angel tang | kompas fellowship | myefski architects | 2019 - 2020

UN-BABEL

on vision-loss friendly design:
some discussions, a dictionary, and an application

THE FALL OF THE TOWER OF BABEL
| Cornelis Anthonisz, Etching, 1547

Un-babel preface

If language is defined as a structured system of communication, then architecture and the human sensory system are both languages. **Architecture** is a structured system of spatial elements that communicate possibilities of body movement with its users. For example, a stair prompts the possibility of travelling vertically with one's feet; a wall influences the direction of travel; a door presents a potential to (dis)connect adjacent spaces. **Human sensory system** is a structured system of information processors that communicates decisions based on environmental stimuli with the brain. These two languages are needing a bridge.

This research effort is meant to join a dialogue on how to translate the language of architecture into the language of senses.

Just like how we all have the need to navigate architecture, senses are also something we share. The Aristotelian senses - smell, sight, touch, taste, and hearing - are our windows to the world. Signals come through these sensory channels and carry information to our brain; the brain integrates and interprets them, then commands our body to interact with the environment. We repeat this process every second that we're alive. Most architecture relies on visual signals to present cues, excluding people who have impaired visual channels. For people with sensory impairment, unlike wheelchair users, architectural design is not a question of gaining access to the physical space, but about equal access to information. For example, without clear sight, how can one quickly tell if this tread is the last one on the stair? Where is the door? Where does the corridor lead to? Am I walking straight? Is that a clear entry or a panel of glass? Confusion is likely to cause safety hazards, frustration in navigation, and ultimately a compromised level of autonomy.

Thus, designing for sensory impairment is about **providing equal access to information**. Under this context, designing is about presenting information timely, accurately, and beautifully. Good design achieves this translation to support the autonomy of the end user.

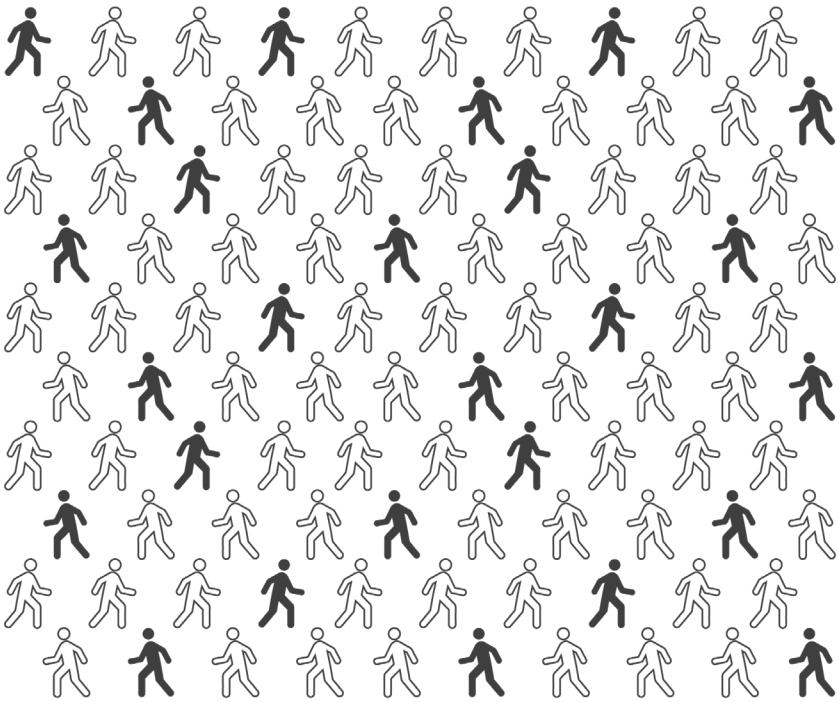
Though conversations on universal design have been around for decades, we still lack an easy-to-follow design guide to bridge the gap among professional knowledge, construction practices, and the end users who can benefit from designs that are friendly to the low-vision community, which I sincerely believe to be all of us. The current code is boring to read and hard to retain because it was not designed to be understood by everyone. Consequently, it did not start from the connection we have - the complexity of human sensory system and the universal need to understand the language of architecture.

If there is a disconnection in communication among us, like in Tower of Babel where different groups speak different languages,

if designers cannot communicate in terms that clients understand,
if regulation writers don't consider the readability to users in need of this information,
if builders don't understand the importance of those details,
if users in need of accessible architecture do not have the means to connect with professionals,
then, accessible design will only exist in an architect's mind.

The current code is not intuitive; but, because we share the same senses and needs, it should be. Segregation, indifference, and discrimination are the results of not understanding how basic the unfulfilled needs are, and we can change that. We make the change by bridging the differences by what we share.

And here enters my attempt to **un-babel**.



AUDIENCE | Based on 2016 U.S. Census, at least 26% of people in the U.S. have vision problems.

1 BACKGROUND

As 26% of the people in the U.S. have vision problems, visual impairment is not as uncommon as we might have thought. Designing for vision-loss is not just caring for the people who are diagnosed as "legally blind", but also for other people with low vision, including the elderly and our future selves.

Yet how can we care? Luckily, we see with our brains, not just with our eyes. Thanks to the multitude of human senses, visual impairment can be compensated through providing alternative access to the same information through non-visual senses, like hearing and touch.

Hearing and touch have different strengths and weaknesses, which make them suitable for different kinds of environment. Aural cues deliver one piece of information at a time and are often backed up by existing language systems, which make them the most desirable alternatives for explorations in the digital realm, like surfing the internet, or reading an Excel chart. However, for spatial navigation in the physical realm, aural cues might become disruptive for perceiving other signals. For example, when crossing the road, verbal instructions from the headphones are likely to interfere with the reception of traffic sounds, which can be life-threatening to miss. Additionally, there are significantly more people with hearing impairment than the ones who cannot feel pressure or temperature. These characteristics make the sense of touch the most inclusive alternative for translating visual information that architecture implies.

senses for navigation information processors

1 VISUAL

1.1 definition: perceptible by sight

1.2 sight: the physical sense by which **light stimuli** received by the eye are interpreted by the brain and constructed into a representation of the **position**, **shape**, **brightness**, and usually **color** of objects in space.

1.3 losing sight: (1) low-vision; (2) legal blindness

1.3.1 low-vision: vision that is no longer correctable by glasses, contact lens, surgery, or medication.

- Approximately **63%** of people in the U.S. over the age of 40 have vision problems (NIH, 2010). Within this population, nearly **19%** have chronic visual impairments.
- The number of people with visual impairment or blindness in U.S. expected to **double** by 2050 (NIH, 2016).

1.3.2 legal blindness: vision is equal to or less than 20/200 in the better seeing eye.

- **2.4%** of the population in the U.S. are reported to be legally blind (NIH, 2016).

2 AURAL

2.1 definition: perceptible by hearing

2.2 hearing: the power of perceiving **pitch**, **loudness**, and **tone**.

2.3 loss of hearing: unable to hear 25 decibels in at least one ear

- **15%** of American adults aged 18 and over report some trouble hearing (NIH, 2016).
- **13%** aged 12 years or older have hearing loss in both ears (NIH, 2016).

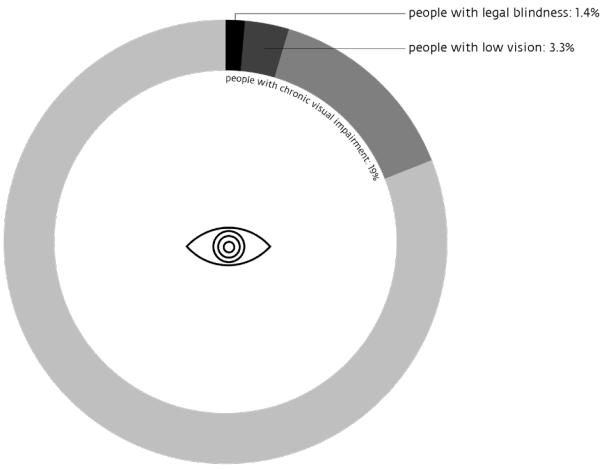
3 TACTILE

3.1 definition: perceptible by touch

3.2 touch (i.e. sotomasensation): feeling **texture**, **temperature**, **pressure**, **pain**, or **vibration**.

3.3 loss of touch: congenital insensitivity to pain (CIP)

- not perceptible to pain; can still feel discriminative touch (though not always temperature). (OMIM, 2014)
- extremely rare condition caused by genetic mutation; about **20** cases recorded in literature. (NIH, 2016)



Among the 89 million people in U.S. that have vision problems, nearly 17 million have chronic visual impairments, including 2.9 million with low vision and 1.3 million with legal blindness (NIH, 2010).

visually-abled classifications

1 BEST POSSIBLE EYESIGHT: 20/8: the physical upper limit of human vision due to diffraction of light.

2 NORMAL EYESIGHT: 20/20: at 20 feet, one can see the details of what should normally be seen at this distance. *not the best possible eyesight.

3 ABLE TO DRIVE: 20/40: able to pass Driver's License Test in all 50 States.

20 / x

The test subject sees at [20 feet] that person with normal vision sees at [x feet] .

VISUAL ACUITY | sharpness of vision measured by the ability to discern characters at a given distance according to a fixed standard.

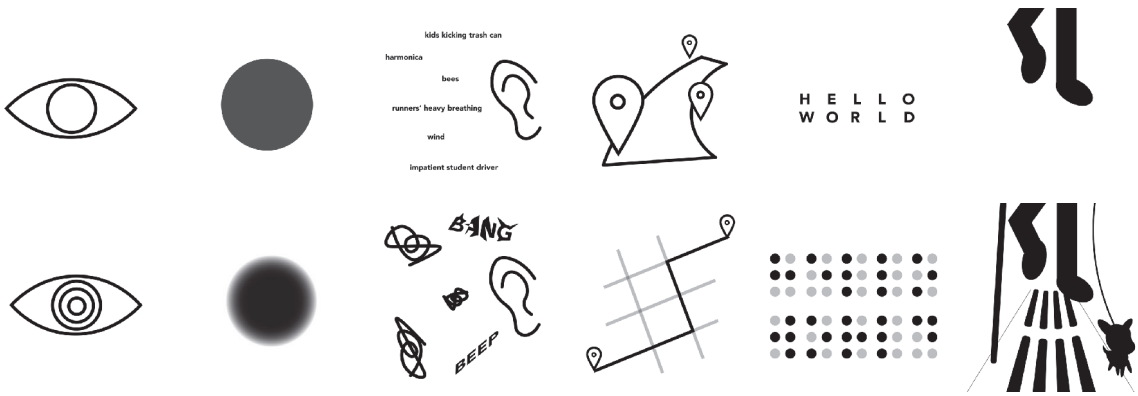
visually-impaired classifications

1 PARTIALLY SIGHTED: indicates some type of visual problem, sometimes with a need of receiving special education.

2 LOW VISION: a person who has measurable vision but has difficulty accomplishing visual tasks with prescribed corrective lenses; usually falls within the range of 20/60 to 20/200.

3 LEGALLY BLIND: someone who has less than 20/200 vision, or who has 20 degrees (diameter) or less of visual field remaining in the better eye.

4 TOTALLY BLIND: no conscious light perception; has to perceive information via Braille or other non-visual media.



living assistance tools and companions

1 BRAILLE ALPHABET: a system of tactile letters, numbers, and symbols.

2 WHITE CANE: a walking stick to scan surroundings for obstacles or orientation marks, but is also helpful for other traffic participants in identifying the user as visually-impaired.

