

How Social Design Works

Affordances and Interaction

In thinking about the social design of smart objects, I often reflect on the relationship I have with my laptop, which could in some ways have been thought of as the ultimate, all-purpose smart object (that is, before the advent of the smartphone). As cold and hard as it might be, over time it has grown to something that feels natural. When it's closed, it's my accessory, a thick metal stand-in for a notebook, carried under my arm and reminding me of the potential for creativity and connection with other people. When open, it transforms into an entity that demands my attention. Its screen stands upright, directly facing me and blocking the view of anything beyond it. Glowing brighter than anything around it, I'm drawn into the activity happening on the illuminated rectangle. No longer a sidekick, it becomes the focus of my attention, supplanting any interaction that might be taking place and becoming the main conversation. I perform an action on the keyboard, which

results in activity through light or sound. I am completely immersed, sometimes for hours, at the exclusion of everything and everyone else around me.

A short caress of the trackpad sends the page traveling upward, allowing me to review the outline originally written above this. Sometimes I absentmindedly use this little caress to reinforce the connection I have with the machine, nudging the pages up and down on the screen to bounce around along with my thoughts. Many times during the interaction, I am one with the machine, my hands flying around the keyboard, taking advantage of muscle memory that's been developed over decades and is so second nature that I'm not even cognizant of how the thought starts and how it ends.

This intuitive and intimate interaction is a good example of social interaction—one in which back-and-forth communication requires little conscious thought or mental gymnastics; however, this intimacy did not come easily. Undeniably, the way we control our computers—through mice, keyboards, and trackpads—is an uncomfortably unnatural way of interacting. (In my years of teaching design tools to art students at the graduate and undergraduate level, I have memories of several students who were new to computers assuming that the mouse should be placed right on the screen

in order to control the cursor. Though this seems absurd to anyone who has trained themselves to use a mouse, it does fundamentally make sense.) It exists, at best, in what I would call the “awkward teenage-years” progression of computing devices—that is, it is good *enough* to serve its purposes and was the best manufacturers could do with the components and their respective costs at hand, but it is far from ideal.

Despite the challenge, I have developed an intimacy with my laptop, and this relationship is just one example of a social interaction that takes place in everyday life. Other social exchanges take place between me and my coffee machine, my mobile phone, my thermostat, and my car dashboard. Some take place through taps and caresses, and as microphone and camera technologies become more sophisticated and ubiquitous, others increasingly take place through voice and physical gestures, but they still add up to an enormous cognitive load perpetually foisted upon me throughout the day.

In the past it was not always economically feasible to develop products with truly sophisticated and intuitive interfaces—sensor components were expensive, software was onerous to develop, and microcontrollers were not small and affordable enough to make sense in many consumer product applications. We knew computing devices were woefully inadequate, and we

ardently envisioned, explored, and even prototyped ideal solutions, but it was rarely possible to implement these new ideas in mass-produced products. It was clear to us that experimentation around the potential for new ways of interacting would prove valuable to future product design efforts.

With so many technical hurdles now behind us, designers can lean on decades of ideal visions to inform new product solutions and bring them to life in real, concrete ideas and viable product proposals.

Social Affordances

This book will focus on ways to create and measure the social affordances of new products. *Social affordance* is a term that builds upon cognitive psychologist Donald Norman's definition of designed affordances, with the specific filter of social value applied.¹ It was originally used by Erin Bradner, research scientist at Autodesk, to consider how communications between people that are mediated by technology (such as email, messaging systems, and conferencing technologies) can facilitate group work.² Here, we expand upon the definition to include social interactions that take place between a person and their product. In other words, the social interaction can be the

result of using the device as an avatar, or stand-in, for a person, or it can be the vehicle for communication between the person and the product as *an entity in itself*.

Social affordance for product design has a few aspects to consider:

- *Degree of intimacy*: Defining the nature of the relationship on the self-other continuum. Is this product an extension of myself, or is it an agent that acts on my behalf through tasks that it conducts independent of my direction?
- *Form*: How the physical shapes that make up the product's anatomy communicate social abilities and intentions and relate to the human body.
- *Dynamic behaviors*: How light, sound, and motion changes influence the social interactions between person and product.
- *Conversational elements*: How the messages conveyed by the product shape the way in which the relationship between product and person evolves.

Social Affordances and Better Product Experiences

Fortunately, we are in a new era in which those of us creating products can do much better, diminishing the learning curve

for getting accustomed to an interface and thus building a stronger bond, making products easier to use and accessible to a greater portion of the population. Imagine my laptop as an extension of my body, allowing me to move the cursor where I want it just by shifting my gaze instead of having to manage the removed interface of the trackpad. Perhaps it could be a thin, flexible interface that I unfold so that it's in my pocket whenever I need it. And maybe its main interface can shift from being a keyboard to being a drawing surface so that it allows me multiple ways to input ideas.

In this way it could serve as a prosthetic, a natural part of myself. Another type of relationship one could have with a computing device would be as another entity with whom it would be natural to interact in social ways. As a designer, a big “aha” moment for me in terms of the value and power of social interaction with computers came in 2007, when I became part of the core team invited to develop a robot named Simon at the Georgia Institute of Technology in the Socially Intelligent Machines Lab led by Dr. Andrea Thomaz.

Simon was an upper-torso humanoid robot being developed to look at ways for people and machines to live and work alongside one another, and I was brought on board to lead the creative aspects of designing the robot's overall architecture,

which would serve as a core means for defining its movement and behavioral characteristics. Together with Andrea and mechanical engineering partner Jonathan Holmes, we set out to create a robot that could explore how we might be able to control and train computers without needing any knowledge of code, mechanics, or button presses. The goal of the Simon project was to try to create a computing machine that relied only on social cues for its control and performance. In other words, to interact with the robot, one needed only to approach it with the skills he or she already had in interacting with people: talking, gesturing, exchanging objects, and so on. Simon understood spoken sentences and used voice, movement, and light behaviors to respond appropriately. If it didn't understand a certain request, it raised its arms in an apparent plea for forgiveness or cocked its head to express confusion. Its ears lit up when it recognized a color, and it spoke back when a person finished talking.

Simon was a one-off prototype developed to study people's interactions. Although I can describe how intuitive it is for me to use my laptop, it actually took a lot of cognitive effort at some point in my life to learn how to interact with it. Whether aware of it or not, I spent years training myself to use a QWERTY keyboard, originally as a teenager on an old-fashioned typewriter and eventually on a computer keyboard similar to

the one that's part of the laptop case. The trackpad that feels so smooth under my fingertips was also a device I had to learn to use, gradually building an understanding of how to position my finger on the small rectangle while looking away at the larger rectangle in front of me onto which it was mapped.

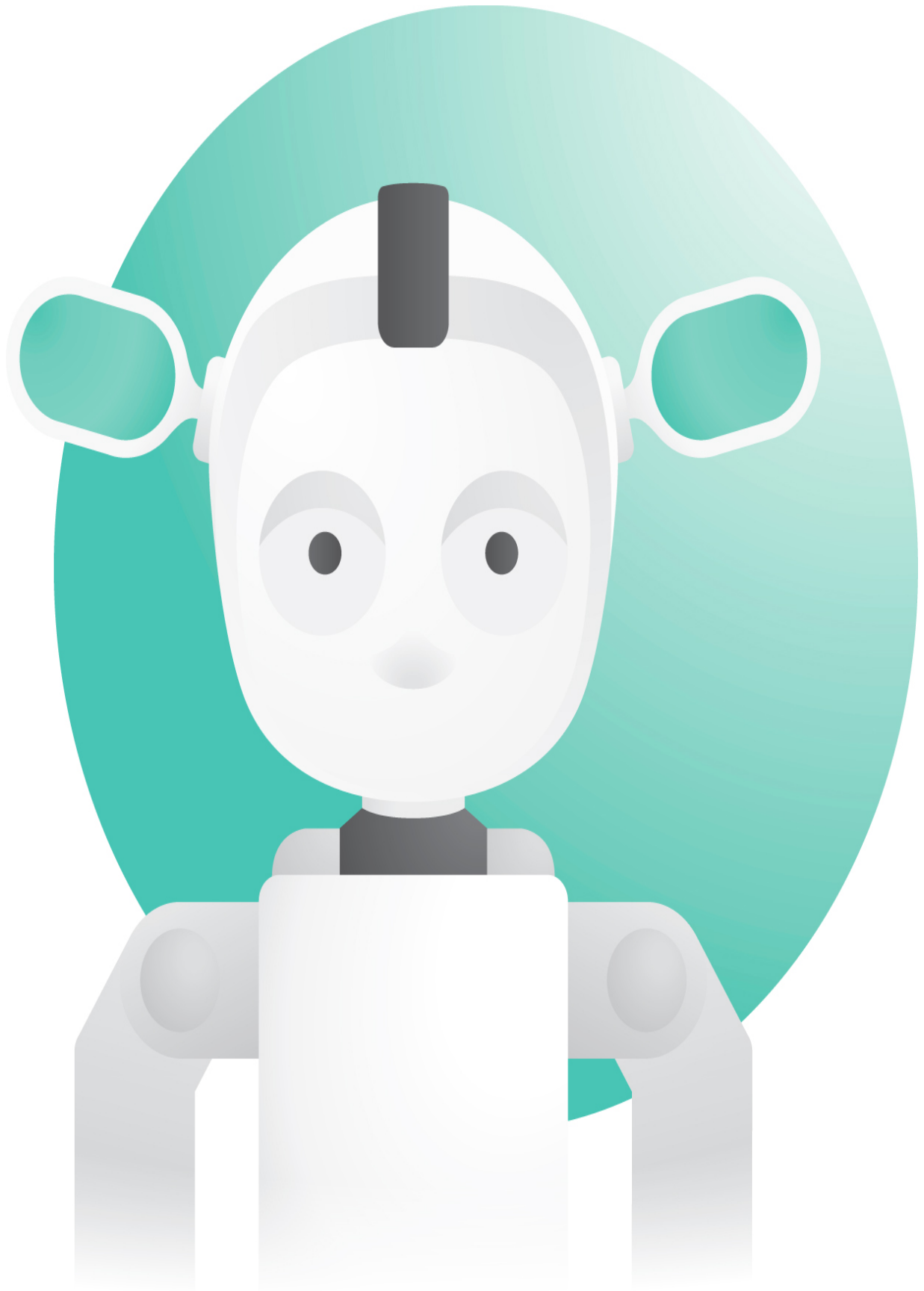


FIGURE 2-1

Simon, the Robot That Relies on Social Cues

Simon's Ears

Simon was by far the most exciting project I had worked on up until that moment, and as a designer interested in interactivity, this was about as extreme an interface as one could get. But before we could get to thinking about how (and if) the robot might speak, move, or light up, I had to develop a clear direction on its overall shape and form. Relying on Andrea's research insights from previous robot projects, I knew it would need to have an expressive head that was capable of multiple gestures. It would need eyes that could indicate gaze (where and what it was looking at) and show social attention (with whom it was communicating). But one feature of the robot's anatomy that I may have taken for granted before this was what might seem to be functionally unnecessary: ears.

Ears serve no mechanical function for a robot—the microphones needed to understand speech can be well hidden within the head or torso. In fact, Simon's ears don't actually house the microphones that enable it to "hear." Instead, these appendages serve a purely social function, offering both

logistical clues and emotional feedback. Andrea had initiated the Simon project after her PhD research on Leonardo, a seminal project in social robotics under the auspices of Dr. Cynthia Breazeal.³ The team that had worked on Leonardo learned that the robot's ears provided people with important nonverbal information regarding what was happening during their interaction with it, much the way that people decipher the meaning of ear movement on a cat or dog.

Knowing this, I decided to exaggerate the ears to make them large features that would be used for expressive feedback. This feature also corresponded to our goal of having curiosity as a cornerstone of the robot's character, boldly announcing its intention to listen to commands in order to learn how to accomplish new tasks, so before any interaction even takes place, the physical form serves to establish its role as a social actor in the room.

Prominently placed on the upper hemisphere of the head, the ears appear as two long half capsules, almost like thick antennae. Since part of the goal of the design was to set the expectation of the robot as a machine (as opposed to a humanlike creature), the ears are more like extensions of a helmet than organic elements. They each have two degrees of freedom, allowing them to both pivot up and down and spin to

face forward or backward. The result is a wide range of motion that can be harnessed to enhance the interaction. While working with the team, I learned some of the ways that a seemingly frivolous or purely decorative form serves to enhance the interaction.

The ear position can indicate many aspects of the state of the system—for example, sleep, wake, standby, busy, or in an error state. It can show the robot's successful localization of the sound of an individual's voice, something we humans do intuitively but that requires programming and processing for a robot to do well. It can show attention—that is, point toward the person with whom it is actively engaged, even if the voices of others can be discerned nearby.

Some of the most nuanced aspects of the interaction with the robot are its ability to express communicative gestures, and the ears play a big role in emphasizing the messages that the robot communicates. For example, during an exercise in which the robot was trained to identify the colors of objects through spoken prompts, the ears can pivot up and forward to indicate that it is in the process of listening for words in a sentence that relate to colors. If someone says, "It goes in the green bin," Simon can parse the sentence and pull out the word *green* and then learn to associate that word with the color of the image its

camera picks up for that object. If it isn't able to discern color information from the way the person phrased the sentence, it can lower its ears, as if to say, "I didn't understand you and am trying to listen for more information." If it places the object in the wrong bin, the person can chastise Simon, and the robot can lower its ears as if to say, "I'm sorry I messed up. I care about getting this right."

Because of the robot's ability to gesture, the exchanges can be loaded with a great deal of information that is carried by the form and the gesture and therefore doesn't need to be explicit. In other words, Simon can say, "I'm sorry" in body language without having to add more words and sentences to the conversation. And while all this is taking place, the communication can serve to establish the robot's personality, indicating that it cares about doing the job well and is invested in the task at hand. Having a personality that can be understood also helps people to build reasonable expectations for how the robot will behave in future interactions. This, in turn, provides an intriguing emotional hook that encourages people to continue interaction and have empathy for the robot as an imperfect entity that needs to mess up in order to learn.

This powerful sensation of having an emotional exchange with a product is the holy grail of product design; an instant,

intuitive interaction can make the difference between a person feeling frustrated with their product and adoring it. The key to pulling off this type of interaction smoothly, in which the person can be drawn into the exchange with the product and linger for as long as is needed, is not a humanoid form. Instead, the core part of the experience relies on designing a system that can respond appropriately to the exchanges that are likely to take place. While sensor systems and programmed actuators are intrinsic parts of what's needed, it all starts with the product's architecture and a physical design that's sensitive to the social potential of the interaction. So in Simon's case, it may be exaggerated antenna ears, whereas for other products it may be another characteristic, like a wagging car door handle or a microphone that can bow and point to where it's listening.

While Simon is what I call an "extreme" interface, exhibiting many sophisticated behaviors and features that are not necessary for most household products, I have drawn on my experience with it, as well as subsequent robots developed with the Socially Intelligent Machines Lab (which later moved to the University of Texas at Austin) and Diligent Robotics, a company that was an offshoot of one of the lab's projects and for which I served as head of design. I rely heavily on these insights when embarking on the design of all kinds of products, from interactive water bottles to car interiors.

