“Cities are fantastic places for the blind,” says Chris Downey, an architect who lost his sight after designing buildings for twenty years. He continued to design and build, vigorously redesigning his way of working and using all his senses in their unique power.

Downey makes drawings with flexible wax sticks; these are the basis for discussions with architects and collaborators. His design practice addresses the tactile, olfactory, and acoustic experience of users. Architects like Downey, and others who experience blindness, are expanding the frontier of design holistically.

Barbara Apel, a former fine jewelry designer (for twenty-two years) describes how she uses her senses today. Her observations are the wellspring from which designers can draw to make accessible products that utilize multiple senses. “I use smell very differently now than I did when I was sighted,” she says, “because it’s part of seeing. Going in an elevator, through smell, I can sense another person’s presence, regardless of their perfume. Touching is part of seeing: when I cook I gently touch a hamburger to test its doneness. Listening is a part of seeing: when I go to museums and listen to the curator describe sculpture or painting, I visualize their images. If I am given the opportunity to touch the sculpture I get a better sense of its proportions and the artist’s concept.” Smell, touch, hearing, and taste are ways we take in information about our environment. Each is an option. Some use one best, others have strength in another.

Karen Kraskow

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Illustrations by Jennifer Tobias
In this essay, we will discuss design solutions proposed (or recommended) by users who capitalize on four of our senses—those beyond sight. We will point out existing products and spaces on the market that function for all, or at least are a step in that direction. By highlighting what our users with blindness or low vision create, purchase, or use everyday, we hope to stimulate creative thinking. We will learn from users I’ve interviewed what design limitations they encounter, and what they would like to see improved. We will meet with them in the home, the workplace, the city, the marketplace, etc. The following individuals have generously granted their time and insights: Chancey Fleet, a technology consultant; Chris Downey, an architect; Frank Senior, a jazz vocalist; Joan Reveyoso, a professional singer; Barbara Apel, a former fine jewelry designer and currently an avid museum aficionado; Annie Leist, an artist; and Christine Ha, 2012 winner of the television competition Master Chef and producer of the television cooking show Four Senses (AMI). All these consultants delve into their work in private and public spaces, using sound, touch, smell, and taste. Some have been blind or visually impaired since birth, and some have lost eyesight later in life.

The expert users I interviewed aim to accomplish their goals with independence and self-direction, in a well-designed environment. Desiring healthy relationships, they do not want to rely on others unless truly necessary. They also would prefer not to count on memory where the other senses—if mobilized in the design of objects and spaces—could successfully communicate information needed for use. The people I spoke with think about themselves in different ways. Some call themselves “sightless,” to indicate that they have rich capacities in other senses (these abilities may vary, of course, from individual to individual). Others use the word “blind,” “low vision,” or “visually impaired” to directly and openly name a factor in their lives. Not all the solutions we will discuss have achieved the goal of universal design (accessibility for all), but they suggest milestones, or stepstones, along the path to that goal as seen in the day-to-day lives of these individuals.
Navigating the environment is our starting point. Chris Downey listens acutely to the sound of traffic—such as a person stepping on a metal plate on the sidewalk or the footsteps of other pedestrians. These cues contribute to his sense of direction. Chancey Fleet crosses a street by listening for the “parallel surge” of traffic going in the same direction as she is, which indicates it’s okay to cross in that direction. If traffic is traveling perpendicular to her line of travel, she must wait. When she goes to a place that is unfamiliar, she prepares by printing out a TMAP (tactile map) on an embossed printer. The map, with its raised dotted lines and street names in braille, provides her with a mental model of her journey. If the crossing is especially difficult, because a market has recently been set up in the street, for example, she uses the app Be My Eyes on her smartphone. With this app, she can scan the environment with her phone’s camera and talk with a volunteer who views her images and can suggest directions.

It should be noted that not all who navigate using the four senses we are highlighting are tech-savvy. Some grew up before technology reached the mainstream; others prefer simple, personally devised solutions. For example, a friend of Chancey’s brings a supply of braille labels as her shopping list; she places them on the objects she picks up at the store so she knows what is in the packages when she gets home. She may have picked them off the shelf herself (Honey Bears or foil-topped Pellegrino cans can be identified by feel), or found them with assistance. Some people are quite comfortable with technology and use digital devices in many aspects of their lives. Similarly, some designers develop their ideas using traditional methods and materials, creating elegant, simple products, while others focus on digital solutions. All avenues are worth exploring.