3 LIGHTING: directed, low-glare lighting in high contrast environment.

4 SOUND: non-visual information that provides the most clarity.

5 TOUCH: non-visual information that can be quietly perceived primarily through hands and feet.

6 ASSISTANCE DOG: helps with navigation and provides companionship.

7 WEB AIM: accessibility guidelines on font, color, and layout in webpage design.

8 SCREEN READERS: a software that runs alongside an operating system that uses text-to-speech technology to voice what would be displayed on the screen. The common ones include NVDA, JAWS, VoiceOver, TalkBack, Dolphin, and Narrator.

challenges daily life impact

1 PHYSICAL: reading, safe pedestrian travel, self-care, cooking, and recreational activies.

2 MENTAL: common co-curring issues: anxiety, depression, phobias, PTSD.

3 SOCIAL: difficulties in responding to social cues including body language, facial expressions, and personal space; lack of confidence in participating group activities (e.g. group meal); might fail to recognize when someone is approaching or leaving; more likely to experience isolation, discrimination, and deception.

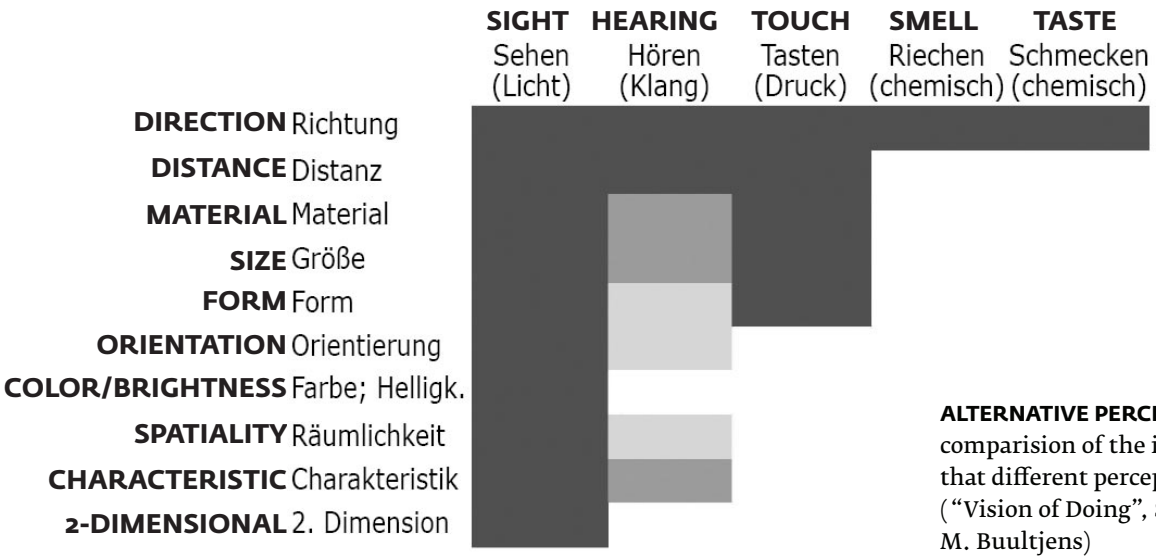
20/20 **20/200** **20/400** **20/600**

BLINDNESS SIMULATION | live renderings from Eyeware, a desinger tool that allows design professionals to see the world with a variety of eye conditions.

Zwei-Sinne-Prinzip two senses principle

The principle from DIN-18040 states that each piece of information should be simultaneously presented for two complementary senses. The principle is fundamental in designing for people with sensory impairment, as information can still be perceived if one of the senses is compromised.

The combination of senses can be any two of the three non-intrusive senses: seeing, hearing, and touching/feeling.



ALTERNATIVE PERCEPTIONS | comparision of the information that different perceptions entail ("Vision of Doing", S. Aitken and M. Buultjens)

TACTILE MAP | information of the site is conveyed in three senses through (1) drawing with contrastive forms, (2) tactile blocks that follows the building arrangement, and (3) buttons that reads the name of buildings.

Based on specific applications, it is important to classify how important the lack of alternative sensory information is. According to the theory by Carsten Ruhe, Two Senses Principle should be applied according to the three priority levels below:

Priority 1 - emergency warnings and alarm signals
The alternative must always be present and delivers without ambiguity.

Priority 2 - (one-sided) information
One-sided information that does not entail the possibility of asking questions (like announcements) should generally always be presented with a good level of clarity.

Priority 3 - supportive information
Alternatives for supportive information or for information that can be further clarified through queries have the lowest priority and should be offered as often as possible.

2 PROCESS

To educate myself on the needs of people who have visual-impairment, I started by volunteering with people from various organizations in Chicago and asking them about places where they felt included and cared for. These conversations became the catalyst of many design details later.

Moreover, as more and more cases of design innovations that are outside of the U.S. came up in the discussion, I became motivated to study design standards and guidelines for vision loss from Japan and Germany, countries that have a reputation of pioneering barrier-free architecture. During the research, many built details in those two countries expanded my understanding of the aesthetic possibilities of vision-loss-friendly designs.

The findings during the above process encouraged me to find a better way of representing the design strategies that are currently inaccessible to many of those who are not familiar with our profession.

2.1 Encounters

The encounters in Chicago became the basis of my project, as they led me to be creative out of necessity. At first, the desire to communicate ideas to my interviewers inspired the design of tactile drawings. Then many other ideas followed: seeing them having to either touch all over the wall to look for the braille tag or count doors from memory just to get to the right room inspired me to put tactile information on the surface of door knobs and other operable hardwares. Watching them align their path of travel by finger-tracing the walls inspired me to provide hand-level signals whenever possible; meanwhile, their expression of fear towards walking in monotonous open spaces where tactile cues are unavailable, like the parking lot, urged me to design cues that are perceivable under blurry vision. Eventually, a mother's flood of concerns on home renovation for her baby born with glaucoma motivated me to compile the vision-loss-friendly design details into an illustrated dictionary that makes customized architectural designs more accessible.

I started my research with volunteering at the 14th Disability Pride Parade and the Visual-Impairment Cruise with Chicago Lighthouse and Chicago Yacht Club. Just like me, it was the first yacht experience for many Lighthouse members, too. Everyone seemed to enjoy the guided lunch at the Club and the cruise: the taste of the beef patty, the smell of the lake, the touch of breezes on our faces...which got me thinking about what the pleasure of architecture is beyond vision.

Getting everyone on the boat was the most challenging task in the day; luckily, our captain was very experienced in guiding the guests. To demonstrate the drop height and the length of the stride needed to be made, he held the guest's hand holding the white cane, tapped on the pier and then the boat, so that the guest can hear the sound of different surfaces and feel the drop distance. Next, the captain would instruct the guest of where to put his feet and how to adjust his/her step as the person steps down. As expected, the process took longer to board than people with normal vision do; but everyone was very patient and helpful. This experience gave me some insights on how to ease the fear of navigating in unfamiliar, irregular environments - can architecture provide some non-visual signals before the visitor approaches the destination, so that he/she knows what decisions need to be made?

WATER CANNON PERFORMANCE | To show love and support of the city on the day of the cruise, the Chicago Fire Department sent out a boat to do a water cannon performance for us, despite the fact that the spectacle is purely visual (unless the captain drives the boat into the water sprinkles).

At an all-staff meeting I shared with the team some beautiful vision-loss-friendly design details that I found after researching both local and international resources. During the informal presentation, we discussed how vision-loss design guidelines are not as accessible to non-professionals: the code is written using jargon with little to no illustrations. For example, why do we assume someone not in the architecture industry would understand the term “nosing”? And, it’s likely to be especially challenging to simply ‘imagine’ how a space could look using the recommended designs - surely an illustration would help to clarify the message for all.

DETAIL | The break on the handrail acts as a tactile indication of the end of the treads. (International School in Annecy, France)

Discovering these design details has reaffirmed my belief that it’s possible to design environments that are both accessible and beautiful, and it has further inspired me to compile my fellowship research into a “dictionary” – an attempt to systematically share design strategies for visual impairment with a wider audience.

Following a suggestion, I connected with Polly Abbot. Polly is an Orientation and Mobility (O&M) instructor, and a dear friend to many of her clients. The conversation with Polly enlightened me in the way I think about information. In our conversations on O&M, braille, and architecture, she inspired me to think about a more universal way of communicating signals.

Let me ask you this, what’s common between the following two things: the nudge you feel deviating from your lane while driving, and the pictorial men/women symbols on bathroom doors? Polly pointed out that they both deliver subtle, but clear, messages that are independent of language. How can architecture provide similarly effective orientation hints?

PICTOGRAPH | signages that makes the point of entry for bathrooms easy to understand

Polly kindly introduced me to her friend, John Gleichman, a licensed architect in Chicago. John invited me to a lunch gathering with some architect/designer/builder friends that he met through the organization, which provided even more perspectives to consider. Although John’s friends experience different levels of vision-loss, they are all striving for a successful professional life, embracing their conditions, and living with much strength and hope. Aside from our passion in architecture, the courage they shared with me is something I’ll forever be grateful for.

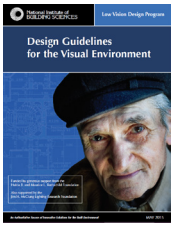
After talking with John and his friends, I'm convinced we need a universal language to talk about vision-loss-friendly designs among builders, clients, and architects. After all, architecture is a champion of human universality. We all share the same need for space; to stand we need a floor, to partition space we need doors and walls, to hide from rain we need a roof, to go up and down we need stairs and elevators. Innate need makes communication smooth between us and architecture - when one sees an architecture element, rarely would one need words to understand the usage of it. However, when one is visually impaired, the built environment presents a different case.

How can we make the built environment intuitive for those with vision loss in the same way that it is intuitive for the sighted? Can we present the same signals and information using a 'language' that works for the people with only blurry vision, touch, and hearing?

2.2 Design Guidelines Comparisons

As I started to read design guidelines on accessible designs, I noticed a stark difference between the guide in the U.S. and the one in Japan: the guide in Japan is primarily illustration based, where the text serves as a supportive element to the drawings; on the contrary, the guide in the U.S. is text-dominant.

Below are their respective sections on building entries.