Interaction Intelligence

From a technology standpoint, products and services have been augmented with the ability to speak and listen using normal language, the capacity to remember what you did last week, the potential to sense factors like the weather, and the connectivity to get updates from the internet. These feel like advances in the intelligence of our devices because we are going beyond buttons, knobs, and screens, and we have just begun to interact using intuitive human behaviors such as conversation and gestures. Interactive agents such as Apple's Siri, Amazon's Alexa, Google Home, or Microsoft Cortana are artificial intelligence (AI) agents, though the experience they enable goes well beyond what AI alone can offer. From a consumer standpoint, *interaction is intelligence*.

The distinction between interaction intelligence and AI is an important one to understand. Today's AI enables rapid search, pattern recognition, complex planning, and massive data processing. This can be helpful to making interactively intelligent systems but is far from enough to accomplish that job alone. The ideas in this book focus on the interaction intelligence that will be the cornerstone to designing socially savvy products and establishing paradigms for the next generation of consumer device design.

From a business perspective, it will be critical to hire people who can understand both the technologies of interaction and the psychological and social rules that govern people's responses to different interaction designs. These next-generation interaction designers will need a broad suite of skills beyond those taught to designers, engineers, or computer scientists today.

Modeling Interaction

In addition to the social design framework, which will be used to organize the overall structure of the book, it will be helpful to refer to a model to help illustrate basic interaction genres and analogs. This model diagrams the communications between a person and product—we'll call them the *interactants*—beginning with a common communication medium such as a phone. It is something that will be expanded upon in stories and examples throughout the book.

This book addresses how we as designers need to approach the design of interactive objects, knowing and understanding that people may interact with those objects like they are people.

A Nested Approach

While it's simple to understand the need for social design to be imbued into the product creation process in its early stages, actually implementing interaction intelligence is a complex undertaking, given the many facets of the design process and the various disciplines involved. Much more complex than drawing up plans in illustration form or even three-dimensional renderings, social design requires envisioning a product from its shell through to its "soul," so to speak, or the way that it will behave, react, and relate to a person. Keeping these many elements in mind at once is the social designer's challenge, and a helpful way to conceive of a product in this holistic way is to map out the product goals, beginning with its physical characteristics (presence); considering its dynamic behaviors (expression); planning out its dialogue with a person (interaction); maintaining a sensitivity to location, timing, and state of mind (context); and positioning it within a larger network of related products and services (ecosystem). This formidable task involves sketching, storyboarding, role-playing, physical prototyping, technical experimentation, and many other concurrent activities. Keeping a team aligned and focused on the core idea of social design is complex but essential.

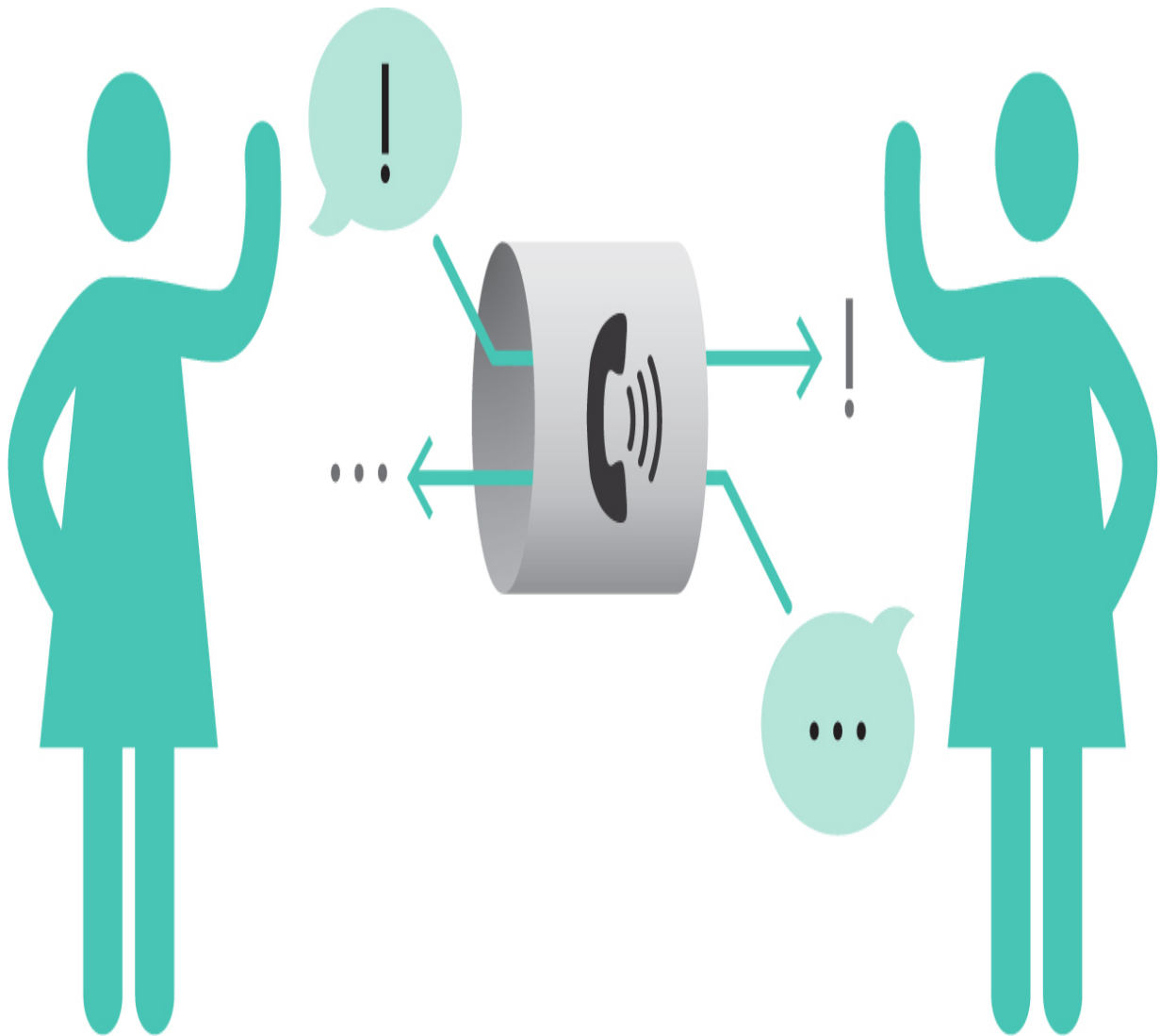


FIGURE 2-2

Product as Person-to-Person Conduit

Here, we diagram the real-time conversation two people are having over the phone. The phone functions as a social medium, a channel through which social interactions occur. The message is a communication between the two people, and it is transmitted verbatim so that what one person says is precisely replicated in what the other person can hear.

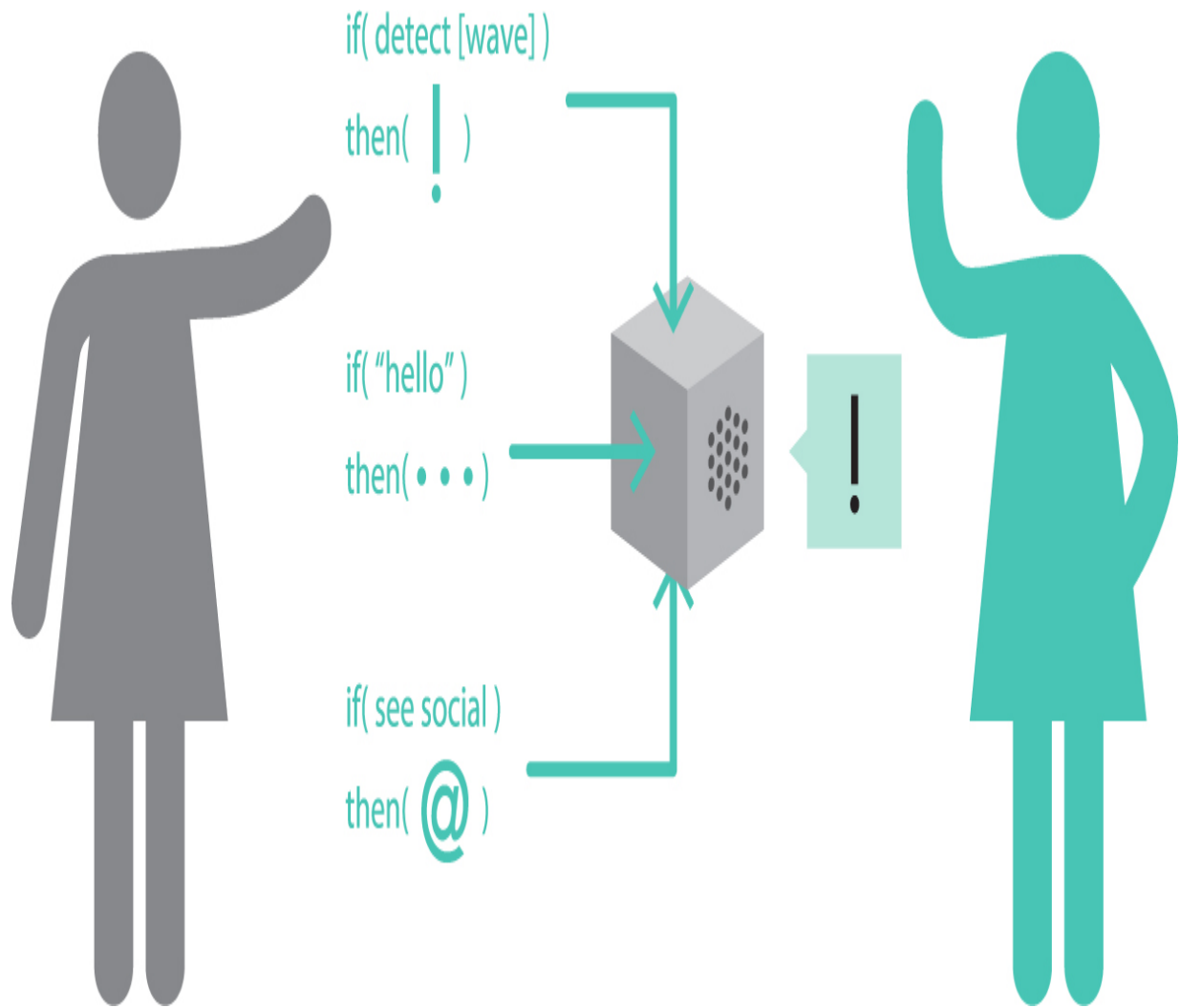


FIGURE 2-3

Product as Communicator of Embedded Messages

When a designer creates an interactive object, such as a microwave oven, certain messages need to be programmed into the object to be delivered at an appropriate time based on that person's interaction. It might be something like "Your timer is up" or "The meal is ready." The microwave conveys social messages and responses to the end user, but instead of the message being sent from a person, it's essentially sent from the designer *through* the microwave in response to an anticipated sequence of events. It is perceived by the person as machine generated.



FIGURE 2-4

Product as Independent Social Entity

More commonly, people perceive of the product as a social entity unto itself, communicating with the end user directly. If they are happy or offended when they use the product, they are happy with the product or offended by the product, not the company or the designer, of which they have little awareness. This is becoming more common with the development of highly responsive, connected products and the rise of conversational agents, but we would argue that at some level this has always been the way people have engaged with products.

The socially intelligent product framework serves to assist in envisioning these many aspects holistically, with a nested structure that starts at the most physical aspects and radiating layers that build upon one another in increasing complexity. The first nugget of product vision, triggered by a product's presence, or what roboticists like to call *embodiment*, is where the next chapter will kick off as we explore how the framework relates to core design activities.

Product Presence

Form Follows Feeling

As much as I love my mother, it would be dishonest to describe her telephone habits throughout most of my adult life as anything but a pain in the neck. In my twenties I came home from work to listen to multiple answering machine messages: “Carla! I called you an hour ago! Why didn’t you call me back?!” In the 1990s, when cell phones became more commonplace, I got multiple calls a day from my bossy Italian mama, and as a dutiful daughter I put up with it. About eight years ago, I introduced her to the concept of emails and the internet through the gift of an iMac. As an intensely intellectual person who could spend hours poring over the *Encyclopedia Britannica*, she was totally into it and quickly got the hang of browsers, web surfing, and *New York Times* video features.

A few years later, as the glimpses of dementia began to reveal themselves, my mother slowly lost her ability to use the

computer. Email became a challenge, and then the burden of simply clicking on a browser link became insurmountable. Now, at ninety-two, the complexity of a cell phone is too great and, heartbreakingly, dialing a number on any kind of phone too challenging. In reaching this difficult moment with my mom, I could suddenly see what I'd taken for granted in terms of cognitive hurdles and how her need for something tangible and present in the room was essential.

Staying in Touch by Staying in Touch

When the Covid-19 pandemic hit, visits to my mom at the assisted-living apartment were prohibited, so her facility purchased iPads. Upon request, Zoe, my mother's caseworker, will take a break from everything else she is doing to manage paperwork, logistics, and health-care strategies and suit up like a lab worker from *Breaking Bad* to enter her room and hold up the tablet so she can videoconference with me. But since Zoe's time is scarce, it means that the video calls are difficult to book and can't happen very often. Given all the circumstances in my mother's life right now, a robotic product that would facilitate the video calls makes a lot of sense, which is what made ElliQ so intriguing.

ElliQ is a physical product that consists of what would best be described as a robotic head perched on a platform beside a tablet computer. Imagine a rotating/pivoting lampshade on a side table that can talk, nod, play sounds, spin around, and light up. Even to a robotics aficionado like myself, that description has an air of the absurd. I can hear my inner voice now saying, “Hey, wait! I need a disembodied robot head on a table to talk to my mother? What has this world come to? That sounds elaborate, expensive, and ridiculous.” However, if I put my bias aside and look purely at the core needs of the situation, it makes a ton of sense. I see in my mom an isolated older person acutely in need of interaction with family members but unable to overcome the cognitive burden of successfully navigating a tablet interface. The ElliQ is described by its manufacturer as “a friendly, intelligent, inquisitive presence in older adults’ daily lives—there for them, in their corner, offering tips and advice, responding to questions, surprising them with suggestions—a dedicated sidekick on their journey through this remarkable part of life.” When a call comes in, the robot head will light up and announce, “You have a video call from your friend Esther. Are you ready to video chat with her?” It will pivot toward the tablet to bring attention to it as an object and will await an answer. If ignored, it will prompt the person with reminders such as, “Esther is still trying to reach you. Do you want to sit in

front of the tablet and talk now?” It can understand the person’s response, and the software engine behind it will continually take into account a number of factors to understand more about the person’s overall health. A number of refused calls by a person who is otherwise very social, for example, might indicate a situation that warrants examination.¹

What ElliQ offers that so many apps and software products will never achieve is what interaction designers refer to as *embodiment*. This literally means giving a physical presence (a “body,” if you will) to a software agent. Embodiment provides value for many reasons, such as:

- Providing key physical features that relate to tasks, such as a receiver for a telephone
- Relating to the human body, such as a thermometer that needs to be placed on the forehead
- Marking a symbolic value based on its location in a room, such as a bowl for keys and mail in an entryway
- Having proximity to other objects, such as a lectern facing a number of audience chairs

What *Presence* Means

Considering the salient aspects of a product's physical presence—that is, the impact of its shape, color, position in the room, and tangible elements—is a fundamental design element and rests at the core of our framework for developing product context. It is the characteristic upon which everything else is built.