A much-lauded tool on smartphones harnesses sound. Screen readers, like VoiceOver (on iOS) and Talkback (on Android), turn text into voice. When the user passes a hand across the home screen, for example, the device speaks the names of the icons they touch. When the user hears the one
they are seeking they double tap it, and the application opens. This touch-sound technology has been applied to (or recommended for) many devices—in the kitchen, in taxis, etc.

Frank Senior is a tech maven. He uses BlindSquare, a smartphone app, to guide him in getting around New York and other cities. BlindSquare is similar to the GPS systems used in cars. GPS plus third-party navigating apps (e.g., Open Street Map and Foursquare), allow it to determine your location and give you oral directions to your destination. He speaks his starting location into the phone, and it responds with step-by-step voice directions. “Seventeenth and 7th Avenue,” he says to his phone, as he disembarks the bus to Manhattan. “Turn right,” the phone responds. “Walk two blocks straight...,” and so on. At intervals, BlindSquare lets him know how close he is to his destination: “One hundred feet ... fifty feet...,” and so on. The closer he is, the more the app talks. If he wishes, Frank can set it to tell him about places of interest he is passing, should he like to stop by. When he arrives at his destination, a ring will sound. Frank also uses BlindSquare when he travels internationally to perform. Once, when walking to his performing venue in Denmark, BlindSquare (the English version) had some trouble pronouncing the Danish street names—a tech problem that is solvable. Frank says that BlindSquare would be even more useful if, in addition to helping him find his way to streets and building locations, it could tell him in a park or other open area that “the footpath is four feet ahead ... when you get there, turn left.” Paths are not yet describable by location in the same way as buildings located on a street are.

An innovation found at a number of street corners in the United States is the Audible Pedestrian Signal (APS). A yellow box, attached to a lamppost, makes a beep to let a person know where it is. When the pedestrian feels the large button on the APS and presses it, they will hear: “WAIT... WAIT... Fifth Avenue.... Walk sign is on to cross Fifth Avenue.” A problem, however, with many sound devices in the environment is competition with the noise of the surrounding streetscape. Most of these devices work well, but not all intersections have...
them. Thus the complete path to the destination is choppy. The devices also require maintenance. The Department of Transportation plans to add seventy-five new APS signal boxes a year in New York City. Frank states that APS boxes are especially helpful on an angled street like Broadway, because he can hear the beeping from the other side of the avenue and know that he will be crossing diagonal to the curb, instead of straight across, as at most intersections.

A proposal to add a tactile diagram above each APS button is being developed by Steve Landau, president of Touch Graphics, and the NYC Department of Transportation (DOT). Through touch and sight, these diagrams will give additional information about the crossing: the width of the street, the number of lanes it has, the direction of traffic flow, and whether there is a mid-street island or bike lane. After testing these diagrams with users at the intersection of 23rd Street and 7th Ave, DOT will consider implementing them at other street crossings.

Another digital solution to navigation, developed by AIRA/Visual Interpreter for the Blind, incorporates Google Glass. Users wear a special pair of glasses with a camera attached; the camera takes video images and screenshots of everything the user’s head turns toward. These images are transmitted to a “live agent” sitting at a computer in a remote location. The agent talks with the user, letting him or her know how to get to a particular place. (“You are five feet from the entrance to the building...”) The agent views a map of the user’s location as well as the individual’s profile on the screen. He or she can inform them of options in the area that might interest them. Frank observes that this system is especially helpful in open spaces such as parks. An agent can guide a user to a bench “on the right,” to the entrance gate, “two feet away,” and the like. Agents work for an hourly wage, and, much like today’s taxi services, they are called upon when the need arises and when they are available. The project is still in beta, and may be expensive at this moment. Frank is one of the users testing the system. AIRA gives him confidence, plus
detail and company. The fact that you have “real time eyes with you” is reassuring.

Annie Leist would like to see facial recognition added to AIRA. When she’s in a crowded restaurant or at a conference, she would like the live agent to be able to tell her who is there and that her friend from college is across the room. (Annie has low vision.) This she hopes could be done by data transmission of attendees at a conference, or by facial recognition software.