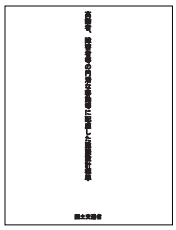


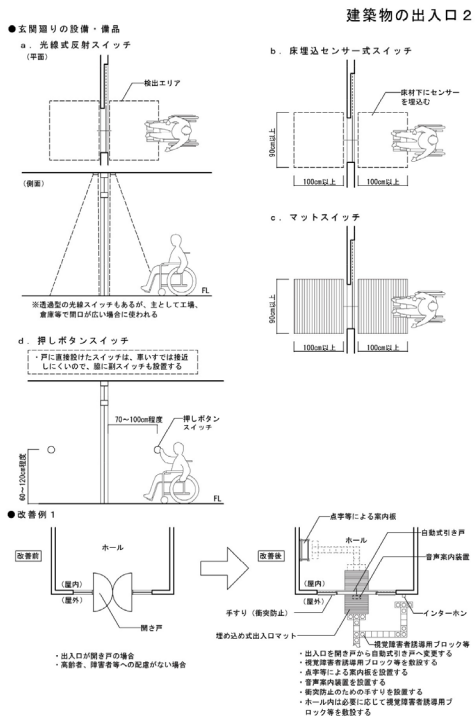
3.3 Lobbies

Traditional building lobbies are typically large, high-ceilinged open spaces designed to serve as reception, orientation, wayfinding, and security screening spaces, which are consequently well-populated and visually confusing at peak periods. They are the transitional spaces from the outside world to the building's interior circulation, and often include monumental stairs, elevators, escalators, and other circulation features:

- Planning of the entrance area should provide for the first-time visitor, without a guide companion, who may need assistance finding information about navigating the building. This might suggest placing reception personnel as close to and directly visible from the point of entry as possible. In buildings with security screening, security personnel should be sensitized to the needs of persons with low vision to assist them through the screening process and direct them to the reception and building information directory.
- Touchscreens for building directory and wayfinding information should provide fonts and graphics that persons with low vision can read, and be augmented with sound. Placement of the device should be such that it is easily seen from the entry door and activation of the screen should be obvious such as by a large, visible button. Dynamic tactile systems (electro-mechanical arrays for changeable braille characters) for Braille users might be located adjacent the touch screens. Position the touchscreen to avoid glare from windows and lighting for people standing and sitting.
- The use of electronic audio communications as audio guidance assistance in buildings may not be adequate if visitors cannot be assumed to be equipped with the necessary receiving devices before they enter the building. However, audible announcement systems are useful for emergency announcements.
- Personal audio assistance receivers using triggering key fobs, smart phones, or similar handheld devices may be useful for populations who frequent facilities such as schools and places of employment where the system can be designed to serve that population and devices can be made available for regular use. Careful design of the audio assistance system's speech quality, message length and clarity, and coordination with other audible systems is crucial to avoiding confusion and misunderstandings.

U.S.: DESIGN GUIDELINES FOR VISUAL IMPAIRMENT (2015)

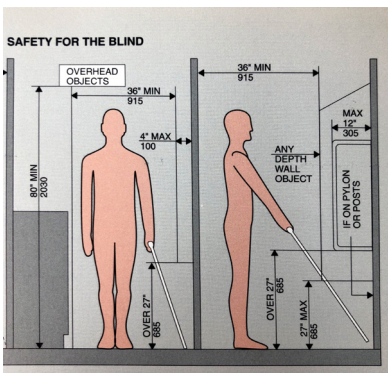




JAPAN: STANDARDS FOR ACCESSIBLE DESIGN (2012)

How can I compile a guide that makes design strategies more accessible, so that readers can quickly grasp where, how, and why the information needs to be presented?

Feeling inspired, I attempted to translate the text into drawings.



DESIGN GUIDE ILLUSTRATION | "The Measure of Man: Human Factors in Design", Henry Dreyfuss (1960).

Where bollards with linking chains are used as barriers to prevent pedestrians from stepping into traffic, the chains must be visually prominent in dimensions and color so people with low vision do not miss seeing them. However, caution should be used in selection of use of varying colors and patterns in paving that might obscure actual steps or other changes in paving levels or, conversely, may become false suggestions of level changes.

See Table 4D-2.

2.2 Building Orientation, Location, and Form

Building orientation will affect the amount of direct and reflected solar penetration of interior spaces, and the need for controls to mitigate or prevent consequent glare. Buildings with natural landscape and views will benefit from reduced reflected solar load and glare and provide better occupant comfort. Narrow footprint shapes favoring the south and north façade exposures will enhance daylight exposure opportunities from more than one direction. Wherever possible under site and location conditions, the following are recommended:

- Direct east- and west-facing exposures should be avoided for building occupancies such as offices and other workspaces to avoid the direct low angle light from the rising or setting sun.
- Design buildings to maximize daylight penetrations without direct sunlight
- Locate buildings with views of landscape when possible.

2.3 Site Circulation

It is recommended that walkways in the public right-of-way comply with the following, in addition to the standards of the Authority Having Jurisdiction:

- Walkways must not present hazards of tripping and falling due to uneven surfaces or from steps, curbs, and edging that are not clearly visible with change of color, value, and texture. Curbs and other walkway edges should be raised above the walkway pavement a minimum of 100 mm (4 in.) (20), and be of contrasting color or value sufficient to be clearly visible to the pedestrian as a pavement boundary. Pavement edge curbs are generally not needed where there are handrails. (See Table 4D-2.)
- The approach pathways to public entrances must be easily identified with signs or visual clues such as architectural or landscape features so that approaching persons will be able to locate the entrance.
- Stairs and steps should be designed with leading edges (i.e., nosings) that clearly contrast in color and value with treads and risers (24). Where steps cross grades, tapered risers to meet grade may be hazardous to the unwary pedestrian who may be unable to see the edge of the step and/or detect them visually or who may have balance issues. Where possible, tapering should be avoided or, in addition to contrasting leading edges, use

3.5.9 Wayfinding Aids

Wherever possible, wayfinding aids should be placed facing the direction of travel rather than on walls and doors along the corridor sides. Signage placed across corridors at the ceilings may be difficult to see for some people with low vision to see and may be difficult to illuminate properly.

- All wayfinding aids must be in high contrast with the surrounding fields in color and value. See Table 4D-2.
- All wayfinding aids require electric lighting illumination that does not result in glare from reflections off the signage or adjacent surfaces[3] (34).

3.6 Stairways

3.6.1 Surface Finishes

- Stair risers should contrast with treads to aid in visibility to persons ascending the stairs.
- Stair tread nosings should be in high contrast colors and values from stair treads and should be 50 mm (2 in.) wide so that the edge of each tread is highly visible to the user descending.
- Stringers or skirting should have a strong value contrast with treads and risers to enhance their visibility.
- Highly figured or patterned materials should be avoided, as they may be confusing to those with low vision. Continuous carpeted stair runners with such designs may camouflage the edge of the tread and create a fall hazard.
- The sloping undersides of stairs and escalators could become a head-bumping hazard, so spaces under the stairs or escalators must be enclosed or otherwise protected to prevent access below a height of 2030 mm (80 in) See also ADA Standards 307.4 (30).
- See Table 4D-2.

3.6.2 Hand rails

In addition to code and regulatory requirements, the following is recommended:

- Hand rails should contrast with wall surfaces in color and value.
- Where handrails turn corners, it is preferable that they be continuous rather than interrupted.

3.6.3 Undersides

The sloping undersides of stairs could become a head-bumping hazard, so spaces under the stairs should be enclosed or otherwise protected to prevent access below a height of 2030 mm (80 in).

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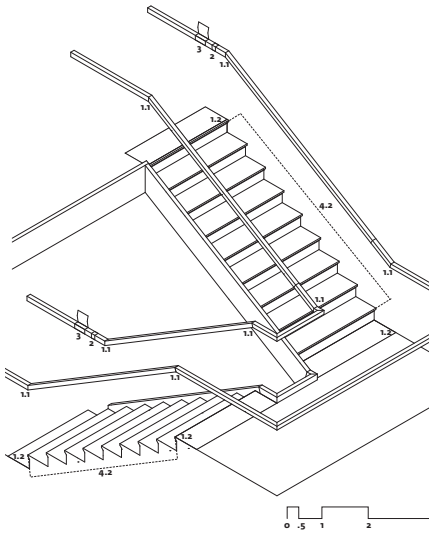
handrails to lead or guide the pedestrian to the full step and riser section of the stair/steps.

- Pavement patterns and color changes that could be mistaken for steps should be avoided where they cross paths of pedestrian travel.
- Drains and gratings should be placed to the sides rather than in the pathways in paved pedestrian areas. Gratings bars should run perpendicular to the path of travel and be spaced not more than 13 mm (1/2 in.) apart (20).
- Avoid lighting placement that shines directly into pedestrians' eyes.
- Walkway lighting should be provided to minimize glare. For example, bollard lighting should be directionally downward and overhead, and post lighting should be baffled from view by walkers looking at the pathway.
- Lighting directed toward the facades and other vertical surfaces of a building or facility is preferable to fixtures directed outward from eaves, as often is done for security. Careful coordination of lighting is needed to avoid "blinding" closed circuit televisions (CCTV security cameras) on one hand and building occupants on the other, while providing desired building and landscaping lighting for aesthetic purposes.

2.4 Courtyards and Plazas

In general, courtyards and plazas are subject to many of the same recommendations as other paved areas, with the following additional considerations:

- Older adults and those with low vision have longer adaptation times when moving from areas of bright to dim lighting and vice versa. Therefore, where courtyards and plazas are accessed from the building or are part of the entrance design, transition from the bright light of an outdoor space to an indoor space should be made with a vestibule in which the daylight level is reduced by the design or with glazing or shading devices.
- Where courtyards are adjacent to the building walls, large glass areas such as windows in the building perimeter could be mistaken for openings by the person with low vision. Therefore, clearly visible barriers to prevent accidental collision are recommended, such as horizontal rails, mullions, or muntins. Doorways must be clearly identified.
- Fixed seating, tables, containers, etc., should comply with Section 2.5 below.
- Landscaping within the courtyard or plaza should comply with Section 2.6 below.
- Sculpture placed within paved areas of a courtyard or plaza if not of a size, form, and/or color that is readily visible in contrast to the surroundings, should be placed or mounted to avoid accidental collision by pedestrians with low vision, such as providing a contrasting pedestal or highlighted by a contrasting outline of the base that is flush with the surrounding walkway to avoid a trip hazard.
- Lighting in courtyards and plazas should be provided to minimize glare. Bollard lighting should be directionally downward.



stair *vertical circulation*

1 THE START/END OF TREADS

1.1 *<tactile>* indicate the start/end of stair treads at or within the distance of (0.5 tread depth) on the handrail to the first tread.

1.2 *<tactile>* place truncated-cone paving or other tactile flooring at the start/end of treads.

2 FLOOR LEVEL *<tactile>* place braille or other tactile marking that indicates the floor level on the handrail following Item 1.

3 FLOOR MAP *<tactile>* place tactile map of the main circulation of corresponding floor on the handrail following Item 2; indicate the reading orientation.

4 STAIR BOUNDARY

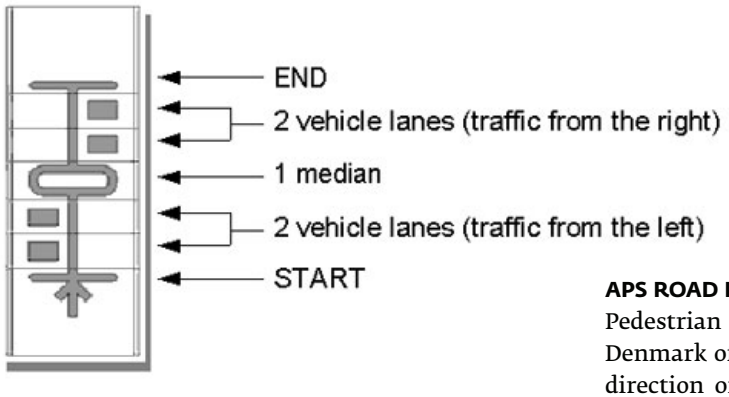
4.1 *<visual>* highlight stair nosing with contrasting color, material, or under-stair lighting.

4.2 *<visual>* install wall lights along the edge of treads.

GUIDELINE TRANSLATION | left: the sections that are relevant to "stair" in *Desigh Guidelines for the Visusal Environment*;
right: illustrative translation

2.3 Case Studies

During the research, many built details that are vision-loss-friendly came to my attention. They expanded my understanding of the aesthetic possibilities of designing for sensory impairment, and inspired me to capture the essense of these implementations in the diagrammatic dictionary entries.



APS ROAD MAP | Tactile Accessible Pedestrian Signals (APS) in Denmark offers information of the direction of crossing, direction of cars, and the number of lanes and medians.