There is an entire field of study established to understand the meaning and application of presence in the design of interactive objects, and a conference called Tangible, Embedded and Embodied Interaction (TEI) is a biannual event for specialists in this area to gather and share knowledge.²

For a clearer understanding of the reasoning behind a company like Intuition Robotics investing in the development of embodiment (plastic parts, motors, lights, and other electronic components) in their ElliQ product, let's look back at our interaction model and consider my mother's relationship to the telephone or computer. For years my mom was okay with the traditional model and the telephone as a medium, but now she does need that extra nudge, so a product like ElliQ that can serve as the interface *to* which she communicates, rather than having the extra cognitive layer of being an interface *through* which she communicates, could make all the difference between her being in touch with family or being completely

isolated from them and, in our increasingly virtual society, from the world at large. And the other benefits that ElliQ provides, such as medication reminders, scheduling help, messaging, and healthy living “nudges” like encouragement to stretch and go for walks, are added bonuses, but all of it is facilitated by the physical presence of ElliQ providing as streamlined an interaction as possible, allowing my mom to rest on what she knows about social interaction—someone (in this case, something) speaks to me, I speak back—rather than having to input numbers, touch buttons, or follow prompts before she can get through to a call.



Presence

Expression

Interaction

Context

Ecosystems

FIGURE 3-1

Presence, the First Ring in the Social Life of Products Framework



FIGURE 3-2

Intuition Robotics' ElliQ Personal Assistant

This is how we interact with the telephone. There is a great cognitive load involved in making or receiving a call that we simply take for granted but that can be a big hurdle to someone with cognitive impairments.

By allowing the person using the product to interact directly with the device, we eliminate the cognitive load involved in having to translate the need to make and receive calls into product interactions. Instead, the person can fall back on familiar behaviors of social interaction.

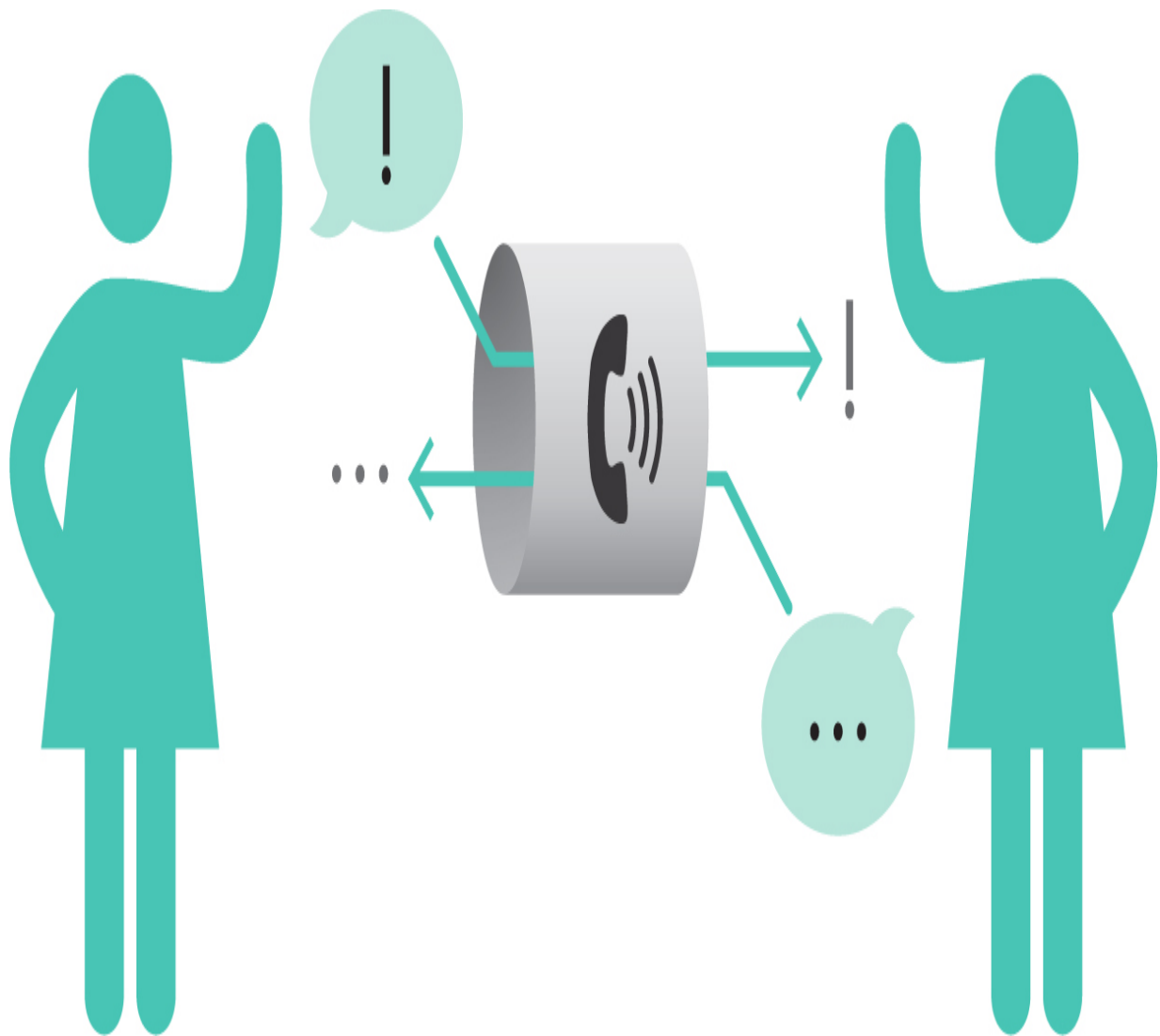


FIGURE 3-3

Product as Person-to-Person Conduit

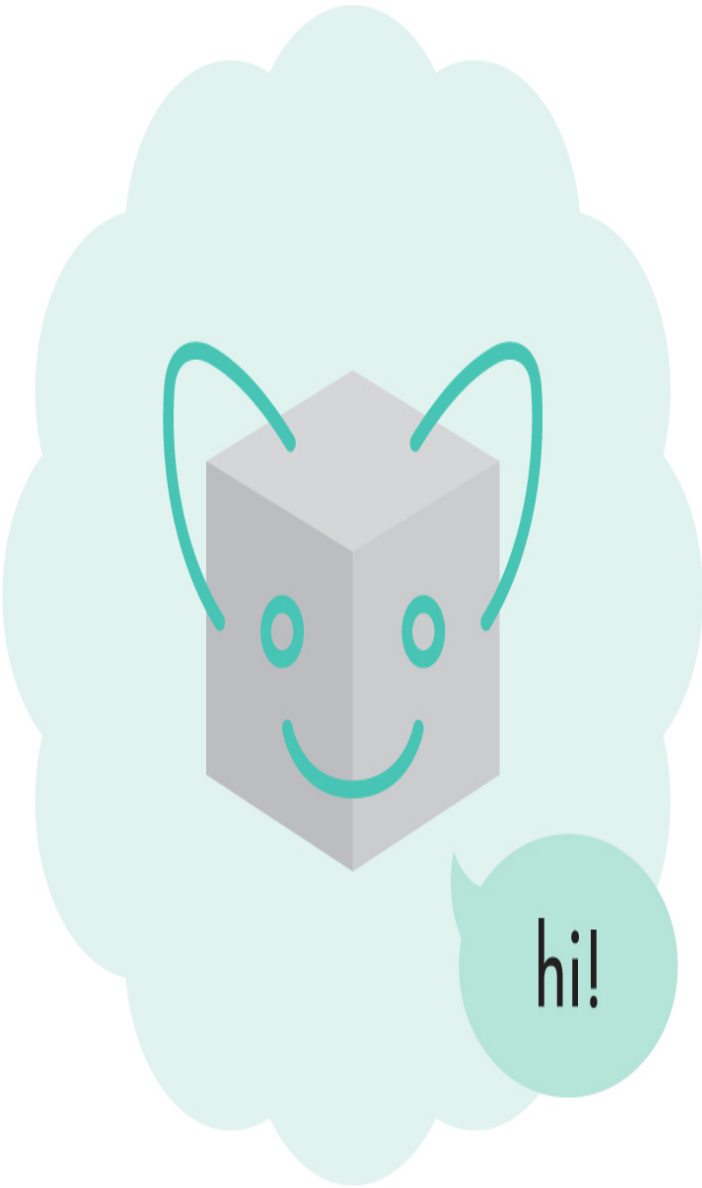


FIGURE 3-4

Product as Independent Social Entity

As of this writing, ElliQ is still in product trials, so I haven't had a chance to try it out with my mom, but I have changed my tune from wondering if this product is a silly indulgence to seeing the light of a last chance for her to maintain communication with loved ones, particularly during the pandemic.

Product Semantics: Showing Up and Playing the Part

“The most important part of X is showing up.” This is a mantra that is widely used, with *X* being a variety of things such as parenting, succeeding in school, building your professional network, and more. While trite, it is largely true for many challenges in life. The same is also true for many products, in that their presence plays a big role in their performance as social actors. This refers to their entire holistic presence—or what artists like to call the *gestalt*—as well as the details within an object.

To consider the nuances of presence in our interactions with social products, let's return to our doorman scenario.³ In

addition to physically opening the door so that guests don't have to exert the effort, his presence serves several functions. His gestures welcome visitors so they are assured they have arrived at the correct place and are given the message that they are invited and expected. For residents, interacting with the doorman on a daily basis provides a reminder of the level of luxury of that particular residence, thus bolstering the brand of the building. For would-be intruders, his presence serves as a deterrent. Not all doormen are burly bouncer types, and although they might be easily physically overtaken, their stance tells people they mean business, and at the very least, someone looking to break in is given the message that they would have a struggle on their hands. Finally, the doorman's absence at the door exterior can send the message that the door is closed because it is after hours.

The actual physical forms that are manifest in a product can communicate in powerful ways, even if their communication is implied and not consciously read or translated. Similar to the doorman, an airport kiosk can be the first interaction a person has with an airline on the day of travel. It allows people to perform flight check-in procedures, but before a person even gets that far, its presence provides travelers with the assurance they'll be able to access their trip information and leapfrog the lines of customers waiting for assistance at the desk. Kiosks are

typically designed to have a strong presence; they can be recognized at a distance; they stand upright at shoulder height; their screens face upward, allowing for a comfortable view of what's on the screen; they are at an adequate distance from one another to allow privacy during interaction. Each of these aspects is carefully designed with a sensitivity to how the object's presence will affect a person's exchange with it. It serves as a representative of the airline and thus must portray the correct brand values—even the overall shape, whether elegant, tall, and thin or cute, stocky, and rotund, will communicate brand values—and it also serves as a comforting presence within the context of the overwhelming airport environment, a space that can often feel alienating and isolating.

When creating a product, a designer selects shapes, colors, and materials to deliberately communicate important aspects of the product's value and establish its character. These design details may include clues relating to how one might operate it, such as buttons, knobs, or dials, where it should be placed in an environment, and what memories or emotions it is intended to evoke. This nonverbal language of design is often called *product semantics* and refers to the creation of deliberate formal characteristics that communicate one or more aspects of a product's role.

Design theorist Klaus Krippendorff defined product semantics as “the study of the symbolic qualities of man-made forms in the context of their use and the application of this knowledge to industrial design. It takes into account not only the physical and physiological functions, but the psychological, social and cultural context, which we call the symbolic environment.” And he explained that “the designer could be cast in the role of a communicator whose messages to the user concern the symbolic qualities of products. Just as a journalist creates informative messages from a vocabulary of terms, so could a designer be thought of as having a repertoire of forms at his disposal with which he creates arrangements that can be understood as a whole in their essential parts and that are usable by a receiver because of this communicated understanding.”⁴ We can take this one step further and describe the designer as editor—that is, someone capable of understanding the potential of communication of a variety of diverse forms and selecting the one most appropriate to the situation at hand.

When bringing social design to bear on product creation, this means using formal and dynamic characteristics that indicate how an object can offer important cues about how people can interact with it. Aspects of its form can indicate that it can be spoken to or that it can see text, graphic codes (such as bar or

QR patterns), or gestures. Designing forms that clearly set expectations for how and when to interact will enable the smoothest social interaction possible.

“The Best Camera Is the One That’s in Your Pocket”

One thing I enjoyed most about my time at Smart Design was the company’s culture of creating successful designs by bucking trends. One example of this was the Flip Mino HD camera from back in the days before smartphones, a pocket-sized video camera with an iconic big red button. When building the design strategy for this product, my colleagues thought deeply about the whole experience of shooting videos, from sporting events to family parties to baby’s first steps. While every other manufacturer was busy pouring resources and time into developing video cameras that competed in the one-upmanship of feature specifications (higher resolutions, variable file formats, special lens configurations, etc.), they went in the opposite direction and presented people with *fewer* specs. Their research showed that the current products were relatively heavy cameras that required a series of decisions to use; people had to choose resolution, light setting, file format, mode, and more. So they challenged all of it by creating an ultralight, slim,

bar-shaped camcorder that needed just one control to use, and that control would appear in the form of a big red button. To use it, you simply turned it on and pressed the button to stop and start recording. That's it. Downloading videos to a computer was a similarly streamlined process. Instead of having to track down a connector cable, you could extend a built-in USB plug and use software that was built into the device.

What might have seemed like a kids' toy was a runaway success that created an entirely new category of product. Other manufacturers rushed to copy the product's physical style and overall architecture, but the Flip remained the winner of its category for many years. The product's physical presence offered a streamlined experience that met the needs of its core customers, and because it was durable, it was more likely to be handy in a pocket when there was something fun to shoot and share. Its rapid-fire red button operation meant the video was more likely to be captured spontaneously. In terms of social affordances, this served as a prosthetic.

Although Pure Digital was bought by Cisco and the product terminated when smartphone video capabilities caught up to what the Flip could do, the success of the design was a lesson that emphasized how profoundly key decisions about the

fundamental architecture of a product can affect the overall interaction.

Product Character and Product Story

While so much of the excitement around the newest genre of smart products revolves around how they behave, like the chime of a washing machine or the display on a microwave oven, their social essence begins with their visceral, physical form, driven by an overarching strategy that guides the product's creation. Designers commonly refer to that strategy as the product's *story*. It is manifest in powerful ways through form and materials and enhanced with sounds, lights, audio and text messages, and movement, even if it is implied and not consciously read or translated.

Simon the robot's story, for example, is based on it being a helpful and trainable server/sidekick that is humanish but also clearly robotic. As it was meant to focus on learning, it's got a "toddler aesthetic" to communicate the idea that it needs to be taught even the simplest of ideas, such as "What is a cup?," and "What color is red?" This manifests through a large head and wide eyes but a hard plastic robot-like shell and geometric forms.⁵ Story is intrinsically linked to presence and can become a conceptual litmus test of sorts to guide design decisions. For

example, we wondered if Simon should have hair but ultimately settled on a helmet-like structure that had the semantics of a robot head but could also be the sort of thing a kid would wear.

Great teams work together on developing story so that design decisions can be aligned from the start of the process through product development, building a sense of character. Defining the character of a product is at the heart of the story for social products and can be extrapolated upon to make design decisions about the details of dynamic characteristics later on in the design process.