Finding fixtures in the environment, and avoiding them when they are in the path of travel, is a design opportunity that architect Chris Downey has addressed. His proposal has two parts. First, he would create a planter strip bordering the edge of the sidewalk (stopping at the corner curb cut). In that plant-filled area, the bus stop, a bike rack, a trash can, and anything needed in a pedestrian’s travels would be located. Pedestrians would always know where to find them. The planter strip would beautify the area—and walkers would enjoy the flowers for their scent, their sound in the wind, or their visual qualities. In between the planter strip and the buildings on that street travelers would circulate. As the planter strip would have on the ground a different texture from the circulation area, a person using a mobility cane could feel that difference and let that guide his or her movement. This technique of cane use, called “shorelining,” helps one’s path stay straight, or curved, as the landform necessitates.

A second part of Downey’s proposal is to place the amenities in the area close to the perimeter of the buildings (instead of, or in addition to, the interior of the planter strip). In the world of retail, the area around the building(s) is called the “pop-out zone.” In this space, the business owner might set down clothing racks or tables with merchandise to expand their sales area. A bay window could project into that zone, and planters could enhance the area from that window as well. A bike rack, a bench and/or a trash can would be found next to the building. Both of these solutions (the planter strip at the curb and the pop-out zone beside the building) keep necessary objects out of the path of travel. They beautify an area and
leave an open circulation path either between the planter strip and the pop-out zone, or simply beside one or the other.

Inside buildings, wayfinding takes a different form. GPS does not penetrate the interiors of buildings, so “beacons” (or proximity sensors) can be posted at different points. Beacons placed at the reception desk, the cafe, the restroom, etc. can communicate via Bluetooth with the user’s smartphone at some hotels and airports. They tell the visitor where that facility is located, how to get there, and how near they are to it. An app at the San Francisco Airport can help one find a power outlet, an important tool in travel today.

A range of apps and simple, non-technological solutions are options in the home as well, particularly the kitchen. Joan Reveyoso, a professional singer, roasts ham, lamb, and beef frequently in her oven. Her husband has marked key numbers (at 50 degree intervals) on the oven dial with hardened silicone dots that she reads by touch.

Christine Ha, a professional chef, uses technology regularly. For cooking in the oven or grill, she uses iGrill, from iDevice’s line of accessible tools. iGrill sports a thermometer which she inserts into a roast before placing it in the oven. A wire from the thermometer exits the oven and connects to a device attached to her smartphone. On the phone, she can read and set the temperature via VoiceOver.

Pouring liquid into a cup and knowing when it reaches the top differs whether you are pouring hot or cold liquid. For cold liquids, Christine uses a standard Pyrex measuring cup to which her sighted husband has attached hardened silicone dots at the 1/2 cup and 1/4 cup levels. For hot liquids she recommends creating separate glass measuring cups, one for ¼ cup, one for ½ cup, and so on. On the rim of one measuring cup, she can set a Liquid Level Indicator that beeps when the cup is almost full, and changes tone when it is completely full. The measuring cups she has in mind would need to leave space at the top for the right-angled prongs of the Liquid Level Indicator to hang over the rim. Pourfect makes plastic measuring cups of this type, but hot liquids require glass.

The image shows a measuring cup that has been customized with adhesive silicone dots. The user presses her thumb on the outside of the measuring cup at the required level and puts her pointer finger inside the measurer, its tip matching up with the dot on the outside.
Many people use their sense of hearing to know if water in a pot is boiling. Christine knows the sound of water boiling as well as when it simmers. Some people may not be able to hear this; in a noisy environment, when the guests are chatting before dinner is served, not many can. A “Boil Alert,” a filled-in doughnut-shaped slab of plastic, can be set in the bottom of a pot of water, which crackles when the water is boiled. One can also pull out the traditional whistling tea kettle, which Barbara does; it lets her know when water, or soup, is ready. The boil alert or the whistling tea kettle are handy for anyone who wants to know when the water is boiling, especially if they have to leave the kitchen when food is on the stove.

Sound thus plays an important role in the design of kitchen appliances, as does shape or texture. With the many features that kitchen appliances offer today—slow cook, prepare yogurt, or rice—there is a need for universal controls. Print controls address only one portion of the population—those with sight—but other options are available. If one doesn’t have a way of knowing the appliance’s functions, one is forced to rely on another person. Or one must learn and memorize the layout of controls. Barbara uses an audio-enabled rice cooker: when she presses a button (labeled ‘porridge,’ perhaps), the rice cooker announces the option; if she wishes to use that setting she does nothing or presses the Start button to the right. If that is not her choice, she goes to the next button in the row and repeats these actions. Some users (such as Christine and Joan) prefer old-fashioned tools, such as the stove top pressure cooker, which has virtually no controls. Barbara’s choice is the decades-old coffee grinder, which has only one button. Sometimes users ask a relative or friend to attach braille labels, constructing their own interface.