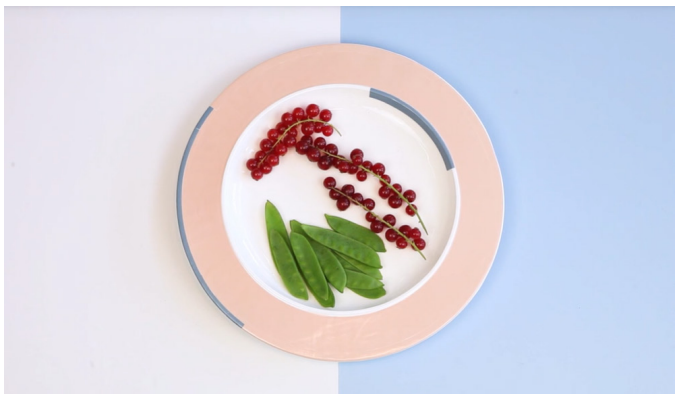
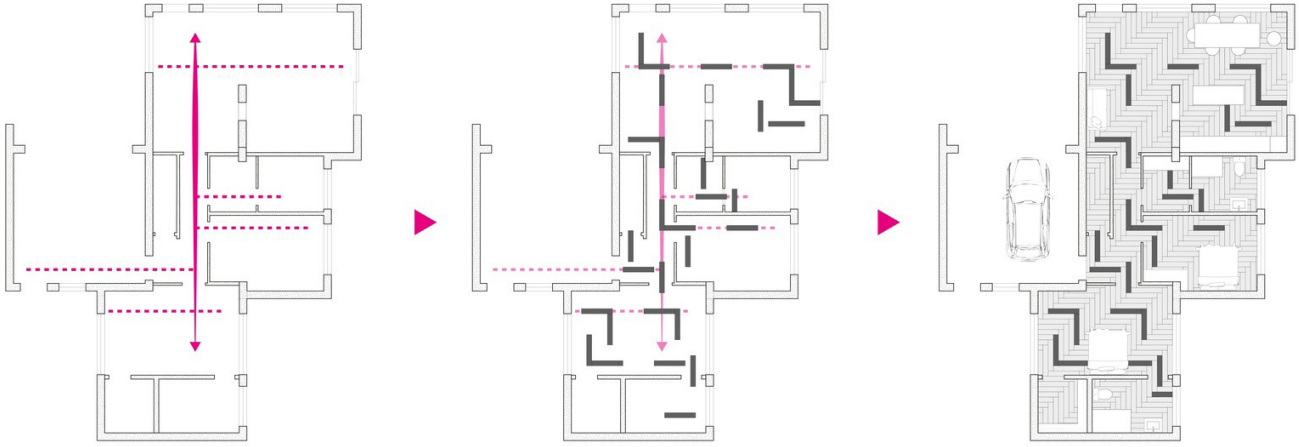


PLATE | From the tableware collection "See-Eat-Through", this plate enables visually-imapired people to perceive the edge of the plate more clearly and gracefully.

DOT WATCH | Compared to the traditional accessible watches that yells out time in warning tones, this watch is a braille and tactile smartwatch that can present time silently.

CENTER FOR THE BLIND AND VISUALLY IMPAIRED, MEXICO CITY | stark light and shadow pattern clearly indicates the point of entry for either building or courtyards, accompanying with the absence/ presense of the canopy.



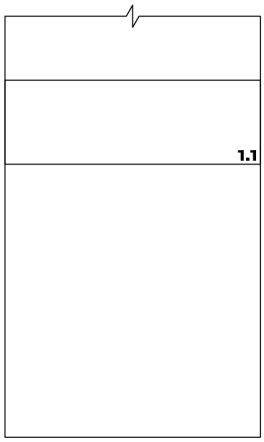
DOMESTIC TACTILE FLOORING | Designed for a blind client, the flooring uses stone and porcelain to embed a glyphic map of the circulation in the house. (So & So Studio, 2018).

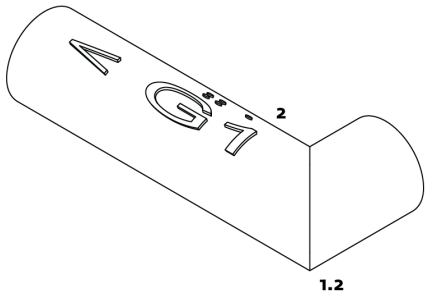
BI-LEVEL HANDRAIL | This design provide support for hand tracing technique that accomodates people with different hand levels with a material that is not cold to touch.

TACTILE HANDRAIL TAG | This tag presents both alphabet and braille of the floor level information via the sense of touch.

TACTILE PAVING | The strips in the train station indicates the path of travel, the boundary of the path, and the node for possible turning.

OPTICAL PAVING | The linear light fixtures on the ceiling and the high-contrast arrows on the floor successfully indicates the path of travel perceivable by blurry vision.





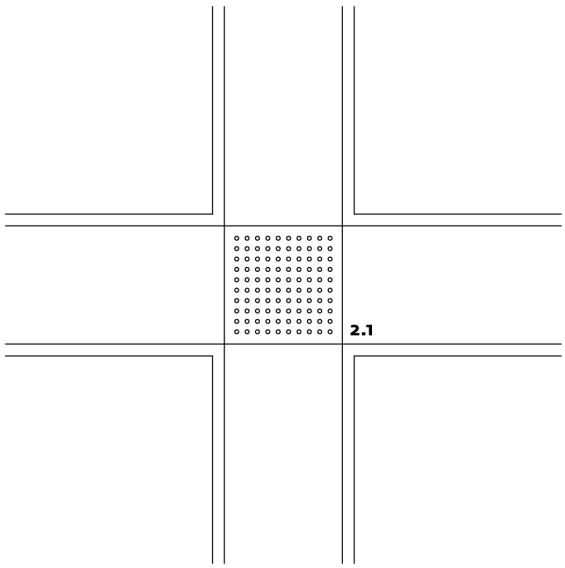
railing path indication

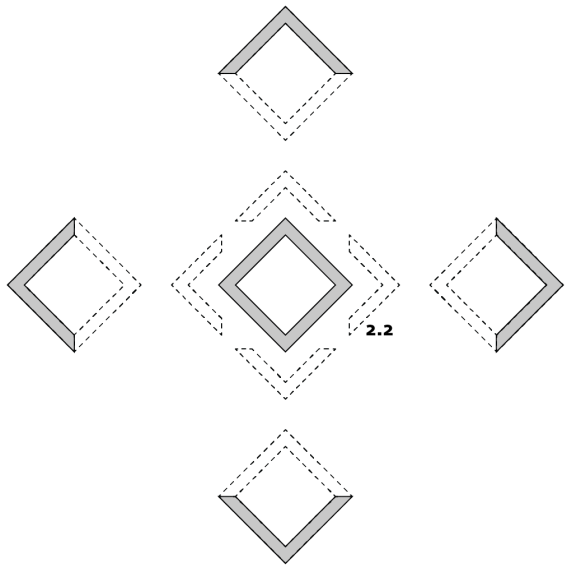
1 PATHS OF TRAVEL

1.1 <visual> indicate the path of travel with high-contrast colors or light strips.

1.2 <tactile> install railing within the indicated zone to provide support and tracing aid; this modification would also provide additional visual cue.

2 TACTILE TAG <tactile> wrap braille and/or other tactile marking that indicates floor information on the top half of railing.





trail path indication

1 NAVIGATION SYSTEM (to lead)

1.1 <tactile> indicate the main circulation with patterns made from different materials

1.2 <visual> integrate navigational pattern into carpets or other floor systems; large stickers with high contrast can also be used.

2 NODE OF CHANGE (to prompt decision-making)

2.1 <tactile> place truncated cones or other tactile paving to provide tactile feedback.

2.2 <visual> additional arrow-like patterns can be used to indicate the directions of options.

2.4 Dictionary Organization

As a design tool, the dictionary has the ambition to analyze any type of space and guide on the location and the content of the signals, laying the foundation for form design, material selection, and its implementation for the user.

To achieve this goal, I resorted to the definition to basic geometry elements: point, line, surface, and volume. If there is a way to address what defines the basic geometry elements, there should be a way to combine design strategies and accommodate any type of spatial arrangement.

Below is a process of analyzing the corridor turning.

TASK: How to provide relevant navigational information at a corridor turning?

STRATEGY: To make a successful navigational decision at a corridor turning, a person ("I") must receive signals regarding the following decision tasks:

Am I approaching a turn? (Confirmation needed at the point of turning)

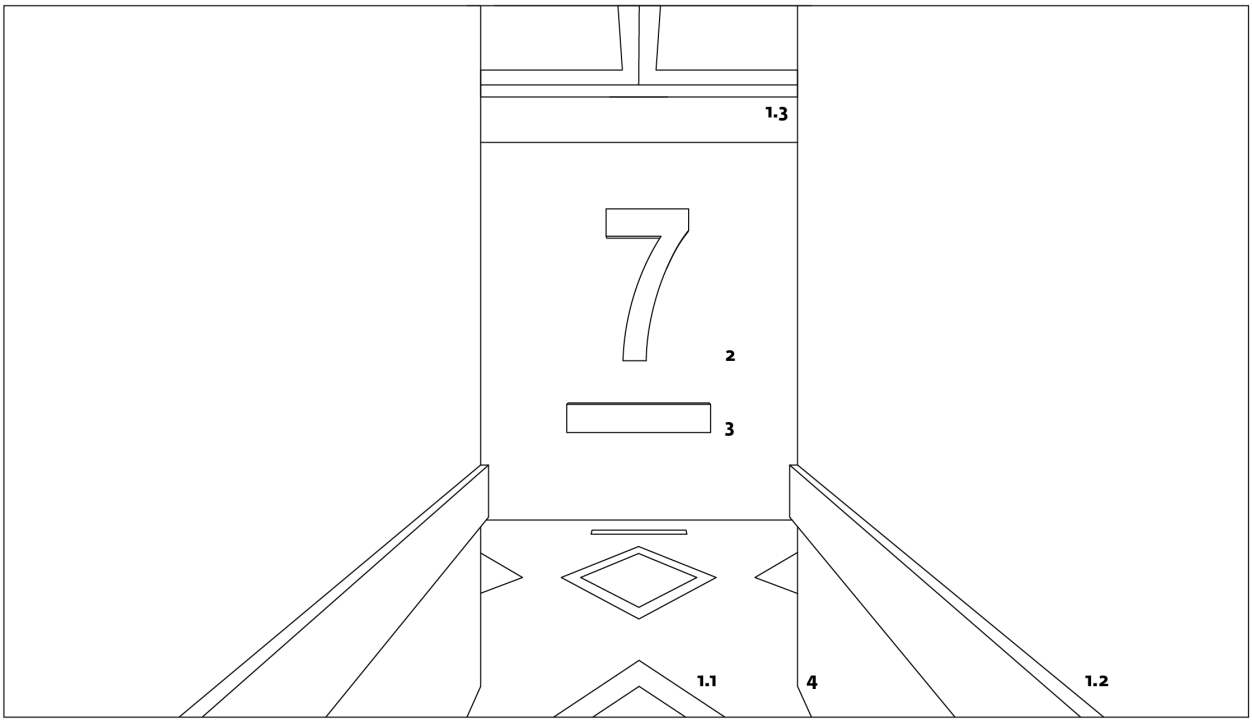
Where am I now? (Information needed at the point of turning)

Where am I going next? What are my options? (Information needed about some points on the line of travel)

Where would I be relative to where I came from? (Information needed about the relationship between the turning and destination points)

Am I walking along the intended path of travel? (Confirmation needed on the line)

RESULT: Based on the geometry of the required signals, a combination of point and line-type signaling information is used as depicted in this entry for corridor turning.



corridor turning horizontal circulation

1 PATHS OF TRAVEL <tactile/visual>

1.1 see TRAIL.