Getting into the Heart of Things: Social Roles

Reflecting on the value of presence in the objects around you will reveal the significance of how specific forms communicate, but at a deeper level, the true emotional value comes from looking at the social roles that objects play in our lives. Sure, we enjoy the tape measure that helps us remodel the closet because its markings are clear, and it snaps back into a compact package when we're done, but we might also love how it feels to walk down the block with that sturdy tape measure hanging from a pocket: its shiny chrome and serious graphics let everyone know that it's the one the pros use; we might also love

it because it was a hand-me-down from a favorite cousin who was a cabinetmaker. When creating products, we can't necessarily dictate all of the complex emotions that will go into building a strong connection between a person and product, but the best designs stem from gathering as much understanding as possible about the potential for connection.

OBJECT LESSON

Nest Outdoor Camera

Sometimes the character of a product comes easily, as a natural by-product of its task. An ambulance, for example, needs to demand attention and express the serious nature of its trajectory as it travels down a busy street. Its character is strident, serious, and authoritative. A security robot in an office setting, on the other hand, may need to interact with a large number of people in a very casual way, limiting interaction that would call attention to itself so as to avoid contributing to a hostile environment in the office. Its character might be conscientious, methodical, and self-effacing. During the research for this book, my friend and former colleague Rocky Jacob shared an anecdote about his passion for controlling the character of a design through its physical attributes, even when

that means making more work for the engineering team to match the vision.

As head of design at Nest, Rocky and his team were tasked to reimagine what a new outdoor camera could look and feel like. The desire to make security feel more friendly and nonthreatening quickly became the leading paradigm. The Nest brand was based on providing customers with calm reassurance that devices were doing the hard work of keeping homes safe and running smoothly, and the camera would join the family of company products, along with the lovely glowing thermostat dome, the even-keeled smoke detector, and the sculpted indoor camera. Because an outdoor camera can benefit from a shield to minimize the impact of sunlight, Rocky started with engineering specifications for a product that would feature a cover above it, making it match the archetype of a stern and scary security camera. He felt strongly that the shield would create an overly serious character, making people think of law enforcement and the fear of crime, whereas the company wanted the product's story to be much more about proactive remote vision of the home. Think friendly uses, like checking on packages left at the doorstep and pets frolicking, rather than burglars and "Keep Out" signs.^a

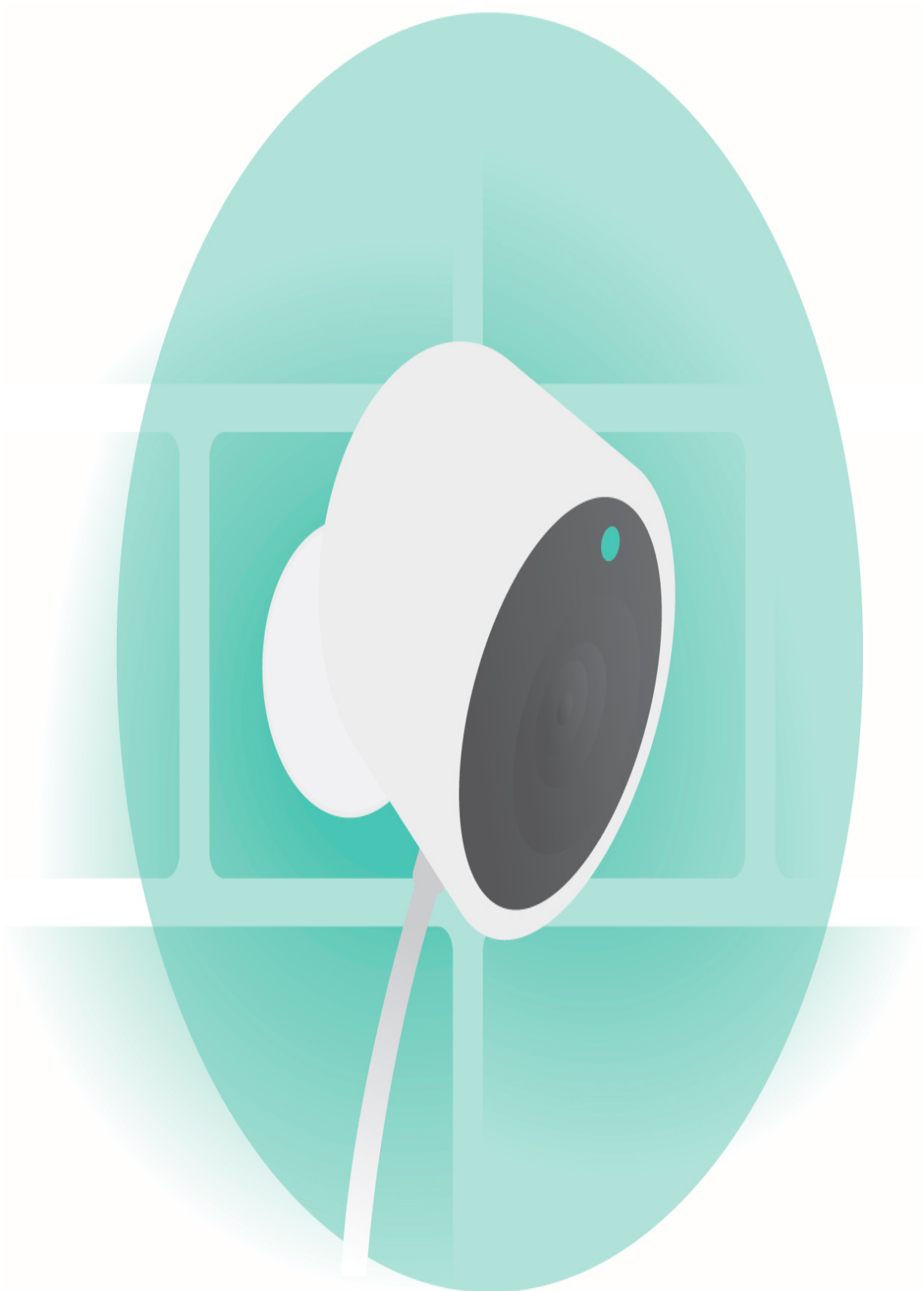


FIGURE 3-5

The Nest Outdoor Camera

“People identify a security camera is by its ‘police hat,’” he explained, referring to the sunshade that is typically built into the form. “And obviously there’s a functional purpose—it’s about protecting the lens from sunlight. But investing in changing the perception of traditional security cameras became a mantra the industrial design team had strong conviction around; we felt that this was the visual element that could really make it *look less* like a security camera, and we wanted to make it a little bit more inviting and approachable, because most of the time this camera’s just going to live there ... as part of the architecture.... But rather than being a beacon of fear, [we could] transform it into an object that provides you with super power computer vision, enabling features like tracking the health of your garden or seeing what your pets are up to.” Getting rid of the visor may seem like a small move, but it required numerous technical and engineering challenges to design a camera lens that works in the various lighting conditions that outdoor cameras encounter. Nevertheless, it was critical to maintaining control over the aesthetic and character of the product. In the end, the entire team at Nest agreed that eliminating

the “police hat” led to the creation of a product that felt much less threatening and fit much better with the brand than the early iterations of the design.

Beyond character, there are many functional needs that drive physical design decisions. Areas on a product that can be touched or grabbed can similarly be indicated by the presence of details such as handles or textural changes like ribs or bumps. And while it may seem extreme to craft three-dimensional shapes to serve as indicators for interaction, these forms not only are more satisfying because of the visceral nature of their presence but can also help people who may be visually impaired understand how to use objects and navigate their environments. The sidebar on “Mental Models, Mapping, and Affordances” describes some tools derived from cognitive psychology that designers can use when envisioning product details.

a. Rocky Jacob, interview by Carla Diana and Wendy Ju, audio recording, New York, NY, March 6, 2018.

In this section we describe some key factors in the social nature of objects, beginning with three aspects of the overall relationship we have with our products. These can be generalized as:

1. *Relational*: What role does the object play in the relationship between person and product?
2. *Emotional*: What feelings does the object evoke through its use?
3. *Conditional*: How do the various states of the object affect the way it's perceived and used?

Relational

Whether we are aware of it or not, products play social roles in our lives throughout the day, though some are more pronounced than others. Acknowledging the role can serve as a metaphor upon which to build design stories, guiding details in expression and interaction (which we'll get into further in subsequent chapters) based on behaviors that people already know and understand. Products may relate to people by taking on the role of prosthetic, tool, assistant, vehicle, or even placemaking. As designers, we consider how the social affordances define the degree of intimacy one has with a product: Is it more like a prosthetic that is used as a tool or extension of the body, or more like an agent that acts on one's behalf?

When designing a floor-cleaning robot at Smart Design, my team and I recognized the relational value that a floor-cleaning

robot might have. In addition to it entering as a new product archetype into the intimate environment of the home, it was introduced at a time when it was likely to be customers' first experience with an autonomously navigating product. In thinking about its social role, we set out to create a device that would be akin to an assistant. We dissected typical service personalities as a starting point for what the product story would be:

- *The hotel housekeeper*: Quiet, conscientious, and for the most part a person with whom you don't interact at all. The best housekeeper is one in which you see visible evidence of the work she's done but you don't actually see her.
- *The butler*: Proper, obsequious, and attentive. He won't let on to what he's really feeling and will for the most part hide all emotional responses but makes you feel comfortable requesting almost anything.
- *The bartender*: Chatty, curious, and empathetic. He feels like your best friend even if you've only known him for five minutes.
- *The nanny*: Traditional, nurturing, and rule-bound. You feel safe when you're around her, but you also know she'll correct you if you go past the limits she's set.

We then used some of the attributes that emerged—precise, hardworking, intelligent, and humble yet playful—and modeled the interaction around the unflappable inventor’s companion Gromit of *Wallace and Gromit*.

Emotional

Everything we encounter has some emotional significance to us, though it’s more powerful for some things than others. While it may seem overly sentimental to look at products through the lens of emotional significance, objects carry enormous meaning for people for a variety of reasons. Even something as seemingly mundane as a light switch can offer power or leave someone feeling vulnerable depending on the nuances of its design. For example, it may seem like an oven’s only purpose is to heat food, but every detail of the oven is an opportunity for a social relationship between the person and the product as well as the person and other people around him or her. The shape of its knobs may reference restaurant kitchens, making a person feel like an accomplished chef; the oven door might match the interior decor, blending into an environment that encourages people to use the kitchen as a gathering space; the typeface on the interface might have a retro feel from the 1950s, making someone feel nostalgic for their grandmother’s pies. Designers as well as marketing

professionals know intuitively how powerful these emotional cues are, and in order for everyone on a product team to maintain alignment, it's important to acknowledge, and in some cases elevate, a product's emotional role for the person who will use it.

Below are a few metaphorical categories to consider when thinking about how the product you're creating will evoke emotion for the person using it.

- *Totems* are objects that represent power and the potential to fulfill a need. The airport kiosk mentioned above is a good example of a device that fills this role. An audio speaker is also a great example of a totem—it reminds its owner of the importance of music in his or her life, and its details, such as a traditional hardwood material versus a slick black plastic, reinforce that person's identity.
- *Talismans* are similar to totems in that they provide a connection to a power beyond the physical artifact but are different in that they are typically smaller and can be held or worn on the body. A wrist-worn activity tracker like the Misfit Shine can serve as a magical object that propels someone to better health through both its ability to count steps and connect to a tracking interface, as well as serve as a symbol of the power of taking control of one's habits.

- *Badges* are products that reinforce identity. A key fob may function to open a door but in many cases will serve a social role as well. When consulting for a leading private jet company, my team and I recognized that many plane owners enjoyed belonging to an elite class. Having a key fob that was not only functional for the person using it but visible to others as well served to reaffirm their identity. This sense of identity with a “tribe” can apply to many categories of products. Even a product as simple as a water bottle might serve as a tribal badge, communicating a sensitivity to environmental concerns based on the shape and material that it’s made of.
- *Mementos* are objects that remind us of others and are arguably difficult to intentionally define. I still have a wristwatch that my late father was given upon his retirement decades ago. A vintage Timex from the 1970s with a personal inscription that says, “Best of luck, Joe,” it bears no resemblance in style to anything else I might wear or use; however, it carries enormous emotional significance for me and therefore trumps any other kind of wristwatch that I might wear in terms of being meaningful. While we won’t always be able to predict how objects will serve as mementos, it is a powerful category to keep in mind when developing a product story.

The psychologist and author Mihaly Csikszentmihalyi has written several books about human emotion and personal fulfillment. He wrote *The Meaning of Things*, a study of the significance of material possessions in contemporary urban life, which has served as seminal reading to help product designers understand the depth of the connection.⁶ In fact there is an entire field of study in material culture that delves deeply into emotional significance and can serve as a strong starting point to understand the relationship between a person and a particular artifact.⁷

Conditional

Conditional character traits are the definitions of how a product behaves in multiple conditions, such as off/on, sleeping/charging/active, open/closed, connected/offline, and so on. While understanding that the emotional and relational aspects of a product are fundamental to setting the foundation for a product story, the conditional aspects are what allow the story to evolve, and considering all possible conditions can help a character feel holistic. The airport kiosk that functions as a totem, for example, should continue to do so even when it's in a sleep state through its architecture, graphics, and perhaps even a light that gently glows.

Laying out all the conditional possibilities for a product will greatly inform initial product definitions that can be used at the onset of a project. While this is a time to lay out the bare-bones functional requirements, it is also an opportunity to build in the necessary behaviors that will round out a character, taking into account all the states it will be in over the course of a person's interaction with it.

In addition to solid form, electronic objects have the ability to show changes in condition through dynamic characteristics, such as light, sound, and alternative shape configurations that emerge as a result of movement. For example, designer Naoto Fukasawa created a vacuum cleaner concept model for Hitachi with a light that would remain largely hidden until the vacuum was full and needed to be emptied, at which time it would begin to glow in its center, as if a full belly was emerging.

Let's return to the floor-cleaning vacuum design project described above. Once my team and I had settled on a character definition for the robot, we identified the extreme moments of interaction: When was the robot happiest? When was it most troubled? Just as a person's character is revealed by how they react in these extreme moments of human experience, so, too, will a robot's character be perceived. To actually apply this character definition, we created a language of expression that

combined light patterns, a sound palette, and choreographed movements. For example, getting stuck under the couch would be a moment of distress, as would having its batteries running low. Completely cleaning a room's carpet might be a moment of jubilation. We wanted to define exactly what the robot would do at these moments. What sounds should it make? How would it move? Just as we might work with a color or material specialist on a traditional product, here we enlisted a music composer to create a palette of sounds, as well as a visual designer to create a custom font for the LED matrix display. To match the "Gromit" character we had chosen, we built in just a little bit of goofy playfulness, like a visual icon with the word *Yum* when it passed a particularly dirty spot, or a greeting tone if it recognized a person in its path, as if to say, "Oh, hello!" Moments of distress, like being stuck under a piece of furniture, were handled, in the manner of Gromit, with grace, with tones that expressed trouble but not extreme anxiety—something more like "Uh oh!" than "OH NO!" Its movement was planned to match these characteristics. In the moment of greeting a person, it does a little wiggle backward before continuing forward to do its work.