Christine suggests that appliances (such as rice makers and pressure cookers) be connected to one’s tablet or smartphone by Bluetooth. Options could be spoken or visible, depending on the best mode for the user. Another concept is to design buttons with different shapes or textures. For example,
a horizontal or vertical row of four buttons, each with a different shape, could be memorized more easily. An arrangement of buttons (all in a circle or a square) can work as well. Raised letters or braille letters on buttons can be helpful on a variety of appliances; for example, one could place a raised “H” or “C” for hot or cold on the office water cooler handles. Thoughtful positioning of buttons, changes in shape or texture, and raised lettering or braille can make appliances and devices function successfully for all users.

This direction of design thinking could enhance many machines in daily life. When Joan took a taxi to my office, she had to ask the driver to process her credit card as the payment information and Enter button were solely in print, not audio. We thought about how universal symbols (such as a raised Arrow, or a circle for Enter) could be placed on the plastic frame and direct her to a screen icon at the edge. However, I learned that there is indeed an audio mode, called VIP Mode, accessed by gently double (or triple) tapping the screen opposite the back seat. The basic system (there are slightly different versions) is composed of screens with a large rectangle on the left and a similar one on the right; below that can be a row of three smaller rectangles—the bottom row. Audio instructions tell you to “tap left for cash, tap right for credit,” “tap the minus sign on the left to lower volume; tap the plus sign on the right to raise it,” and so on. You must listen carefully to the audio instructions, which takes a bit of time, to know exactly where to tap. “Tap at the bottom in the center to repeat instructions,” etc. Some people may feel a little unsure that they will tap the right area.

Chancey and others feel that VoiceOver technology (or TalkBack) is more efficient for taxi functions. Users of VoiceOver explore the whole screen with their hand and hear the names of the icons that their fingers touch; they double tap the one they wish to open. Using one of those screenreaders, Chancey feels, would make the process of paying one’s fare accessible to all. I would add that there could be an option to speak or not speak, and a simple double tap could serve
those who preferred to not have a sound option. Another role that screen could play is to invite users to listen to news or entertainment. In that way, the one screen would be useful for everybody: one could pay one’s fare by auditory or visual cues; one could choose an option to listen to or view news or entertainment. Thus, Chancey suggests, one screen would be useful to many users; it would not single out one group of people as needing something different from others. Passengers would use the mode that suits them best.

An audio option has also made ATMs at banks accessible when one plugs in one’s headphones. Voice directions tell the user what number on the keypad to press for Withdraw, Deposit, Transfer, etc. A raised dot on the 5 (middle key) enables one to infer by touch the positions of the other keys. My experience using my local ATM machine showed me that it worked well, but sometimes the voice commands did not fully coincide with what was on the screen. The mismatch wasn’t enough to prevent me from making a transaction, but it was not quite in accord with our current digital prowess. Christine and Chancey would like to see VoiceOver on ATM screens as well, and any other machine with options; they prefer this to translating from voice to physical numbered keys. Clearly, the integration of computer technology with machine capabilities needs to be explored further with users.

Returning to the kitchen, and also considering the bathroom, we come to the design of packaging. Apps can help users read the text on the outside, but when you’re in the bathroom, or even busy in the kitchen, that may not always be the best technique. When Joan gets ready to wash her hair, she lifts a bottle and does not know if it is shampoo or conditioner, because they are identical in shape. Sometimes she nicks the conditioner bottle cap or asks the salesperson to mark it with a piece of tape. Other times, she puts the bottles in different places—the conditioner on the sink, the shampoo on the tub.

One hotel she stayed in placed braille on the lids of the bottles. The Super Eight Motel in Lee, Massachusetts, uses a two-part wall-mounted dispenser with shampoo on the left,
and conditioner on the right (from Dispenser Amenities). The dispenser can always be found on the wall opposite the shower head. For Joan, these solutions are excellent, as their positioning is consistent and it’s easy to memorize “right” and “left.” The general manager of the Super Eight, Sam Patel, who installed them, chose them for other reasons as well. Dispensers are more economical and sustainable than small bottles. Additionally, it’s easier in the shower to pump from the dispenser than to fumble with a tiny bottle. Christine encounters this situation in her travels. Hotels provide bottles of body lotion, soap, and shower gel as well as shampoo and conditioner on the shelf in the bathroom; but often they are packaged in bottles of the same size and shape. Designers could place a raised “S” and raised “C,” and/or braille, on the bottle for those who use touch (including people who take off their eye glasses before bathing).