1.2 see RAILING.

1.3 place lights or baffles on the ceiling that are consistent with main path of travel.

2 FLOOR LEVEL <visual> place large floor level icon for visual clarity.

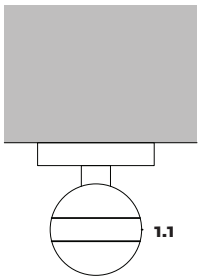
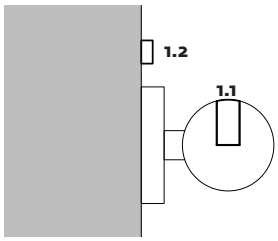
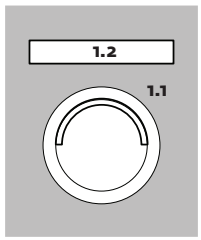
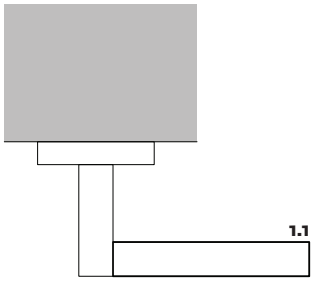
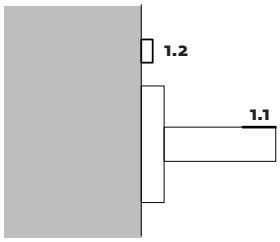
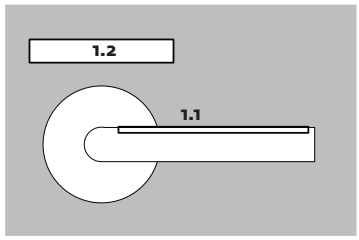
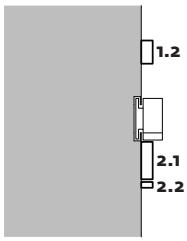
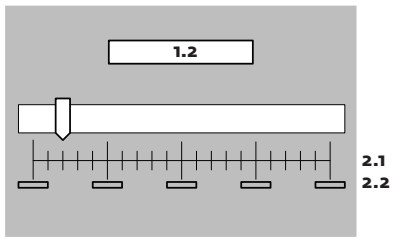
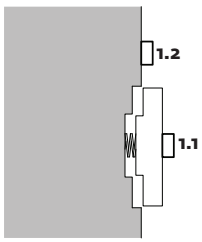
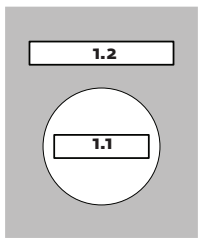
3 FLOOR MAP <tactile> place tactile map of the main circulation of corresponding floor; indicate current location.

4 BOUNDARY <visual> see ROOM.

3 DICTIONARY

Believing in the autonomy of end users and advocating for equal access to information, the "dictionary" attempts to translate the language of architecture into the language of senses, in order to present vision-loss-friendly design ideas. The illustrated dictionary intends to cultivate empathy in readers through demonstrating how basic the unfulfilled needs are, and how easily they can be fixed.

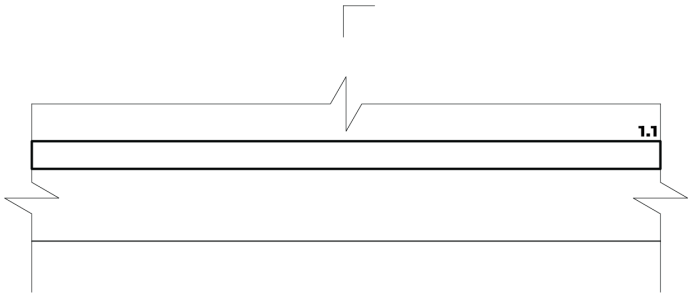
The dictionary is primarily organized in the progression of basic geometries - point, line, surface, then volume - in hope that this can serve as a design guide to tackle any spatial arrangement that needs modification. This guide integrates multisensorial design strategies from projects and regulations in the U.S., Germany, and Japan, and aspires to be a tool for both amateur and professional designers to reimagine everyday spaces in the future.

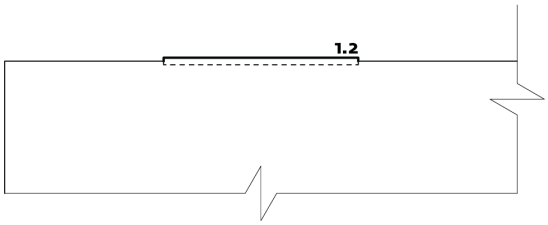
	TOP	SIDE	FRONT
KNOB			
LEVER			
SLIDER			
PUSH BUTTON			

control finger interface

1 ROOM DESCRIPTION TAG <tactile> provide tactile tag of room descriptions on/near the control interface

2 CALIBRATION MARKINGS <tactile> provide tactile markings and explanations for calibrations



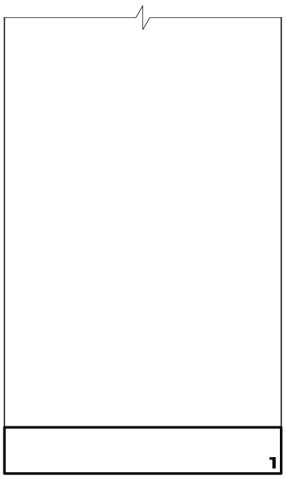


on horizontal surface edge

1 BOUNDARY ALERT accentuate a line offsetted a certain distance from the surface edge to prevent accidental departure; the offset distance is determined based on the function of the surface.

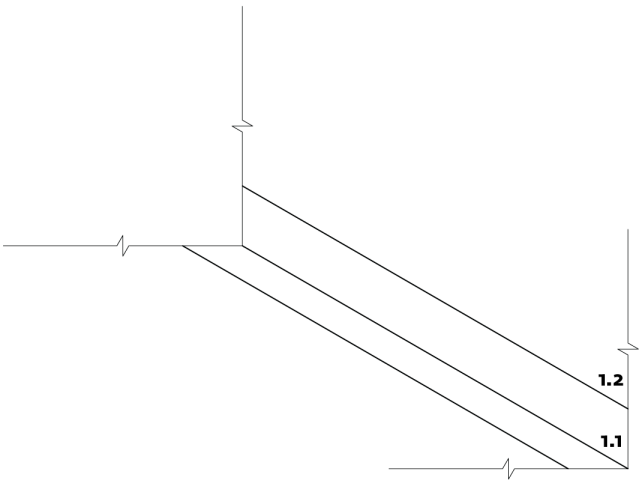
1.1 <visual> distinguish the boundary in high contrast with either color or light.

1.2 <tactile> protrude (or indent) the boundary with additional material or carving



on vertical surface edge

1 BOUNDARY <visual> provide a high-contrast zone aligning to the surface edge to establish clear orientation; contrast provided with color or light.

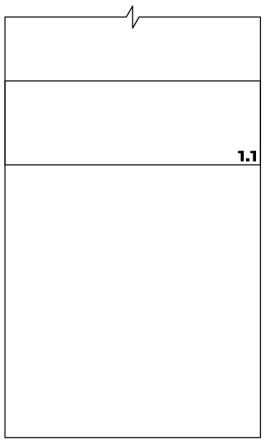


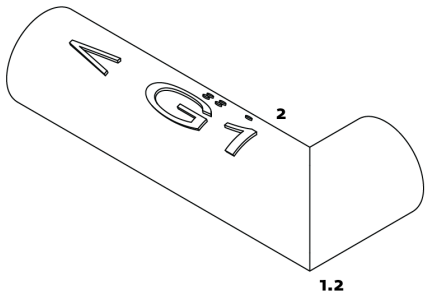
on combination surfaces edge

1 BOUNDARY <visual>

1.1 in case where the two surfaces share colors with low contrast, distinguish the boundary in high contrast with either color or light.

1.2 contrast the two surfaces with different color, material, lighting, or a combination of these elements to achieve high contrast.





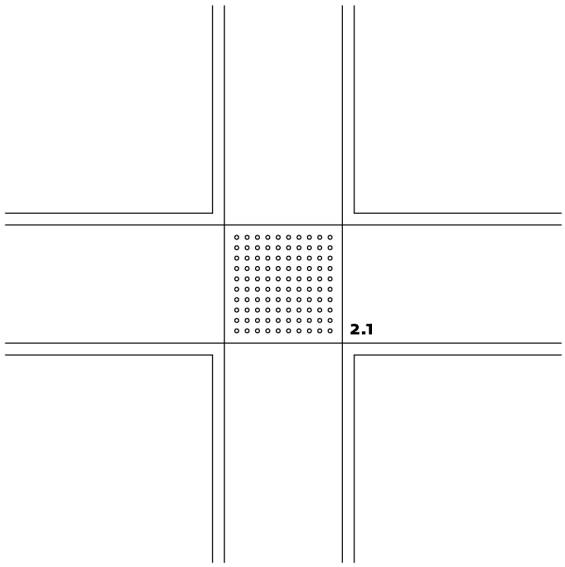
railing path indication

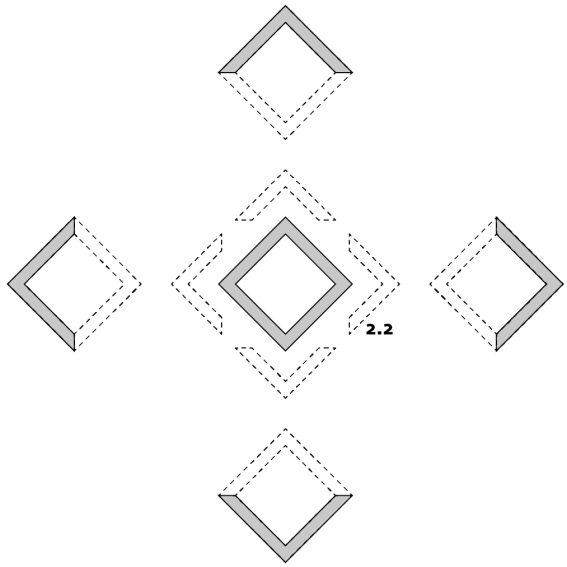
1 PATHS OF TRAVEL

1.1 <visual> indicate the path of travel with high-contrast colors or light strips.

1.2 <tactile> install railing within the indicated zone to provide support and tracing aid; this modification would also provide additional visual cue.

2 TACTILE TAG <tactile> wrap braille and/or other tactile marking that indicates floor information on the top half of railing.





trail path indication

1 NAVIGATION SYSTEM (to lead)

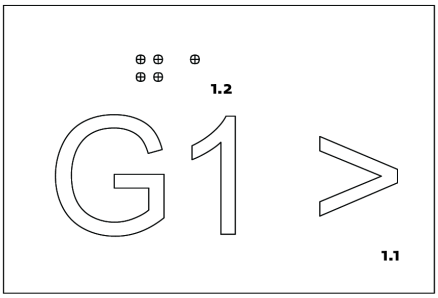
1.1 <tactile> indicate the main circulation with patterns made from different materials

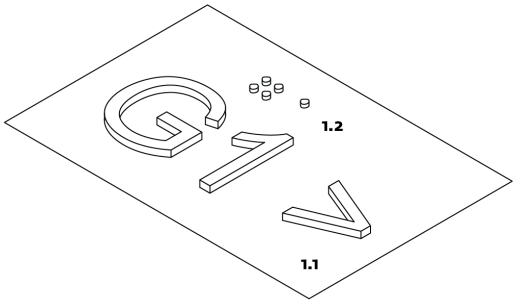
1.2 <visual> integrate navigational pattern into carpets or other floor systems; large stickers with high contrast can also be used.