When looking at how motors might move parts to modify a product's form, like Simon's ears or ElliQ's pivoting head, we can consider how shifting stance can create meaningful and

salient conditional movements during interaction. Pixar animator and robotics consultant Doug Dooley describes the importance of stance in terms of how certain parts of the robot's anatomy are positioned with respect to one another. He explains, "If you want a person to feel as though the robot is interested in what they are saying, the robot needs to lean in toward them for an engaged stance. If a robot is to appear embarrassed, the robot should probably lean away in a disengaged stance.... You will sometimes hear animators discuss this concept as an 'open' or 'closed' pose." He also said, "I show a character's confidence by arching the character's chest out, or arching the character's chest concave in. Since the pivots of the spine are in the back, this also controls how tall and or slouched the character is."⁸

Even an object that is not electronic will alter its presence based on how we interact with its physical components. The 1969 Olivetti Valentine typewriter, designed by Ettore Sottsass and Perry King, presented a radical departure from any past typewriter design in its slim profile and daring red plastic shell, but perhaps the most important aspect of its presence was the travel cover that housed the machine. When removed, it lent itself to being placed on the floor so that it immediately transformed into a trash bin. The presence of this accessory

encouraged the passionate disposal of crumpled up and rejected drafts of novels, poems, and love letters.⁹

Social Cues and Why Clear Communication through Physical Architecture Is More Important Than Ever

Presence is particularly important to communicating the social roles of a product since social interaction is often about potential. When it comes to specifically human interaction (upon which we base our understanding of social exchanges), we gauge what's socially possible and appropriate by presence. At a party, for example, a person's physical presence will afford or prevent an introduction. You wouldn't yell at a person across the room; instead, you might approach that person slowly and physically make your presence known by standing in front of him or her. Your position matters. You wouldn't stand behind someone but instead position yourself so there is the potential to make eye contact. You may even stretch out a hand as a further indication of presenting the potential to socially interact. When we feel uncomfortable in a social situation, we modify our presence to indicate our willingness to engage. We may hang our heads, turn our back, or direct attention toward

social interactions through or with a handheld device such as a smartphone.

OBJECT LESSON

Clikbrik Drummer's Metronome

In 2015 my former Smart Design colleague Ted Booth described a product that his neighbor wished existed. "Konrad is a professional drummer and can't find a metronome that works for him." He explained that the drummer sets the tempo for the whole band, sometimes even guiding people through eye contact and head nodding to make sure everyone is feeling the same beat. "Every single metronome on the market is a fussy little electronic device that requires him to hunch over a box and press tiny buttons. I wonder if we can design something that lets him stay in the moment and keep his presence as the rock star performer that he is?" We put together a team and set to work, and the resulting product was the Clikbrik, a metronome that is operated entirely by drumstick; you strike it once to start the rhythm and again to pause it. The dial for changing the tempo has notches designed to hold the drumstick tip; it has a fitting that lets it screw onto a stand to be part of the drum kit, and the display is made up of large LED lights so it can be seen from wherever the drummer is sitting. Our small team was able

to prototype, develop, patent, and produce the product, and Konrad and drummers like him love how the device lets them maintain their drummer's stance and persona, maintaining the stage presence that is so important for connecting both with the audience and the rest of the band.^a

While these humanlike social cues—in the case of the Clikbrik, taking a small box and buttons and changing their size, shape, and position—may seem like frivolous additions to a product that will increase the cost without functional benefit, let's take a step back and think about the effect that miniaturization and immateriality has in the products that we commonly call smart, such as smartphones, smart speakers, and smart doorbells. In addition to the complexities of simple interactions such as turning the device on and checking its status, there are dozens of other interactions that people may not even consider. While people may know that cameras and microphones are being used for the benefit of smoother product interaction, the fact that these elements are hidden within forms that belie their existence is doing a disservice to both the person using it and the manufacturer.

The first-generation Amazon Echo, for example, sits silently and inconspicuously, only lighting up when it has been summoned, yet as people have become more aware of privacy concerns with

devices that have embedded cameras and microphones, they have developed a growing list of questions and concerns about what's really happening with the device from a social point of view. The Amazon Echo embodies the Alexa assistant in physical presence; shaped like a small cylinder, it is largely designed to disappear into a corner except when summoned with its trigger word. When summoned, it does a good job of letting people know that it's actively listening, with a moving highlight on a glowing light ring it points in the direction of the person it's listening to. When idle, however, it does a poor job of letting people know what it's doing from a social point of view.

If you walked into a room with a friend and there was someone already in the room, sitting in a corner, eyes cast downward, and not interacting with you, it would feel suspect. You would be careful about what you said and wonder if the lurker was listening and question his or her intentions. If the person was a friend or colleague, perhaps lost in a book or mobile device, you would still acknowledge one another and perhaps ask the person for privacy if you needed it. These same concerns are true for our smart devices, which can benefit from a great deal more social affordances than commonly exist today. The mere ability to “bow a head,” for example, perhaps through forms that can pivot against

each other, could give a product like the Amazon Echo the ability to use physical presence to communicate whether or not it's listening.

Many of the issues around privacy can be tackled head-on through form, and specific aspects of presence in a physical object can be harnessed to communicate several important interaction elements. The overall form of a product will communicate orientation—that is, which surface serves as top, bottom, front, back, and so on. This can be critical for indicating what direction a mobile robot might move or how someone should approach a smart device to interact.

Capabilities for interaction such as hearing and sight can be communicated by the presence of physical details that embody the semantics of these capabilities, such as microphone hole patterns or camera lens rings. This not only signals that they exist but tells people where to look when a camera interaction is needed or how to direct speech if voice is an important part of the communication. For privacy concerns, offering an opaque shade that can be slid over a camera can give people peace of mind, even if it's not technically necessary for the camera's on-off control. And it may not be possible to provide proof that an embedded microphone is not on, but giving a clear formal indication of a microphone's status can be reassuring: on, off, actively listening, or on standby.

As we enter an age in which critical and fundamental human rights are being violated through the use and abuse of our data, it will be more critical than ever for designers to find ways to communicate a product's state and intent through deliberate design elements.

a. Edwin Booth, Carla Diana, Michael Glaser, Konrad Meissner, assigned to Clikbrik, LLC, "Contact Responsive Metronome," Patent 15/772517, April 30, 2018.

SOCIAL DESIGN TAKEAWAYS

The stories above show how people read social cues and respond socially even when a product isn't overtly interacting with them. Its mere physical architecture sets the tone and establishes the nature of the relationship between people and product. Here are a few key ideas to keep in mind at the early stages of the product design process.

- ✓ There are social aspects to every part of the design, even the physical form.
- ✓ Product architectures not only enable specific types of interaction but act as physical instruction guides of sorts, offering a mental model that guides every aspect of a product's use.

- ✓ The relationship a person has with a product can be described through a story that can guide the overall creative direction of a design project, determining the product's character and key attributes.
- ✓ Product design characteristics can be framed through relational, emotional, and conditional aspects, and a strong design will take all three into consideration.
- ✓ Just because a product characteristic can be hidden and embedded doesn't mean it should be. Today's smart products are desperately in need of more physical presence to communicate the important, yet intangible, aspects of their operation, such as using microphone and camera data as input.

Mental Models, Mapping, and Affordances

When looking at an object, a person will try to understand its use, even if they have never seen it before, and the myriad elements of its presence are at the heart of how well it is understood. A gold standard for good design is a product that can communicate its use without relying on a person to review a set of instructions. This is an enormous challenge—just looking at videos of kids attempting to use an old rotary phone

can illustrate how hard it is to communicate interactions, especially those that involve more than one operation to complete a task.

Generalizing broadly, the task of making a product do its job (e.g., heating filaments to toast bread) is allocated to product engineers, but the metatask of helping people to understand how to make the product do that job (e.g., making it obvious where the bread goes in) is allocated to product designers. Designers need to anticipate what people know or don't before encountering the product and predict what sense people will make of the product as they get to know it better. Designers need to shape how people think products function by planning for the “mental model” the users might have of the product.

Mental models form a strong foundation in the very early stages of product development and therefore can be a great place for a team to start when forming a design strategy for interaction. Being able to articulate a mental model, whether through a verbal description or visual diagrams, is essential to creating something that people will enjoy using.

Two key aspects of mental models are *affordances* and *mapping*. In the design community, the term *affordance* refers to the elements of a product that signal how a person should interact

with it. In *The Design of Everyday Things*, Don Norman explains that “... visible affordances provide strong clues to the operations of things. A flat plate mounted on a door affords pushing. Knobs afford turning, pushing, and pulling. Slots are for inserting things into. Balls are for throwing or bouncing. Perceived affordances help people figure out what actions are possible without the need for labels or instructions.”^a On a toaster, the lever that lowers the toast and starts the toasting function is usually designed in a way that “affords” being pressed down, and there is usually a visible cue that the lever moves vertically. These affordances help the user construct a mental model that they need to put the bread into the toaster and push down on the lever knob to operate the toaster.^b

Mapping describes the way that controls and resulting actions are related. For example, on a toaster, pushing down on the lever causes the bread to be lowered into the toaster; when the toast is done and the toast pops up, the lever also pops up. This mapping of up-to-up and down-to-down makes intuitive sense; people don’t need to understand the mechanical systems inside the toaster that make that correspondence to understand it.

There are other *semiotic* aspects to the toaster’s design, which provide signs about the states or settings of the toaster. The lever, for example, stays down when the toaster is toasting; the

lever's visible location is a *sign* of that state, even when it is not acting as an *affordance*. The knob setting the length of the toasting usually has other graphic indications—sometimes numbers, sometimes a graduated curve, sometimes just icons of white, tan, and dark toast—which signify the amount of browning.

a. Donald A. Norman, *The Design of Everyday Things* (New York: Basic Books, 2002).

b. Ibid.

Object Expression

Communicating Behavior

“OMG!” I can hear Pecorino, my three-year-old Chihuahua mix, exclaim. “There’s someone on the other side of the door! Come here! Quick!” My dog, of course, neither speaks English words nor gives me specific directives. But he does communicate these messages very clearly through the pitch and volume of his bark, his dancing gestures, and his overall posture. I can read the pivot of his ears precisely and know where activity is happening—outside the front door or in the backyard. I can tell the difference between someone who’s just passing by or someone who is lingering by observing his jumps—he’ll pace around by the doorway a few times for a temporary passerby but escalate to a jumping frenzy if the person stays and knocks.

The Power of Shorthand

Pecorino and I communicate in a sort of shorthand: I can tell what he’s talking about, where it is, how he feels about it, and what he

wants to do next, all at once. Dogs have been bred and domesticated over millennia to work next to people. They have evolved to be particularly good at reading people's communicative cues and responding in kind.¹ It seems like mind reading, but really, it's body language.

Much like my dog, a product can express itself in many nonverbal ways, and as designers we can use this communication to quickly and intuitively offer feedback and other information. In this chapter we focus on ways that dynamic product characteristics can serve as a richly expressive yet highly efficient method of communication.

Just as we read subtle cues from our pets, we can read messages and emotion from our products, perceiving nuances of dialogue and a sense that the object is “alive” when it is actively interacting. Our washing machines can wiggle their doors to remind us to put wet clothes in the dryer. Our vacuum cleaner robot can perform a dance to show that it's proud to have finished a room. These animated behaviors blend together in a magical way, and it's human nature to decode them as if they are emanating from a living entity.²

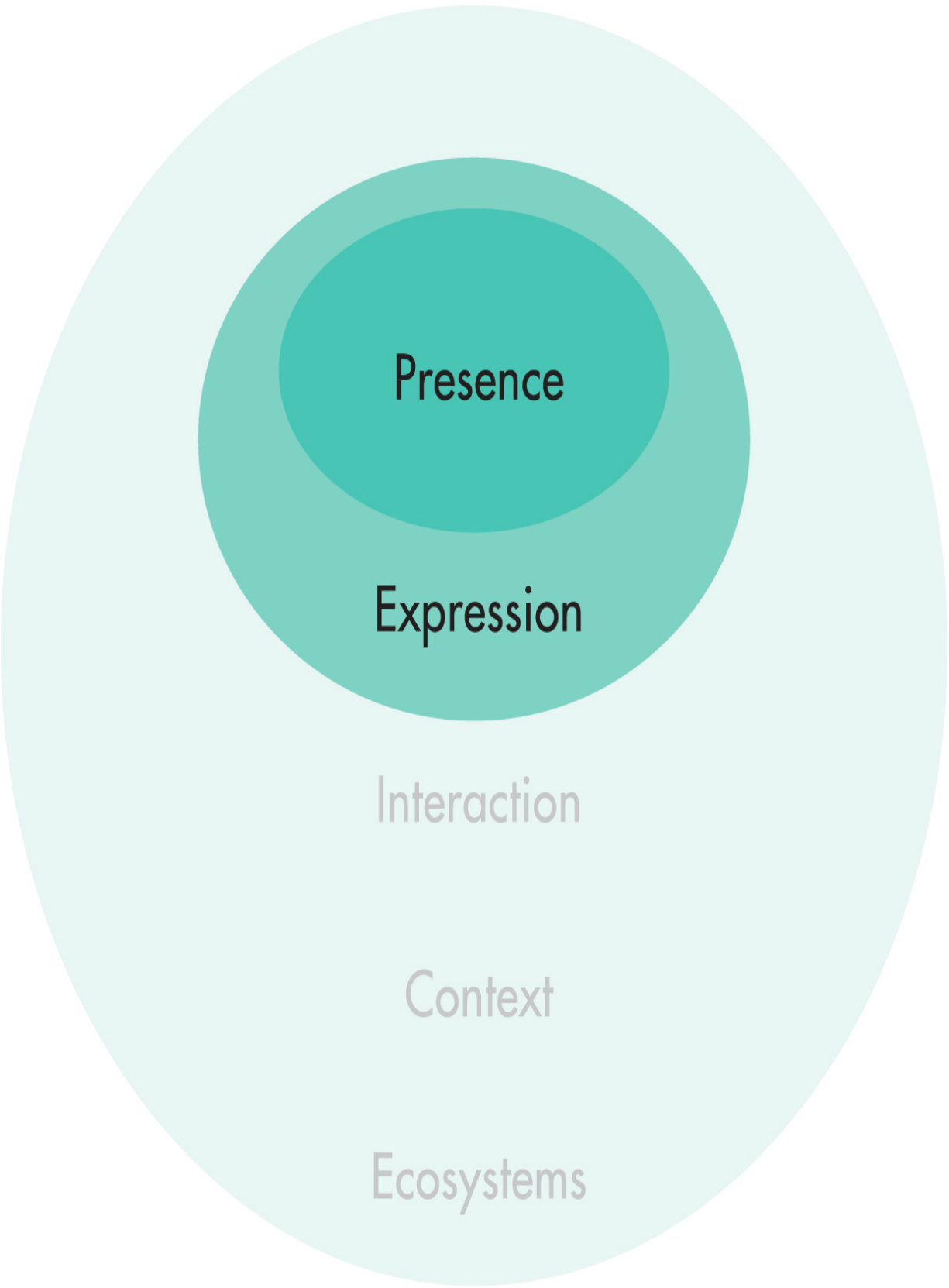
As products continue trafficking in more and more complex information, the temptation to use speech or screens to communicate everything is powerful. While it's popular to think of

elaborate text or voice exchanges, often called *natural language interfaces*, as the best ways for people and products to communicate, this is often not the case. These explicit modes of communication require our undivided focus and are far less useful in environments where we might have demands on our attention, such as in a car or in the kitchen. While today's Siri uses lengthy interstitial language, such as "Today's weather will be ..." and "It appears that you are ...," the most powerful aspect of our relationships with our products will be the split-second, near-telepathic exchanges that can happen with just a flicker of light, a sequence of tones, or a gestural movement—the kinds of messages that can benefit from our full attention yet can also take place in our peripheral vision.