Getting dressed each day presents its own challenges. Sound and touch expand our range of options. When Joan goes shopping for shoes, she uses touch to identify a patent leather shoe and distinguish it from a leather shoe, and purchases a pair of each. (Tags don’t stay in shoes.) Or she’ll buy one pair with a buckle and one without. For clothing, when she gets home after purchasing a dress in different colors, she’ll adjust the tag of each—the white one will have no tag (she’ll cut it out), the green one will have only the top of the tag, and the fuchsia one will bear the existing tag. White or beige sweaters in her closet will never have a tag. Could we not have a system of differently textured or shaped tags to represent the color range? How about tags to identify clothes that fit me when I’m above my normal weight, and different ones to identify those that fit me when my weight is in the normal range?

Christine and Barbara have well organized closets. Shopping allows Barbara to tap into her experience from her youth as a fashion model. She knows quite well what looks good on her. When she shops, she touches a dress to feel its construction. When she intuists cap sleeves, quarter length
sleeves, or full length sleeves, she decides which to purchase. She asks the salesperson, “Is it dark blue, light blue, or bright blue?” She uses this dialogue and her sense of touch to make a decision. With TapTapSee, an iPhone app, you can take a picture, and in a few seconds hear (from a volunteer), “Blue and black stripes.” The more advanced app, Be My Eyes, can generate an extended conversation in real time—a volunteer can tell you not only the color of your shirt but also if there’s a spot on it!

Joan selected her wedding dress by touching bride dolls and inferring their style and texture. She made her choice in a major NYC department store from this tactile information. Christine enjoys online shopping, but rues the descriptions of some products (read by her screen reader). Makeup described as the color of “LSD” or “Mildew” is tough to picture. It would be helpful, she suggests, if descriptions were more straightforward, more imaginable (“tree bark,” “blue sky”). Christine reminds us that she, like all our interviewees, values fashion and its role in her daily life. She regularly consults InStyle and Refinery29 online.

Systems for managing money are also individually devised as well as tech-based. In the United States, coins can be distinguished from one another because of their size. However, bills are all the same rectangular size. Today, Frank folds his $10 bills in half the long way, his $5 bills in half the short way, etc. ($20 bills go in his right pocket, and singles in his left.) Joan uses a satchel with many pockets, with designated, and memorized, denominations. Wallets are available with several parallel pockets for organizing bills. For the tech user, apps such as Money Reader let you take a picture of the bill, followed by an announcement (“twenty dollars”).

Euros have a different system. One can feel short, parallel, tactile lines, spaced differently on each note, on the short edge of the banknote (now for 200 and 500 Euro banknotes). Coins are distinguishable by weight, thickness, and edge texture. The heavier the coin, the higher the value (excepting the 1 Euro coin); the thicker the coin, the higher the value (with the
exception of the 2 and 1 Euro coins). Some coins bear smooth edges, while others have scalloped or grooved perimeters. The European Central Bank consulted on the design with the European Blind Union, knowing that “a good design for the blind and partially sighted (is) a good design for everybody.”

Traveling presents a host of design opportunities; one that Christine notes is the availability of a restroom that is private so that her husband can assist her in finding the toilet, the hand-dryer, and other amenities. She uses the family, or accessible, restroom, as he cannot assist her in the public restroom designated for women. She suggests constructing a group of individual enclosed stalls surrounding a communal sink, available to everyone. An individual stall makes it possible for a family member or companion to provide assistance. When pressed for time in an airport, taking a picture of a hand-dryer and waiting for an app to identify it by name is not always possible. Attaching braille labels, or a map that is both tactile and sanitary, might be design concepts to explore.

I hope, as do the individuals who have generously shared their day-to-day lives with me, that designers will consider all users in their decision-making. Our shared environment can be improved when consumers, designers, and manufacturers keep the diversity of users in mind. Making products and spaces universally accessible—adjustable, communicating through different senses, and fitting a variety of needs—can support everyone. We all have different abilities, and at different times of our lives we may call on different skills. Knowledge about diverse needs, through interviewing, is necessary for informed decisions. Certainly, these conversations should happen while the design process is happening . . . not after the mold has been cast. Whether one is an architect, a teacher, a chef, or a pedestrian enjoying a city, we all need to feel that the environment is an accessory to our success.