2 NODE OF CHANGE (to prompt decision-making)

2.1 <tactile> place truncated cones or other tactile paving to provide tactile feedback.

2.2 <visual> additional arrow-like patterns can be used to indicate the directions of options.



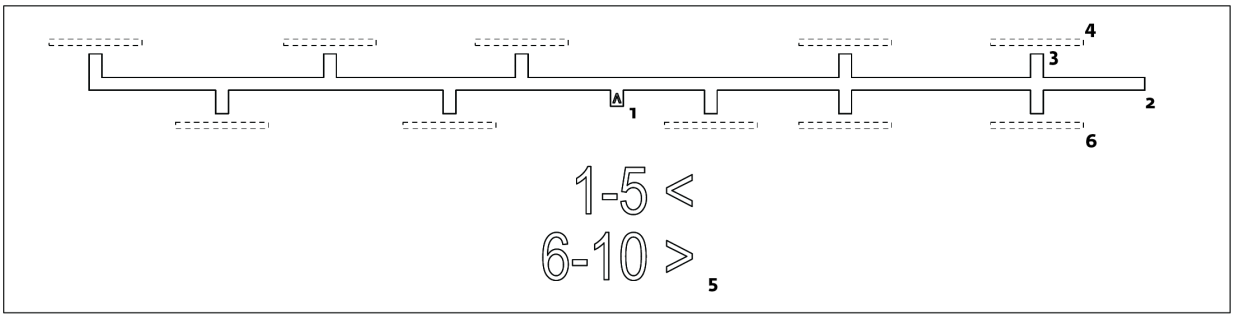


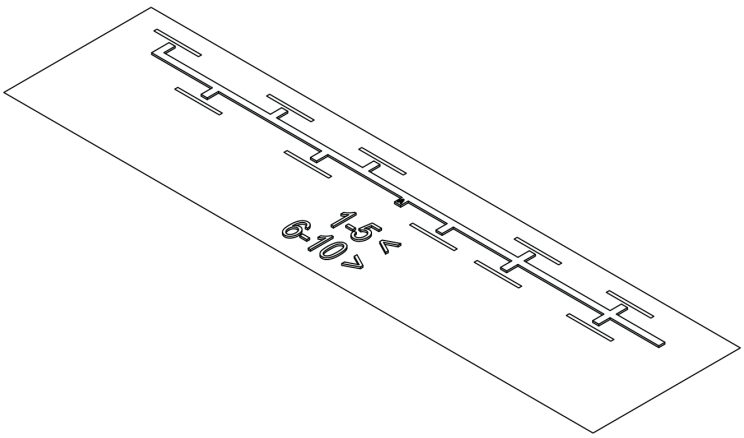
tag finger interface

1 ADDTIONAL INFORMATION ON SPACE

1.1 <tactile> provide tactile marking in the main language for people who are not familiar with braille

1.2 <tactile> provide braille marking for braille users.





tactile map finger interface

1 THE CURRENT LOCATION <tactile> indicate the traveller's current location with an tactile arrow pointing in the direction of travel.

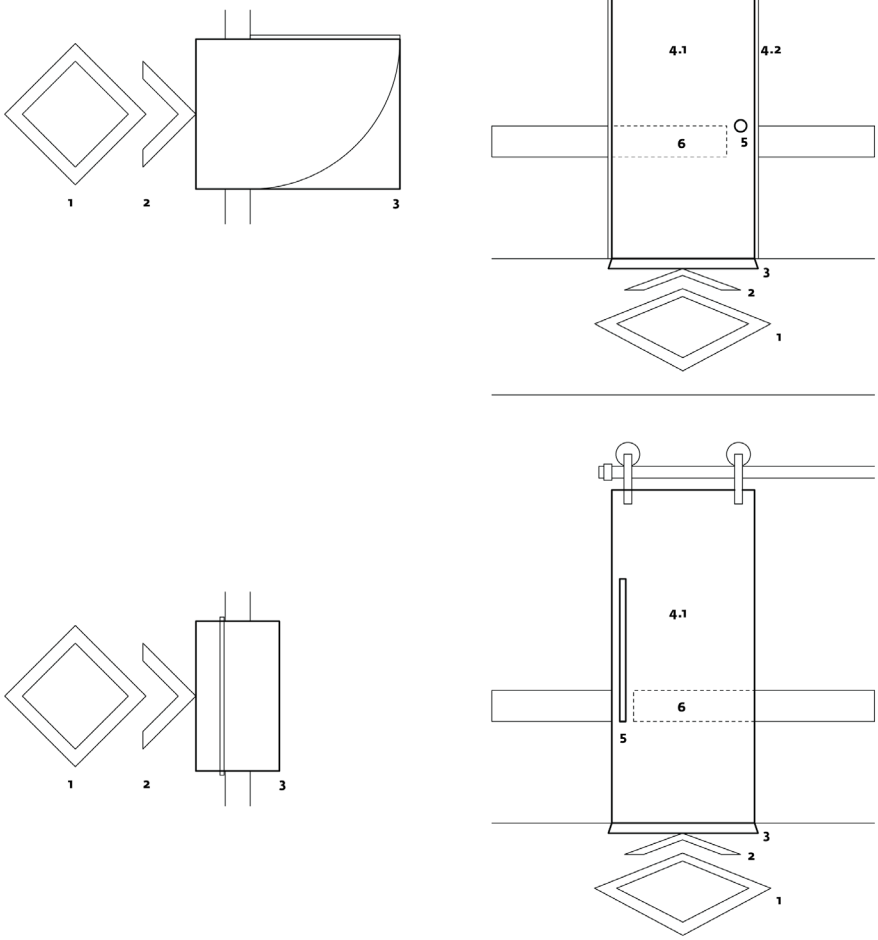
2 FLOOR PLAN <tactile> provide a simplified floor map indicating the main travel paths.

3 DECISION NODES <tactile> mark the location of openings, maps, water fountains, and other interfaces

4 DESCRIPTION TAGS <tactile>

4.1 provide general orientation information of the FLOOR PLAN, like zones and departments.

4.2 provide additional information of the DECISION NODES, like room numbers and names.



door decision node

1 DECISION NODE INDICATOR <visual/tactile> center the indicator to the opening

2 DIRECTIONAL INDICATOR <visual> place an arrow-like indicator to mark the direction of opening

3 THRESHOLD <tactile> place tactile mat to indicate the affected area of the door swing upon entering/exiting.

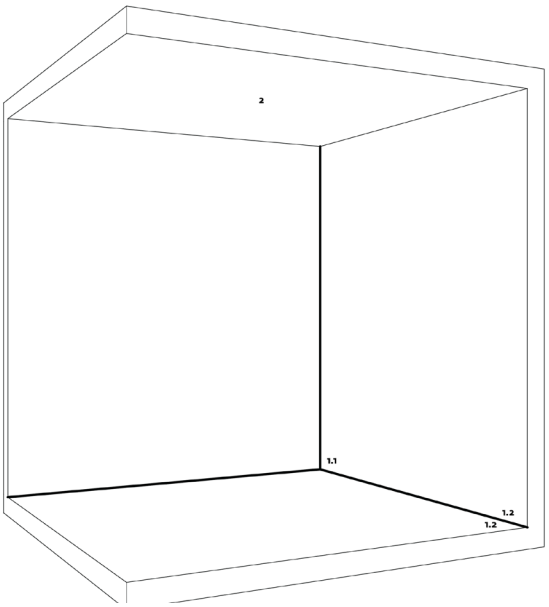
4 DOOR LOCATION <visual>

4.1 highlight the door panel in a color different from that of its host wall.

4.2 highlight the door frame in a different color in case of low contrast between door panel and wall.

5 POINT OF INTERACTION <tactile> at the knob or handle, place additional information of the door following the guidelines of TAGS.

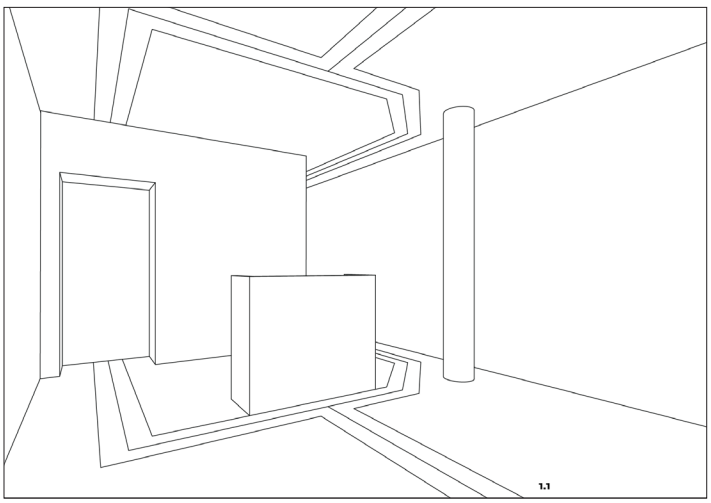
6 RAILING CONTINUATION <tactile/visual> continue the railing system from the wall to the door to provide addtional location cue for Item 5.



room space definition

1 BOUNDARIES <visual> highlight the boundary following the guidelines of EDGES.

2 LIGHTING <visual> distribute even lighting in space; provide the appropriate task-specific light at the location of need.

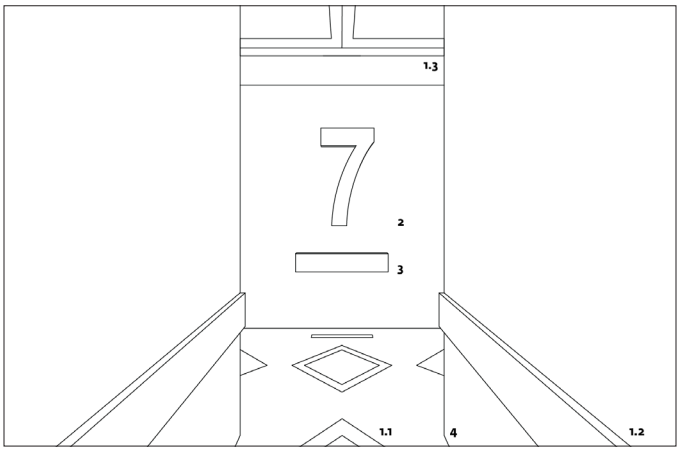


lobby open space

1 PATHS OF TRAVEL

1.1 <tactile/visual> indicate PATHS OF TRAVEL following guidelines for TRAIL.

1.2 <visual> place lights or baffles on the ceiling that is consistend with the floor patterns to add visual emphasis.



corridor turning horizontal circulation

1 PATHS OF TRAVEL <tactile/visual>

1.1 see TRAIL.