Expression

Expression forms the second ring in the social life of products framework. In the last chapter, we talked about presence, the overall impression of a product based on its embodiment, considering aspects such as its color, the shapes of its parts, and the story expressed through its overall architecture. Progressing to the next ring in the social design framework, we take an intimate look at a product's ability to use physical presence to communicate messages and respond to the people and environments around it, making apparent important details about its internal states. We'll

consider ways that a product can enhance its physical form and make the most of conditional abilities. And we will expand upon ideas around the social affordances of dynamic behaviors crafted by expressing information through light, sound, and motion behaviors, exploring the wide palette for expression that's available to product designers.



Presence

Expression

Interaction

Context

Ecosystems

FIGURE 4-1

Expression, the Second Ring in the Social Life of Products Framework

Product “Body Language”

In *Turn Signals Are the Facial Expressions of Automobiles*, Don Norman explains:

*Facial expressions, gesture, and body position act as cues to a person’s internal states. We often call these things “body language,” the name indicating the communicative role. Body language makes visible another’s internal state. The blush of the cheeks, the grimace, the frown and the smile all act as readily perceivable external signals of a person’s internal state, making visible to observers what would otherwise be difficult or impossible to determine.... The lights and sounds of an automobile play a role analogous to the facial expressions of animals, communicating the internal state of an auto to others in its social group.*³

Starting at the very core of a product’s essence are several messages I have observed in my work that products tend to communicate to the people using them on a regular basis. Some of these things take place so often that they demand as much shorthand as possible to avoid a constant and annoying barrage of messaging. [Table 4-1](#) shows some examples.

TABLE 4-1

Messages that products tend to communicate

“I’m alive.”	Power, via cord or battery, is connected.
“I’m awake/asleep.”	Standby mode status.
“I’m waiting for some more info.”	Pinging a server or other data source before an operation can be complete.
“I need <i>you</i> to give me some more information.”	Awaiting a person’s input through interface elements.
“I heard you.”	Confirming that a person has input the necessary information.

"I'm alive."	Power, via cord or battery, is connected.
"I'm in the middle of doing something."	A process is taking place that will require some time to complete.
"I've just finished doing something."	A set of tasks is complete; product is ready for a new task.
"Something is a little bit wrong."	An error has taken place, or there is another issue affecting normal performance such as the inability to read a sensor or charge a battery in time.
"Something is seriously wrong."	An error has taken place that will interfere with performance.

With a floor-cleaning robot, these messages might be seen as a core set; however, there might be many more that take place

throughout the course of interaction involving both functional needs, such as scheduling cleaning times and identifying floor areas, and emotional needs, such as celebrating the moment a house has been fully cleaned or expressing regret for needing to be rescued from underneath a couch. The tone and content of the messages delivered will contribute to a product's perceived character and therefore become important aspects of designing a product that feels holistic.

Light, Movement, and Sound: The Ways of Object Expression

As products become more interactive and content-driven, such as Amazon's Alexa or Apple's Siri, they add speech to the other modalities when necessary, but even spoken words need to be integrated into the overall expression, with the understanding that they are part of an entity that is also expressing messages through light, nonverbal sounds, and movement.

Light

When my little boy Massimo was one, I greeted him in his crib every morning to see him gesticulating with both arms toward the wall and explaining in baby talk that it was 7:00 a.m. and time to get up. While I'm tempted to tell you that my infant recognized numbers and learned to read a clock, what was really going on is

that he and I shared the same vocabulary of lights: the dim blue hexagon meant it's time to go to sleep, and the bright orange-and-yellow rainbow meant it's time to get up. Behind the scenes, I had programmed the light system, composed of Nanoleaf Aurora modular flat tiles, to match our schedule so that the colors automatically mapped to certain times of the day. The end result was a language we both understood, consisting of abstracted messages composed entirely of light. Nanoleaf CEO Gimmy Chu echoed the satisfaction I experienced, telling me that customers used the panels as “extensions” of environments to create a certain feeling, from a calm forest, to a vibrant sunrise, to a creepy dark room.

People take for granted the number of messages that we intuitively read throughout the day through changes in light. The glowing button on the coffee maker tells us when the water is heated and ready for brewing. The light on the range top warns us that it's too hot to touch. Flashing overhead lights in a theater tell us that intermission is over. Virgin Atlantic's Boeing 787 Dreamliner touts subtle shifts in ambient lighting, from rosy amber to bright blue, as a programmed way to communicate shifts in time zones both consciously and unconsciously.⁴

When driving, we use lights as an extension of ourselves to indicate when we are turning left or right. Other drivers as well as pedestrians understand this language and use our signals as the

basis for decisions regarding how and where they will move across a street. Light can be used like semaphores, to convey explicit coded messages, but maybe the more powerful way that light can be used is more subtle, functioning like the blush of a person's cheek or the furrow of a brow to convey internal state or to react to external context. When mapped well it can direct attention, set context, and convey messages. It can be seen at a distance, so it is a good choice for products that may be positioned overhead or in a corner of a room to be viewed at a glance, such as situational monitors (like security cameras, thermostats, or Wi-Fi routers). It is also particularly valuable for robotic products that move around a space and may be far from the person because it can serve as a distant beacon that can communicate clearly.

The introduction of microprocessors along with the availability of LEDs has opened up the palette available to designers considerably by introducing the ability to control the intensity of the light as well as its color, enabling more complex and sophisticated messages to be communicated with a single element. Color and intensity of light add detail to underlying messages and can be mapped to specific values along a range, with red, for example, being 0 percent and green, 100 percent. The location of the light will draw attention to a part of an object, a gestural interaction, a feature, or a form detail that is critical to convey the object's use and meaning.

The combination of lighted elements also allows for sequences of intensity and color to be programmed so that they emit an expressive animation. The front indicator light on the early MacBook Pro is a compelling example of an object that used a simple animation in light intensity in order to achieve a powerful effect: the illusion of being alive. A soft glow shone through the body of the computer, pulsing gradually from light to dark at a regular rate that mimicked human breathing. The effect was mesmerizing and intuitive—so much so that Apple even patented the *breathing status LED indicator*—letting people know the computer was still “alive”—that is, the battery had power, and the system was asleep.⁵

Multiple lights can be strung together to form low-resolution screens that can be positioned anywhere on a product, following the curve of a surface or even glowing from within. When series of lights are adjacent to one another, the changes in their color and intensity will be read as an animation that can be used to craft a variety of messages. Robotic toy products Dash and Dot from Wonder Workshop are remarkable in their use of light. Twelve LED lights positioned in a circle on the robot’s face create the illusion of one eye. It can show attention by pointing the light in the direction that it’s headed but can also use a sequence of light changes, from bright to dim, to indicate changes in expression. A happy response can be communicated by having all the lights flashing around the perimeter of the circle, whereas sadness or

disappointment is shown through lights that are lit in sequence toward the bottom of the circle.

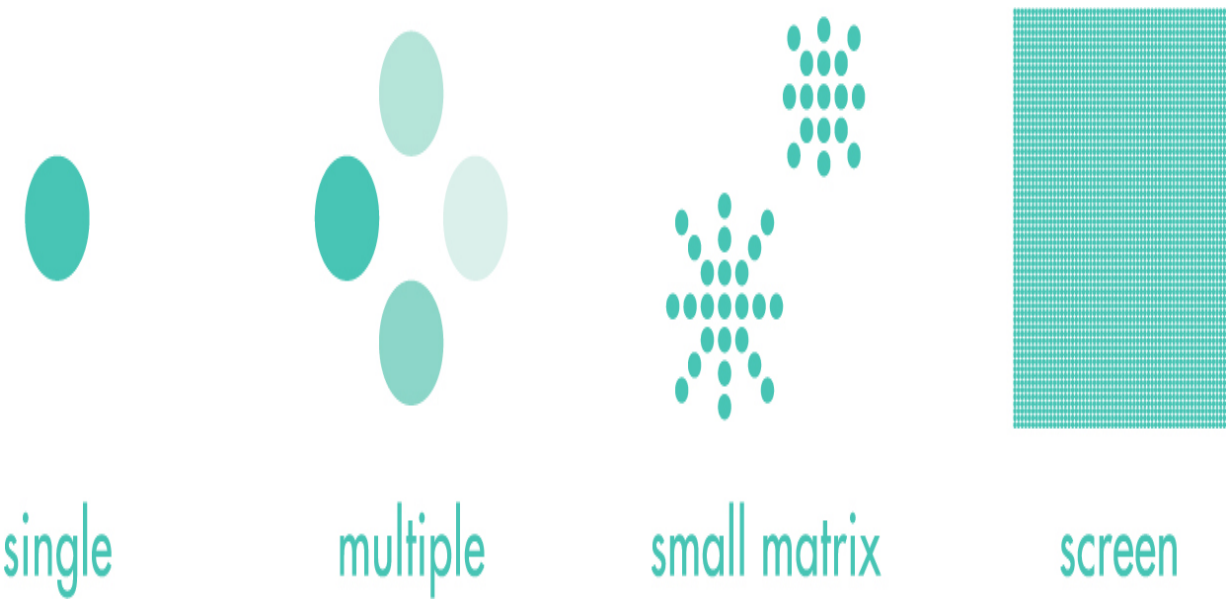


FIGURE 4-2

Arrangements of LED Lights to Place on Products

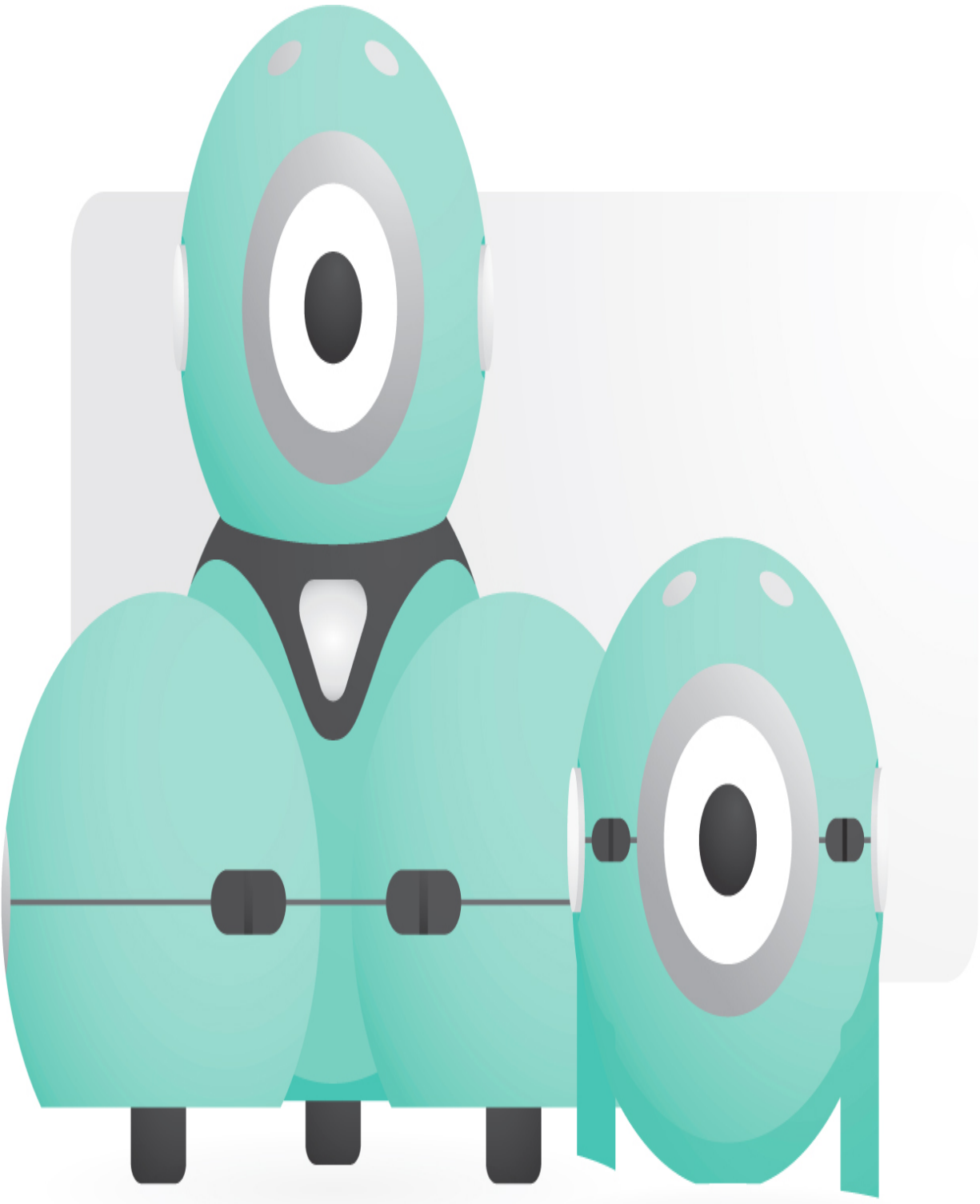


FIGURE 4-3

Robotic Toy Products Dash and Dot from Wonder Workshop

Designing products involves thinking about the overall form and how light will integrate with it. Will it emphasize a certain part of the product, making that dominant? Will it create a sharp spotlight that immediately grabs attention or a gentle wash of light that's reflected onto a wall, table, or other surface? The size of the light can also emphasize certain features over others.

Electroluminescent panels can glow, but they don't emit or "throw" light, so they are useful in situations where only a highlight is needed.

Light is fluid and can fill a three-dimensional space and be integrated into a surface conforming to the physical space that it fills yet still maintaining the integrity of the larger object. When we design with it, we can think about filling a form rather than "painting" light onto a "page" that can only be flat. A voluminous light can imply a space that people can enter or avoid. A spotlight may create a column of brightness and/or color to emphasize a particular area or object. The ElliQ personal assistant has a range of light patterns that glow from the robot's head, providing a spot of light or radiating rings. In a podcast interview, Dor Skuler, Intuition Robotics CEO, explained, "The light patterns are very simple cues to give the user an idea of when she's talking, when she's expecting you to talk, when she's listening, when she's thinking, when she's stuck, etc."⁶ The light in this case thus serves as a dynamic material, changing the object's overall look and bringing attention to it on demand.

OBJECT LESSON

Glow Caps—“It’s Time to Take Your Meds”

The Glow Caps medication bottles tackle the large problem of prescription medication compliance using an embedded light that glows to indicate when it’s time to take a dose, along with an audible signal. The system also includes a wall-mounted plug-in light so that reminders appear in multiple places. This is a good example of a design that includes light features that consider multiple contexts and possible situations. When setting up the bottles, schedules can be set to map the light indicators to times of the day to correspond to when the medication needs to be taken. Since people tend to keep their medication bottles out on a counter or tabletop, having a light indicator allows it to be conspicuous. In the case when bottles may not be visible, there is also a plug-in wall light that allows the notification to take place. The lights on the wall mount and bottles draw attention to these items over others in the room. The condition of the light, whether on or off, maps to the state (medication needs to be taken/doesn’t need to be taken). The lights are also designed to serve one type of user yet play a role in the larger system, which takes into account situations in which the light indication is not enough, and it will notify caregivers of a missed dose. A history of compliance can be provided to a caretaker or doctor through the back-end system.

