawson, the child-testing specialist, came back into the room to debrief, the girls all said more or less the same thing. They liked talking to Barbie. She was a good listener. Conversation was easy and fun.

What exactly girls will make of Hello Barbie isn't clear. Research shows that children don't fully believe that artificial-intelligence toys are alive in a biological sense. But they also don't treat them simply as devices. Instead they are increasingly comfortable with a third ontological category — beings that are less than human but more than machines. Turkle, whose upcoming book is titled "Reclaiming Conversation: The Power of Talk in a Digital Age," says that we have arrived at a "robotic moment" — a milestone that is as much about cultural acceptance as it is technological achievement. "It's not that we have really invented machines that love us or care about us in any way, shape or form," Turkle says, "but that we are ready to believe that they do. We are ready to play their game."

At the Imagination Center, as one of the sessions ended, Lawson told a little girl named Emma that it was time to leave the testing room.

"Is Barbie going to come?" the girl asked hopefully.

"Barbie is going to hang out here," Lawson replied.

Emma got up from the table. Reaching the door, she stole a quick glance back at Barbie, who stood alone on the table, the smile frozen on her pink plastic lips.

Correction: September 17, 2015

An earlier version of this article misstated the role of Michelle Chidoni at Mattel. She is a spokeswoman, not marketing chief.

James Vlahos is a writer based in El Cerrito, Calif., who also contributes to GQ, The Atlantic and Popular Science.

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