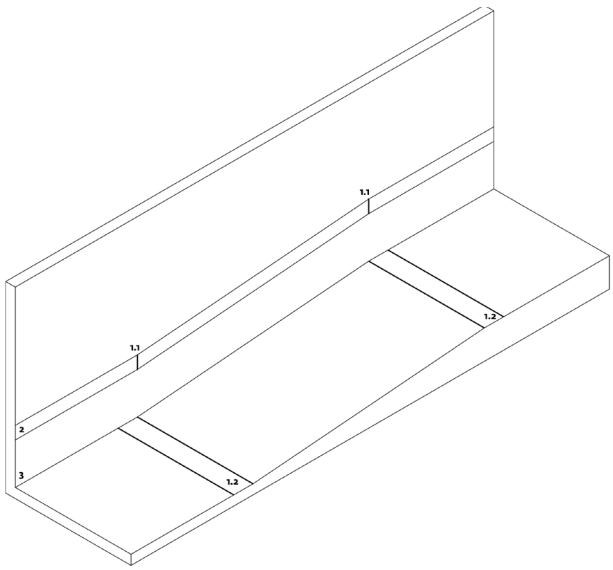
1.2 see RAILING.

1.3 place lights or baffles on the ceiling that are consistent with main path of travel.

2 FLOOR LEVEL <visual> place large floor level icon for visual clarity.

3 FLOOR MAP <tactile> place tactile map of the main circulation of corresponding floor; indicate current location.

4 BOUNDARY <visual> see ROOM.



ramp vertical circulation

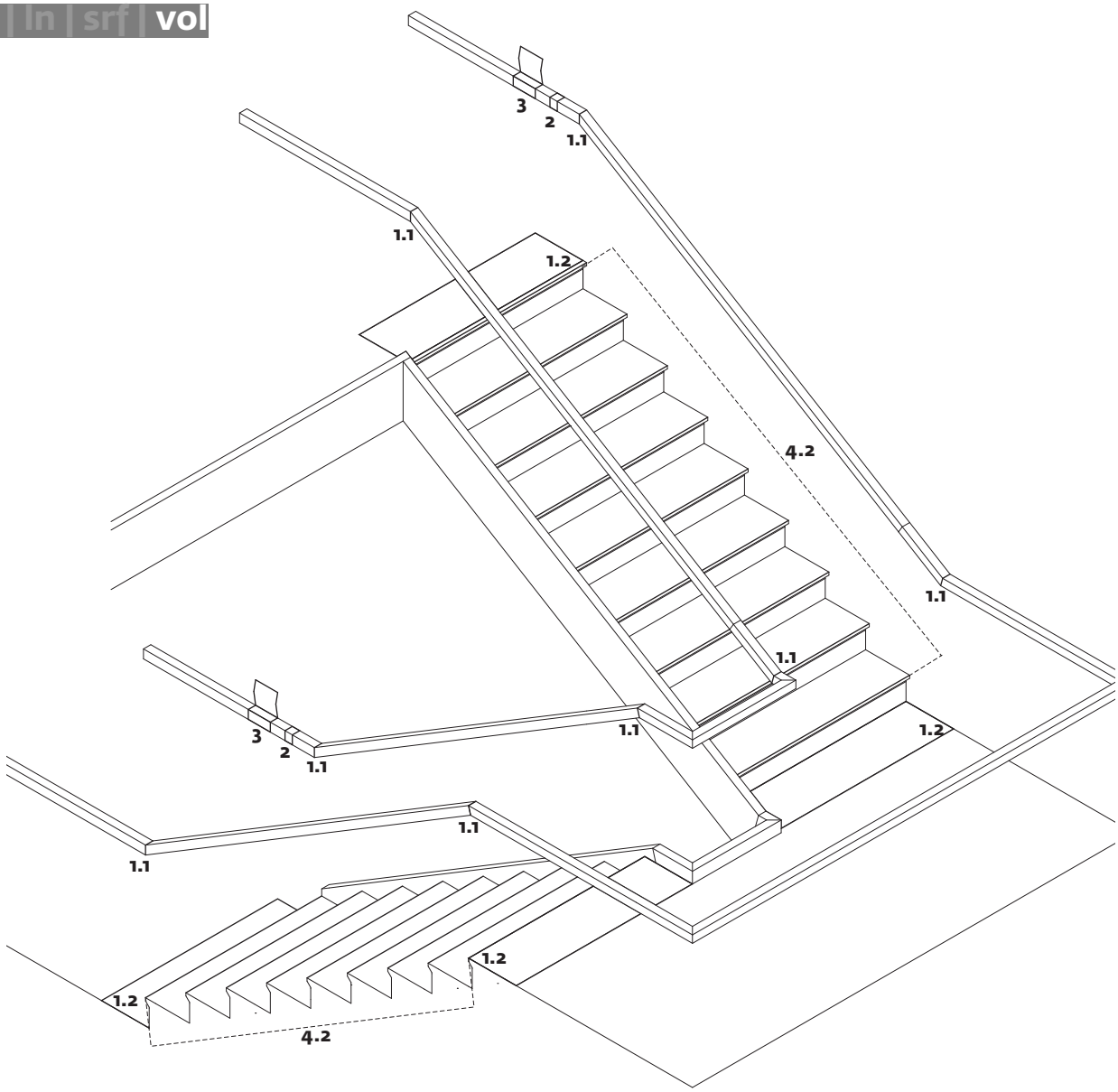
1 THE START/END OF RAMP

1.1 <tactile> indicate the start/end of stair treads on the railing

1.2 <tactile> place truncated-cone paving or other tactile flooring at the start/end of the ramp.

2 RAILING <tactile> see RAILING.

3 BOUNDARY <visual> see ROOM.



stair/escalator vertical circulation

1 THE START/END OF TREADS

1.1 <tactile> indicate the start/end of stair treads at or within the distance of (0.5 tread depth) on the handrail to the first tread.

1.2 <tactile> place truncated-cone paving or other tactile flooring at the start/end of treads.

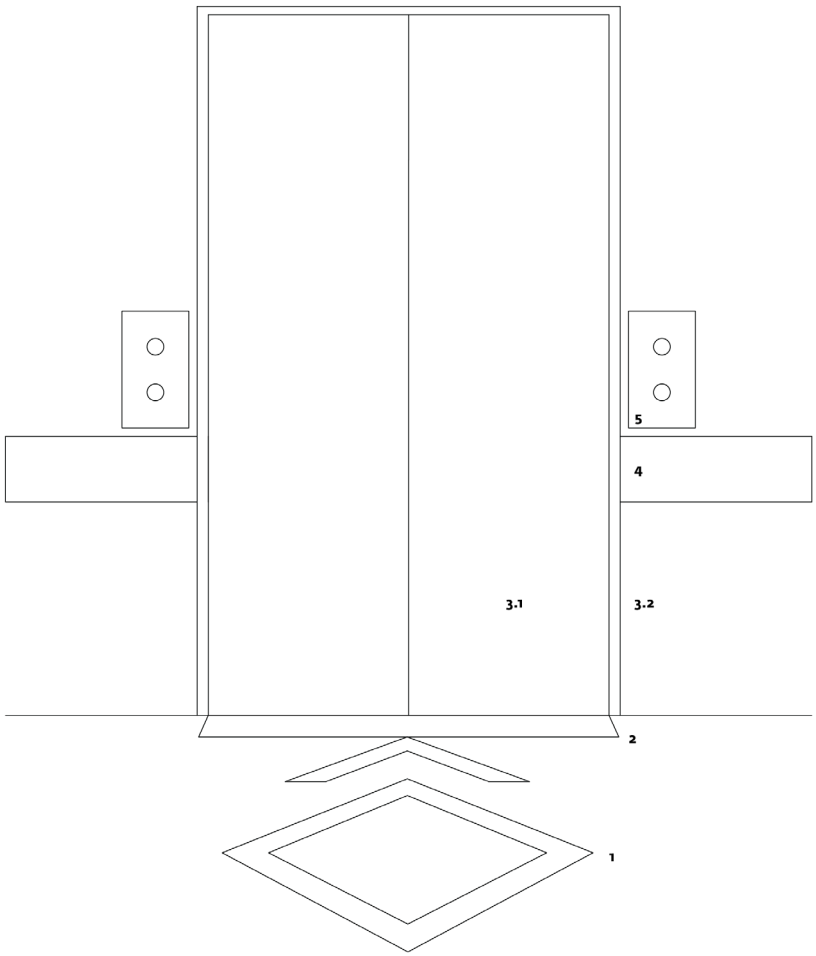
2 FLOOR LEVEL <tactile> place braille or other tactile marking that indicates the floor level on the handrail following Item 1.

3 FLOOR MAP <tactile> place tactile map of the main circulation of corresponding floor on the handrail following Item 2; indicate the reading orientation.

4 STAIR BOUNDARY

4.1 <visual> highlight stair nosing with contrasting color, material, or under-stair lighting.

4.2 <visual> install wall lights along the edge of treads.



elevator vertical circulation

1,2,3,4 see DOOR.

5 CONTROL PANEL <tactile> install panel within a hand's reach; mark addtional information following the guidelines of PUSH BUTTON.

APPLICATION: A GROCERY STORE

4 FEEL N' FIND SHOPPERS CLUB

A grocery store becomes the perfect experimental ground for the effectiveness of my dictionary, for its success is highly dependent on efficient navigation, yet it is usually incredibly hard to navigate. The organization of the aisles is unpredictable for first-time shoppers, and signage is not easily discernible even for frequent shoppers. As a result, the shopping experience relies heavily on visual search skills, which cause significant trouble for people with low-vision, as the only alternative for them is to keep asking around.

In this section, I tried to use the dictionary as a guide to reimagine a grocery store that is vision-loss-friendly. Designed for an urban context, the 20,000 sf store is sectioned into two parts based on two common navigation strategies: "browsing" and "searching". The bold yellow tactile and visual implementations throughout the space not only show support of the autonomy of people with vision-loss, but also educate people with normal vision how information can be provided through another sense.

The store shows the possibility of a common, essential space to be more inclusive, which motivates me to imagine how other public spaces could take the same care.

4.1 From Airports to Grocery Stores

Two major things happened during my fellowship term: I traveled home to China to celebrate Lunar New Year with my family; and, in response to the coronavirus outbreak in the U.S, a Stay-At-Home Order was issued in Illinois. This means that I had the fortune of extensively experiencing two types of spaces that are highly dependent on navigation: airports and grocery stores. Navigating the complex layouts of these visually crowded environments gave me valuable insights into the nuances of an accessible wayfinding system.

For a frequent last-minute traveler like me, it becomes a mental game each time I travel to navigate the airport quickly, so I don't miss my flight. Getting to my destination without any hesitation is always the goal. To do so, I need to quickly identify the first direction to which my feet need to move towards while interpreting additional choices when I have the option to turn.