Some things to keep in mind when using light include:

- Use light sparingly, asking the question, “Is the product’s message important enough to wake someone?” When considering the number of lighted things that might be in a given room, it becomes increasingly important to avoid creating a “constellation” of points of light.
 - Take advantage of all of its dimensions. Light offers a reading of value in intensity, color temperature, and color saturation.
 - Animate a surface through timed responses. While a single light can simply blink, a series of lights situated next to one another can communicate many messages, such as pointing toward a direction or expressing excitement or calmness.
 - Beware of competing with daylight. Light loses its impact in products that will predominantly be used outdoors.
-

Movement

On stage at the 2015 TEDxPeachtree conference, Dr. Andrea Thomaz gave the introduction to her talk with the robot Curi, poised nearby.⁷ I had designed the shells of Curi, Simon’s “cousin,” to have similar architectural features, with expressive round, glowing ears and large, sympathetic eyes. As an important task for a robot is to recognize objects in order to navigate the

environment and manipulate things appropriately, the demo setup for the talk showed the advantage of having an articulated robot body when interacting with a person. To show the power of combining words with robotic gestures, Andrea prompted the robot so it used its robotic voice to ask, “Is the green object seventeen inches from the table edge a flowerpot?” Next, she prompted the robot to make the same observation but use its arms and fingers to point and ask the question more succinctly: “Is this the flowerpot?” The demonstration exposed how much more natural the communication was when movement was harnessed. While the elaborate mechanism of the robot may seem like a great indulgence, if it were a device in the highly stressful environment of a hospital setting, the efficiency of a gesture such as the one described above could save valuable time and cognitive energy on the part of the person using it.

The Power of the Nonverbal. People are highly sensitive to perceived motion. Things moving in nearby space can pose threat or opportunity, so from an evolutionary point of view, our senses are finely tuned to notice movement.⁸ Much of what we do to communicate verbally is presaged and augmented by nonverbal cues. We can easily catch one another’s attention by waving, direct attention by pointing, and signal a willingness to engage—or not!—with a turn of the head or a shrug of the shoulders. Movement can help mediate understanding across distances, in loud environments, or between people who speak different languages.

We are also incredibly attuned to more implicit movement-related cues. Just the *potential* for action communicated through a person's stance makes for great differences in our feelings of intimacy, comfort, or threat. Formal design details such as orientation are important—we're much less wary of a stranger who is turned away from us than someone who is looking right at us from the same distance. A short bow toward a passerby, a nod to an empty seat, or a lift of the hands toward a door handle can indicate an unspoken offer to sit or to open a door. These are not canonical gestures in any sense, but we understand them and employ them without being taught. Movement is part of an intuitive language that even animals understand.

Because movement generally requires a lot more energy than sound or light to produce and because moving parts have a greater tendency toward failure, we don't often see it used for expression in consumer electronic devices. As these gadgets take on more tasks that already require motion, though, its use will become more ubiquitous. The vacuum cleaner robot, for example, already has motors that allow it to be driven across the floor; it only needs to be reprogrammed to use those same motors to signal issues or request confirmations from the people using it. "What is that, Vroomie? There's a block you can't pick up under the sofa?"

The key to taking complex communications and translating them into the elegant nonverbal shorthand of movement is to become

an expert in abstraction, similar to the way that animators do. They focus on identifying key emotional moments in a film and then draw a character that can exaggerate those emotional expressions. Designers can define key moments that are likely to take place during typical product interaction and then specify the way the product should behave in each case.

Students of animation begin with a standard exercise in which they are asked to create a flour sack that's as minimal as possible in terms of form and decoration and then animate it to express a wide range of emotions, such as excitement, shame, shyness, elation, smugness, and so on. The assignment is restricted to a flour sack in order to focus the animator's efforts on the movement above all else. It's a formidable challenge, but talented animators manage to make that sack really come to life despite its lack of any real physical characteristics like a face, limbs, or head, evidence to the fact that nuanced movement can be used as a language to communicate emotional messages.

As product designers we challenge ourselves to do a similar thing using moving parts of products. If we design a simple overall form such as a cube or a cylinder, we'll need to rely on dynamic behaviors to allow it to communicate like some of the social robots being developed in labs. Given its form, we will ultimately be relying heavily on abstracted or implied movement to convey emotional messages and may ask ourselves questions such as:

How can we make a cylinder bow to express regret? Could a cube inflate itself triumphantly to show pride? Or cower to be fearful?

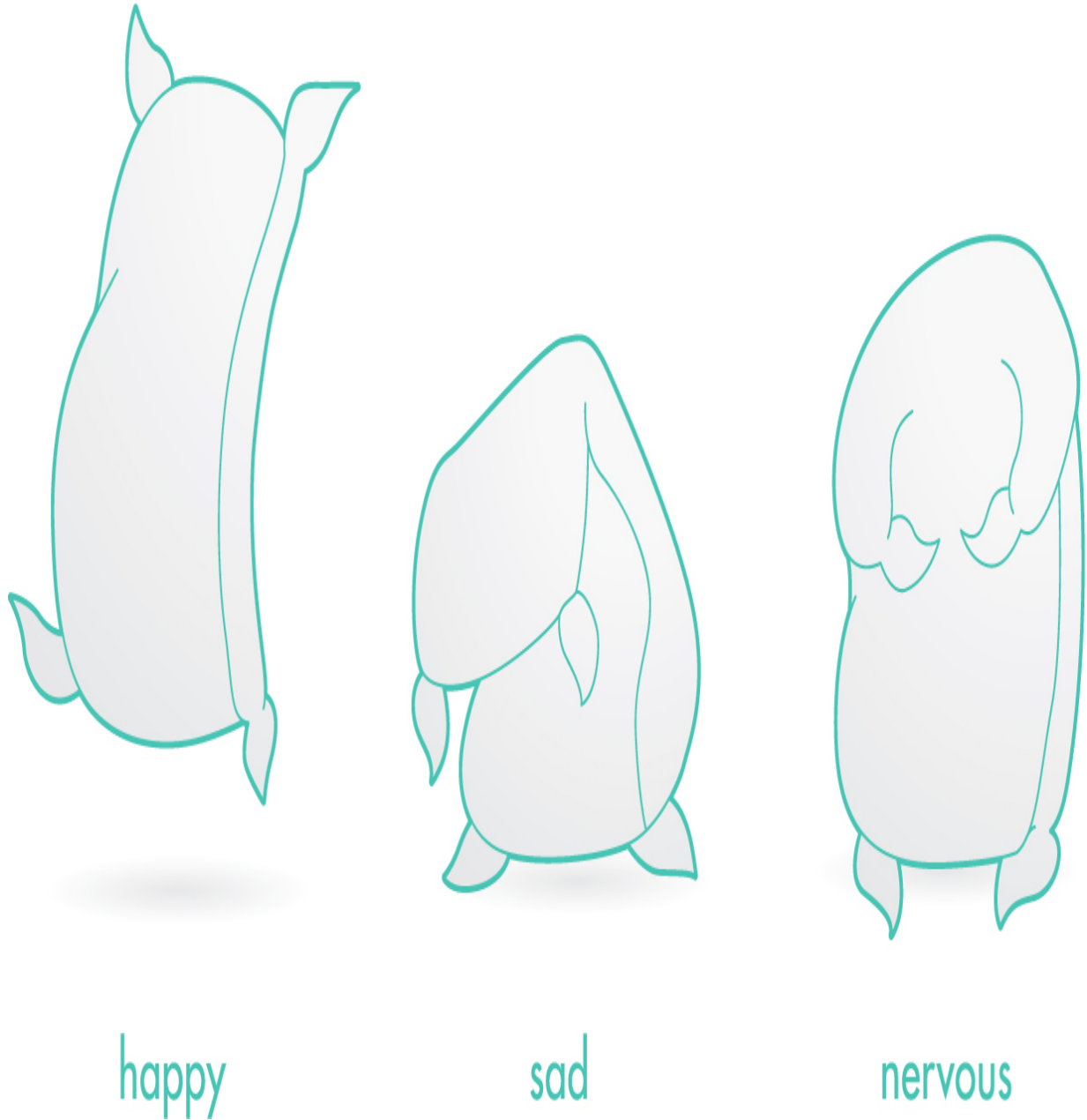


FIGURE 4-4

The Flour Sack Exercise for Design Students

Asking and Answering the Right Questions. Answering these questions in a way that can aid product development requires a few stages. First, there's knowing what to do—that is, defining your messages in human terms. For example, a vacuum cleaner can let you know it's happy because it's successfully completed its cleaning or in distress because it's stuck under the couch. Next is the step of abstraction, or decoding the messages into choreographed movements, so that the “I'm proud that the living room is clean” message is a moment that leads the vacuum to move in a way that makes it appear to do a happy dance. The final step is knowing how to use using mechanical devices such as motors, actuators, and pumps to actually make a product move to follow the intended choreography.

Movement is often the most exciting of the three modalities we explore here in that it can affect the entire architecture of a product in dramatic ways, adding richer meaning to the stories that a product tells. A solar-powered lamppost with a head that rotates can give the impression of yearning as the lamp reaches up to face the sun. A security robot that patrols a street gives the impression of greater awareness of its surroundings than one that stays stationary on a corner. Indeed, any object that can autonomously navigate a space gives the impression of agency based on the fact that it can move its body on its own based on cues from its surroundings.

As compelling as movement is, it's challenging to develop because of the complexity of the electromechanical engineering required. Here are a few things to keep in mind when designing for movement:

- Motors require a relatively large amount of power to run.
- Motors require larger-capacity batteries.
- Products with movement need more sophisticated power management than products with moderate sound and light capabilities.
- Moving parts contribute to wear as surfaces provide friction against one another or stress certain parts of a form.
- Moving products need to be more robust than static ones.
- Moving parts can introduce some safety hazards, such as pinch points.

OBJECT LESSON

Clocky the Runaway Alarm Clock—“Catch Me if You Can!”

Clocky, made by Nanda Home, is a simple alarm clock on motorized wheels. When the alarm is triggered, it rolls away, off the nightstand and onto the floor, shrieking its highly annoying alarm until somebody chases it down across the room to hit its snooze or off button. For those with a tendency to abuse the snooze button or wake up so foggy they

can't remember just why they wanted to wake up in the first place,
Clocky can be the long-awaited solution to getting out of bed on time.

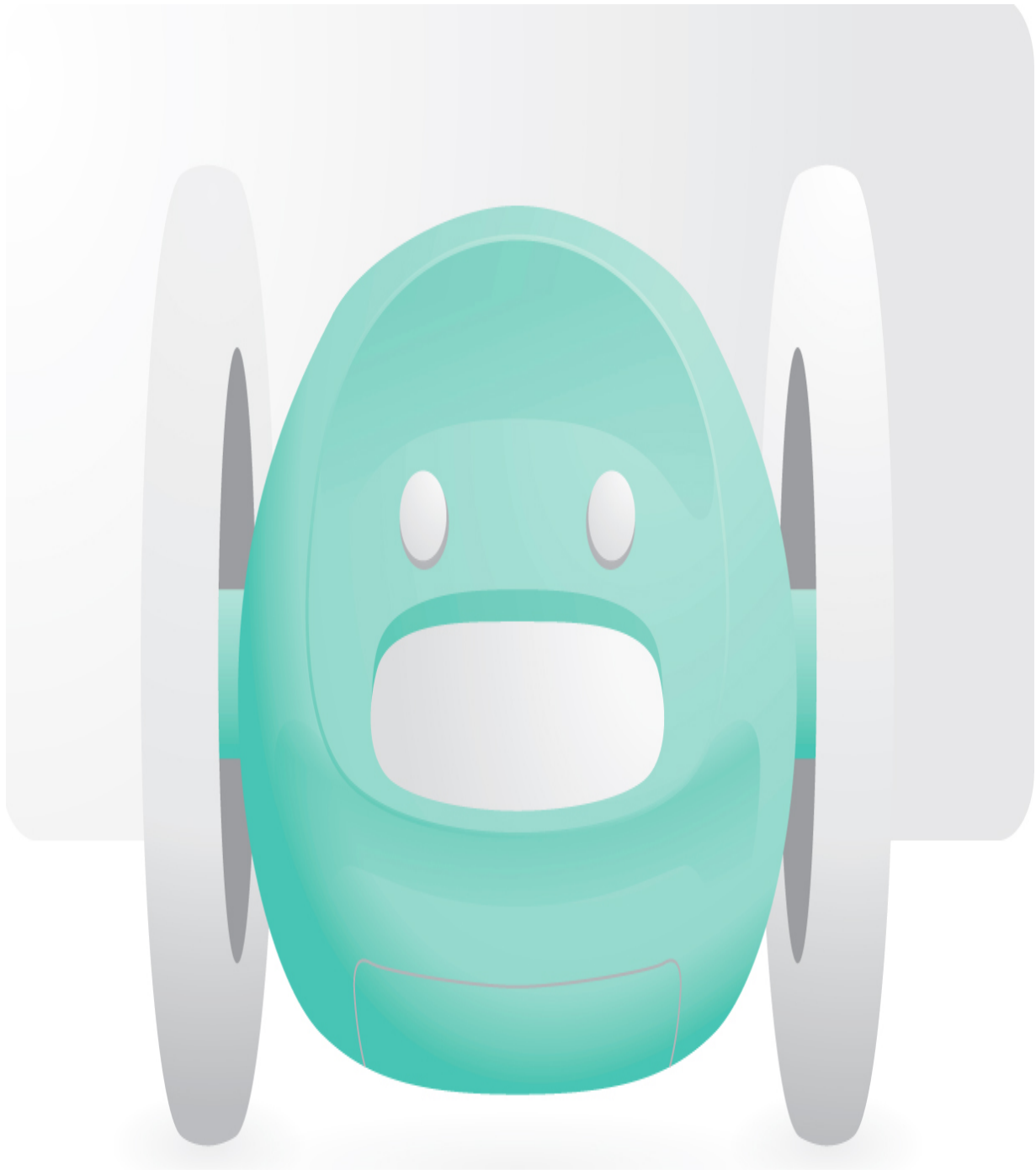


FIGURE 4-5

Nanda Home's Clocky the Runaway Alarm Clock

Clocky is not what we would call a “user-friendly” product, but it is effective. Its form boasts a rounded body, pronounced wheels, and an almost smiling face, which at first read seems friendly. After a few morning chases, however, the same form reads as far more menacing. Its rolling is an exhortation, “Catch me if you can!” Clocky’s ability to move is critical to its agency; because it does not sit and obey our sleepy orders, it can save us from ourselves in our weakest moments.

It is also not a particularly sophisticated product. Compared to app-based alarm clocks, it offers relatively few features. There’s no option for multiple days or changes in display aesthetics. Nonetheless, it still feels like a roving robot. Because its motorized wheels move around in the space, it gives the powerful illusion that it’s a creature moving of its own accord, thus triggering one’s defenses to wonder what’s invaded the bedroom, even if we can only see it peripherally.

Sound

In the ongoing search for efficient and engaging interactions, sound is a promising form of both feedback and input. Much the way my Italian cousin, Silvia, and I have a shorthand language that includes words, phrases, and fragments of sounds (“Uffa!” “Aiyee!” “Eh!”) that represent a variety of ideas, so, too, can a person and a product share a similar lexicon.

In some sense, sound is the most natural way for people and products to conduct social interactions because it's at the foundation of how we communicate with one another as human beings. Whereas the semantics of light and motion require a translation from the original form into a message that we will decode (e.g., green lights indicate "all systems go"), sound can be delivered most directly to people in the form of verbal messages that we already know and understand. Whether they are language-based or warning sounds about what's happening in our environment (the footsteps of an intruder, the imminent fall of a branch, etc.), we have a keen awareness of the sounds around us, and our ears perk up to look for meaning in them.

Sound is invisible, yet it can be ever present throughout a space, traveling across a room and filling a volume. Unlike light or movement, it can be detected by a person who is not looking at the product and thus can offer a freedom to multitask and layer messages on top of visual or tactile signals. It can be used by an appliance, such as a washing machine or dishwasher, to indicate when a cycle is complete but can also be used to deliver highly specialized and sophisticated messages such as news stories or detailed stock reports.

Sound is also an extremely efficient means of communication if we consider how quickly a very compact message can be conveyed and comprehended. In *The Sonic Boom: How Sound Transforms the*

Way We Think, Feel, and Buy, composer Joel Beckerman describes the phenomenon of rapid recognition that we've all experienced at some point in life when we hear a fraction of a musical note, yet the timbre of the music and the pitch of the sound combine to evoke a memory of an entire song: "When the songs are more familiar, then a lot of these motor or so-called premotor brain areas became engaged. Within milliseconds, you're not only recognizing the tune and feeling emotional about it but also rehearsing what action to take to respond to it."⁹

Making Sense of Sound. The human ability to parse and decipher sounds is more sophisticated than we may realize. Much of the sound that happens in our lives is fairly sloppy—that is, it comes from many different directions in a home or street, it spills over from one space to another, and we likely think of a world full of noise pollution rather than an organized and detailed landscape. Nonetheless, the human brain is able to decipher and distinguish sounds to a high degree of resolution. We regularly participate in what psychologists call *selective attention*, or the "cocktail party effect."¹⁰ When having a conversation in a loud room, we are able to make meaning of what we hear from the person speaking while filtering out the other sounds, letting our brains essentially classify them as "background noise." When we bring a new product into our homes, we train our ears to listen for the new sound and distinguish it from other sounds in the environment.

In considering this phenomenon, a product strategy can include both foreground sounds that need to catch one's attention and background or ambient sounds that can provide information if a person is actively listening but don't demand immediate focus. A device monitoring a hospital patient's heart rate, for example, can allow a nurse or caretaker to know the rate is within an acceptable range with an ambient sound that blends into the background but also alerts them when it goes beyond range with a louder, more strident sound that demands attention. What's particularly tricky for nurses in this situation is that they can become accustomed to the alert sounds to the point where those, too, blend into the background while creating noise pollution for patients and family members, so it can be important to plan the sound design carefully to avoid the "crying wolf" effect of alarm fatigue.¹¹

We can think of sounds in terms of two classes of messages: literal and representational. Literal messages are actual words, phrases, sentences, paragraphs, and so on that emanate from a product. Representational aural messages take place in the forms of tones, melodies, blips, bleeps, and more. They are the bell tones that you hear in a car interior when the driver or front seat passenger hasn't fastened his or her seatbelt or the beeping that emanates from your microwave oven when the cooking time has elapsed.

Sound is not an embellishment but a reflection of the heart and soul of the product and therefore must be given a good deal of

attention during the design effort. Professional designers are increasingly turning to sound design specialists in order to invest an appropriate amount of effort into this essential aspect of interaction.

Spoken Words Communicate Directly. Though it's a relatively new phenomenon for products to speak to us with language, it has become a nearly ubiquitous feature in contemporary consumer products, from the headphones that let us know they are connected to Bluetooth—"Connected!"—to the desktop speaker that announces the weather when prompted. Chatty products are beginning to find their way into every aspect of life, such as home safety, sports, security, entertainment, and medical devices.

Spoken words command our attention. They are also very reliable because they do not need to be decoded or translated. They feel natural because they are in the same language we may use to command the product to do what we need. When we say, "Alexa, what's the weather today?," it seems logical for the device to respond in kind, using the same language. Furthermore, we don't need to learn anything about an interface to interpret a spoken word message; simply knowing how to communicate as a human being is all the training we need to know how to use the product's interface.

On the other hand, do we really need all those words? We are living in an era of heavy language usage in new products that employ conversational agents and speak to us in full sentences and even add some unnecessary sentences of their own in the effort to render themselves to us. Every time I set a timer with my iPhone, for example, I hear the standard tones that let me know that my request was heard, followed by a voice confirmation that says, “Your timer is set for XX minutes, and the suspense is killing me.” It’s surely cute, but is it necessary? Similarly, when I ask Siri what the weather is, the device says, “It appears to be raining right now in New York, with a temperature of fifty-five degrees.” While it can be comforting to hear sentences composed the same way a person might say them, the filler words like “It appears to be” are in many ways superfluous.

Dor Skuler of Intuition Robotics described a strategy around what I might call *digital integrity*. He explained a focus on transparency, including attributes such as a filter on the computer-generated voice to give it more of a robotic feeling, rather than trying to have the device mimic human speech. Led by Yves Bèhar’s firm Fuseproject, the design team leaned heavily on multimodal “body” language through lights, sound, and movement instead of simulated facial expressions. He explained, “It’s always an honest relationship that makes very clear what it is, what it isn’t and what it can or can’t do. It doesn’t try to fool you.”¹²

Sound as Opposed to Speech. As clear as verbal messages are, more efficient and perhaps even more compelling might be the development of an entirely different kind of language that the product uses to communicate with the person using it. And much in the way my cousin and I use a familiar shorthand with one another, people can develop relationships with their products that don't rely on full sentences or even full words but some new language or a hybrid of musical tones and language. Think of *Star Wars'* R2-D2 and how much personality he had without speaking a single English word. It can not only be efficient but can contribute to establishing a sense of character that's unique, memorable, trustworthy, and representative of the brand.

How can you develop this distinctive mode of communication? It's helpful to literally write out the conversation in "longhand" form, as if it were a screenplay. While the intention may not be to have the product literally say the phrases you've written, it's a great starting point for what is essentially a translation process. Your team can then place relative value on different parts of the interaction to determine which should be front and center and which may be more appropriate for the background of the user experience. Animator Doug Dooley describes this process in terms of the intonation an actor makes with the phrasing that travels up or down in pitch, with "up" at the end of the phrase being associated with more positive sentiments and "down" at the end of the phrase as being more negative.^{[13](#)}

In addition, there are many practical and technical elements to keep in mind when crafting the sound output:

- *What's the quality of the speakers and the processor?* Not all systems are alike, and many times, due to cost or internal component size, the quality of the system may be relatively low. In this case it's essential to craft the sounds appropriately. Certain low-cost systems use sound that's generated by a chip and commonly referred to as eight-bit sound. It is limited in terms of its range and timbre, but if it's a known restriction of the system, then sounds can be composed specifically for it.
- *What does your brand sound like?* Just as an icon or a color palette represents your brand, so does sound. *Timbre* is a word used to describe the nature of the sound, and it will have a big impact on how your product is perceived. Imagine the difference between a violin melody and a banjo lick, for example. The former is reminiscent of classical music and formal theater halls, whereas the latter may conjure up images of hayrides and overalls. If there are verbal messages, those, too, should be crafted to match the personality of the brand.
- *How far is your product from the person?* Will it be important to communicate from across the room or in another part of the house? The end of a cycle for a washing machine, for example, is something you'll want to know about even if you are in a different room in the home. Therefore, the volume and pitch

should be such that it can travel a long distance as well as be distinguished from the droning of the machine itself.

- *What are the other sounds that are likely to be in the environment?* Will this sound be competing with music? Will it be interrupting dinner party conversation?
- *What's the tone of the context?* An interactive yoga mat might need ways to communicate its state or offer feedback to the person using it, but given the environment and mood, sound may be disruptive and take the person out of a meditative state. In this case a muted sound may be best, if any.
- *How critical is the message?* The Nest smoke detector gives off a clear message when smoke is first detected: “Head’s up, there’s smoke in the bedroom.” It also includes an important piece of information regarding the location of the alert. Since this may be the start of a critical and dangerous situation, it’s important that the message be loud and clear, though it’s also best if it’s not overly alarming so that a person can make a calm assessment of the situation. In some cases, escalating alerts may be appropriate so that the tone of the message, the pitch of the sound, and/or the volume becomes more intense as the situation becomes more serious.

OBJECT LESSON

Jawbone Jambox Bluetooth Speaker—“I’m Connected!”

Minimal physical outputs enable most of the Jambox's expression to take place through a series of sounds as well as spoken words. While there are buttons in the form of a chunky circle along with plus and minus signs, the interface doesn't depend on a screen output for feedback. Instead, small blips confirm button presses, and spoken phrases like, "Jambox is connected!" alert people to events such as low power and Bluetooth pairing. It has a signature sound and voice but also allows customization with voice personality and language preferences. For a brand that has built its reputation on high-quality audio products such as fashionable Bluetooth headsets, it makes sense to demonstrate the core value of the product—its sound output—through every moment of interaction.

Combining Modalities

When planning a product, it's essential to detail the ways that each of the modalities—light, movement, and sound—will operate in isolation in order to develop assets and assess overall messages. However, the experience a person has with a product will ultimately be created by a combination of all the dynamic characteristics at once. Below, I lay out the benefits of each as a guideline to deciding when to use each one.

Light

- *Localizable*: Whereas sound will interrupt a person by making its presence known throughout a space, light stays in the general area of the product, making it useful for communication that only needs to be noticed in context. The light on your rechargeable drill, for example, doesn't need to demand your attention when you're at the breakfast table.
- *Holistic*: Light can create a glow that fills an entire form, changing its overall presence based on its color and intensity.
- *Persistent*: A light that alerts someone to a message can remain lit until the message is retrieved. Sound and movement, on the other hand, are transient—once the message is delivered, it's gone until it's repeated again. Persistence makes it useful for messages that can be asynchronous. In other words, light is an effective use of a message that can wait for the viewer to pay attention when he or she is ready. It's a little more passive than sound in that way and less startling than movement in that it can glow slowly and gently, appearing in a person's peripheral vision perhaps without their realizing its change in state.
- *Flexible in resolution*: Light can offer a block of color indicating something is on or off, or present or not, but the same product may also provide a matrix of pixels that form icons, words, and animations.
- *Glanceable*: In interior spaces, light can communicate simple messages well at a distance, so it's useful for alerting people to

changes in state, such as an oven that's completed its preheating cycle.

Movement

- *Peripheral:* You can perceive movement from the corner of your eye and understand what a product is communicating without having to focus on it, so you can know what Clocky the alarm clock is saying while wrestling with the last minutes of slumber.
- *Rich:* Using movement can make an object more visceral than its still counterpart since it involves a physical, three-dimensional transformation, so knowing that Clocky is roaming around your room gives you more incentive to get out of bed, while the Polycam Eagle Eye offers the reassurance that it's no longer looking your way when it's offline.
- *Contextual:* The same movement can serve different purposes depending on the situation so that a desktop robot's nodding could allow a videoconference to say yes or show you that the product's camera is scanning from the top to the bottom of an object.
- *Universal:* Since movement can communicate messages nonverbally, it can be used as a substitute or to enhance more verbal screen- or voice-based messages. Clocky's movement would be understood as a challenge to chase it regardless of what part of the world you live in.

Sound

- *Grabs immediate attention:* As opposed to being an ambient characteristic such as lights or movement that is seen peripherally, sound can pull a person's attention away from what they are currently engaged in, thus making it a great modality to use when a product needs to be engaged with right away, such as a seat belt alert.
- *Cognitively efficient:* Since we can process sound immediately and can associate meaning with very short sounds, it can be communicated in a fraction of a second.
- *Mechanically efficient:* Unlike motion, which usually requires the energy-hungry and space-demanding resource of motors, sound can be generated with a circuit board and small speaker.
- *Offers deep emotional associations:* Sound has the power to both offer the nostalgia of positive memories as well as establish new significance for the person using it and thus bolster a product's brand.

Up Next: Interaction

In the next chapter, we will move to the next ring on our framework, interaction, which takes into account what we know about product architecture and dynamic expression and then adds to the product the ability to truly interact by sensing the people and environments around it. The product then can not only offer

messages about its internal state but communicate real-time responses as well.

IN THE LAB

Using Sound

When working for the firm Smart Design, designing a floor-cleaning robot for a company called Neato Robotics, I asked the team to break down the product's behavior into critical "moments" for personality definition. With people, we know that a person's true character is revealed during moments of extremes—both negative (stress, anger, fear) and positive (pride, jubilation, satisfaction)—and so we used these moments as key elements to define the robot's character. To create an abstract language of sounds, we detailed every message that the robot might have to convey in "human" language of words and phrases such as, "I'm done cleaning now!," "My battery is running low," or "Help! I'm stuck under the couch." Types of sounds were categorized so that expressive moments such as wake up or cleaning complete could take place through melodies, but other sounds could be expressed as alerts or feedback blips. Just like we might work with a color or material specialist in a traditional product, here we worked with a music composer named Skooby Laposky to create a palette of sounds. The human language was translated into a language of musical phrases and tones that conveyed not only the content of the

message but also the emotional aspect of it, from the distressful alerts to the jubilant celebrations.

When the unit is powered up, it has a “wake up” sound that is also the signature sound for the brand. It’s a short melody that’s memorable and catchy but takes place in under two seconds. When it’s beginning its cleaning cycle, it sounds another short melody, communicating the message, “I’m off to work!” A final melody takes place when the unit is back in its base and about to turn off, or go to “sleep.” During the cleaning cycle, there are several potential moments of interaction that relate to both core cleaning tasks and social exchanges with the person. The moments were then earmarked for three different types of sound that would vary in tone, duration, and volume, depending on the context:

- *Melodies:* These were short musical phrases of a few notes each to signal a major change of state, serving the purpose of celebrating the robot’s wake, cleaning, and sleep cycles. They could be heard from across the room but were not programmed to be at the loudest volume since their message is not critical to the unit’s performance. When thinking about a product’s expression, I like to identify the product’s emotional state, so to speak. In this instance, the robot is jubilant, announcing either excitement about beginning the job or contentment at a job that’s been completed.

- *Alerts:* These represented an announcement of issues or a call for user input. In terms of emotional state, they were cries for help or an indication that the robot was in a state of distress, such as when it was stuck under a piece of furniture, had an obstruction in its intake area, or was running out of power. These were extremely short sounds elapsing over a fraction of a second, usually containing two or three notes and expressing more negative emotions. Since they required user input, we had to consider the fact that the user might not be in the same room as the device, so they had to be loud enough to be heard at a distance. On the other hand, we knew that repeated sounds can quickly become annoying, so we tried to reserve these only for critical situations.
 - *Input feedback:* These were the shortest of the sounds, intended to give the person confirmation that input was received. Rather than being musical phrases or even messages, these were the closest to short impersonal beeps of all the sounds. Since we knew that the person would be hearing these when pressing buttons on the unit and therefore was within a few feet, we knew they should not be programmed to be very loud.
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