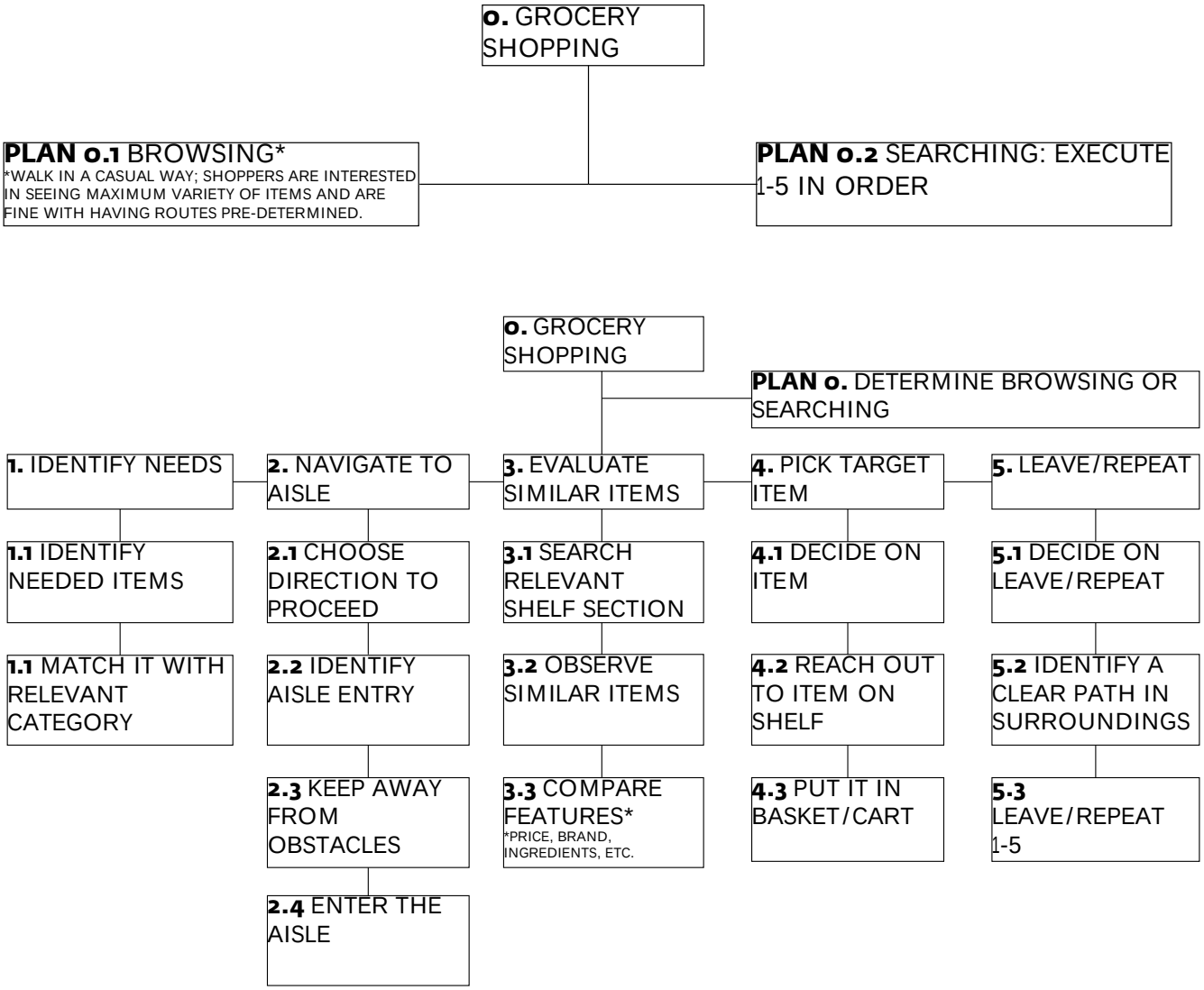
Airports execute this intuitive-sounding task incredibly well, primarily with arrows, numbers, and pictograms that are easy to recognize while on the move. They effectively use size, contrast, and color to make navigation and decision-making clear. From a distance size helps so I can start following directions sooner. High contrast and sans serif fonts make letters more distinguishable. And, consistent color coding helps to narrow down the visual search while I evaluate which signs need my attention. Additionally, instead of overloading the visitor with floor plans and detailed explanantions, airports only provide just enough information for one to make a decision for the next step. Interestingly, these features all coincide with the needs of visually-impaired individuals, which I want to extend to the planning of the vision-loss-friendly grocery store.

WAYFINDING | consistent color coding at La Guardia Airport: black on yellow for gate directions; yellow on black for dining and shopping; white on navy for amenities and services.

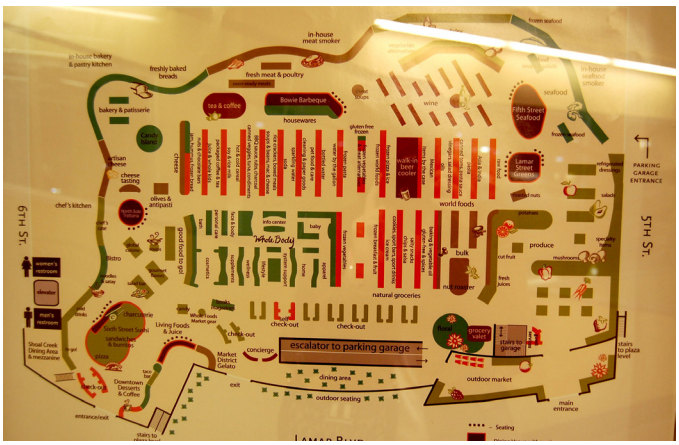
4.2 Planning

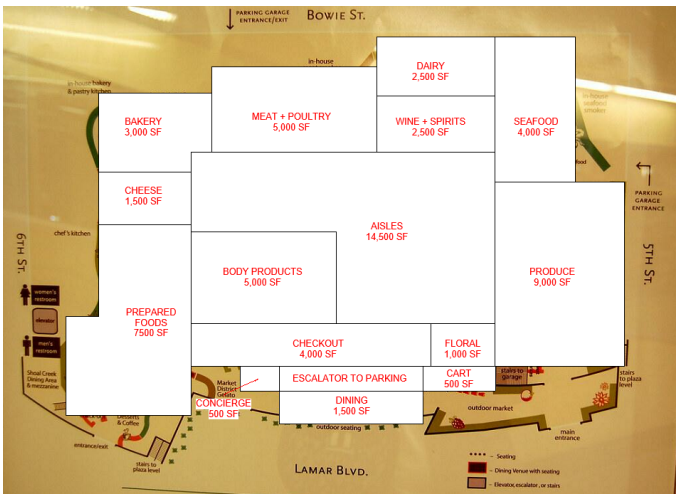
To orchestrate a pleasant navigation experience for people regardless of their level of visual acuity, I started with analyzing the micro-decisions involved in shopping for a grocery item.

According to a research by National Retail Federation in 2018, browsing and searching are the two major approaches in grocery shopping. A searching shopper has specific items in mind and is interested in locating them on the aisles as soon as possible; in comparision, a browsing shopper is more interested in casually scanning through the maximum range of categories and products in a non-repetitive route. This thought encouraged me to study the floor plans of IKEA, a store famous for its linear visiting experience despite the labyrinth-like layout, and efficient self-pick-up section before approaching the checkout.

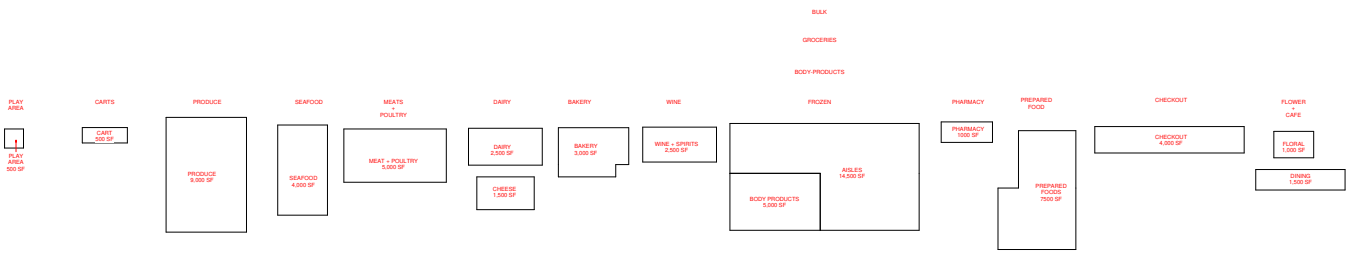


With IKEA's organization strategy as the thread, I rearranged the layout of a traditional grocery store into "browsing" and "searching" along a singular spine, minimizing the potential of getting lost in the maze and ensuring efficient movement throughout the store.

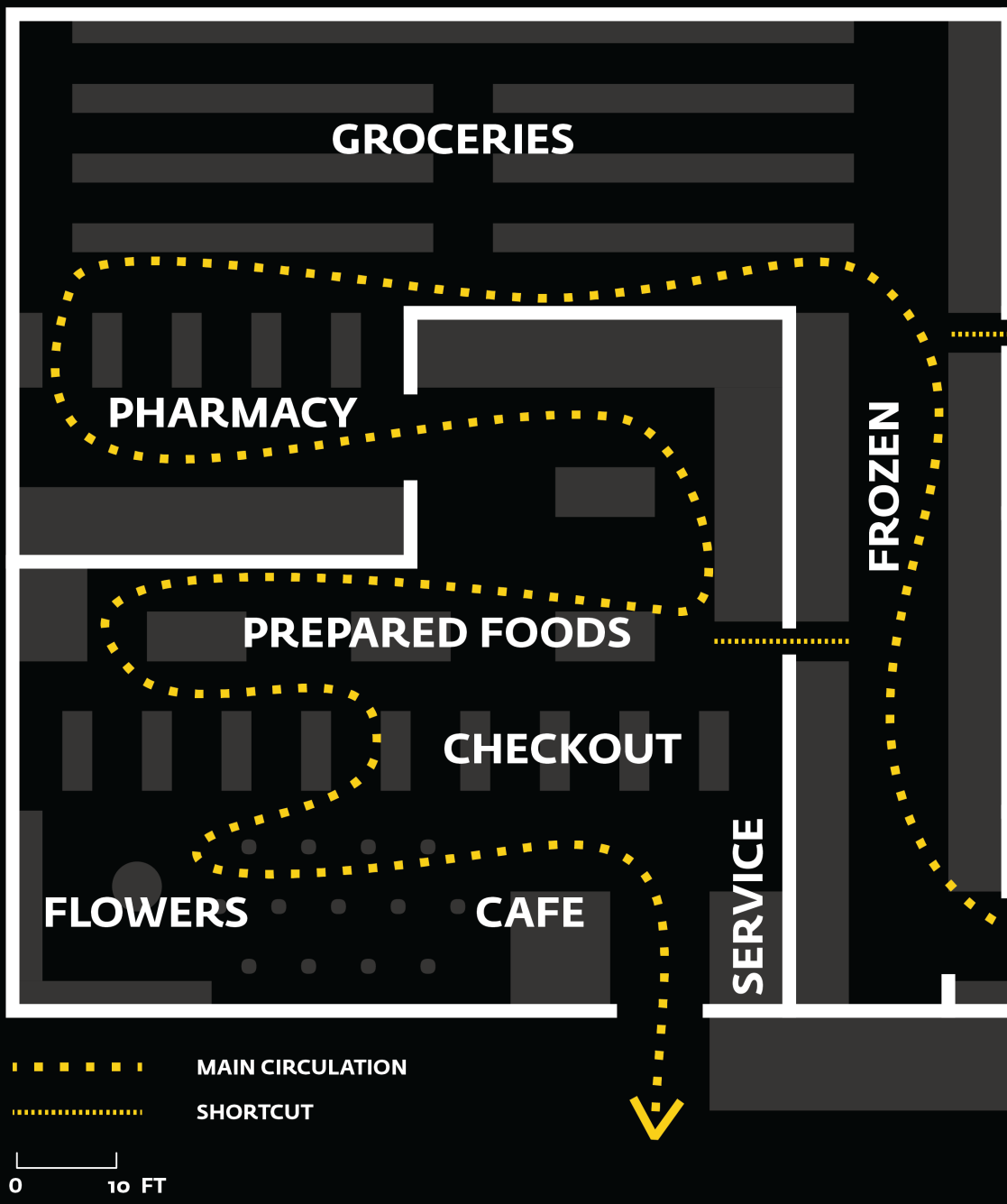




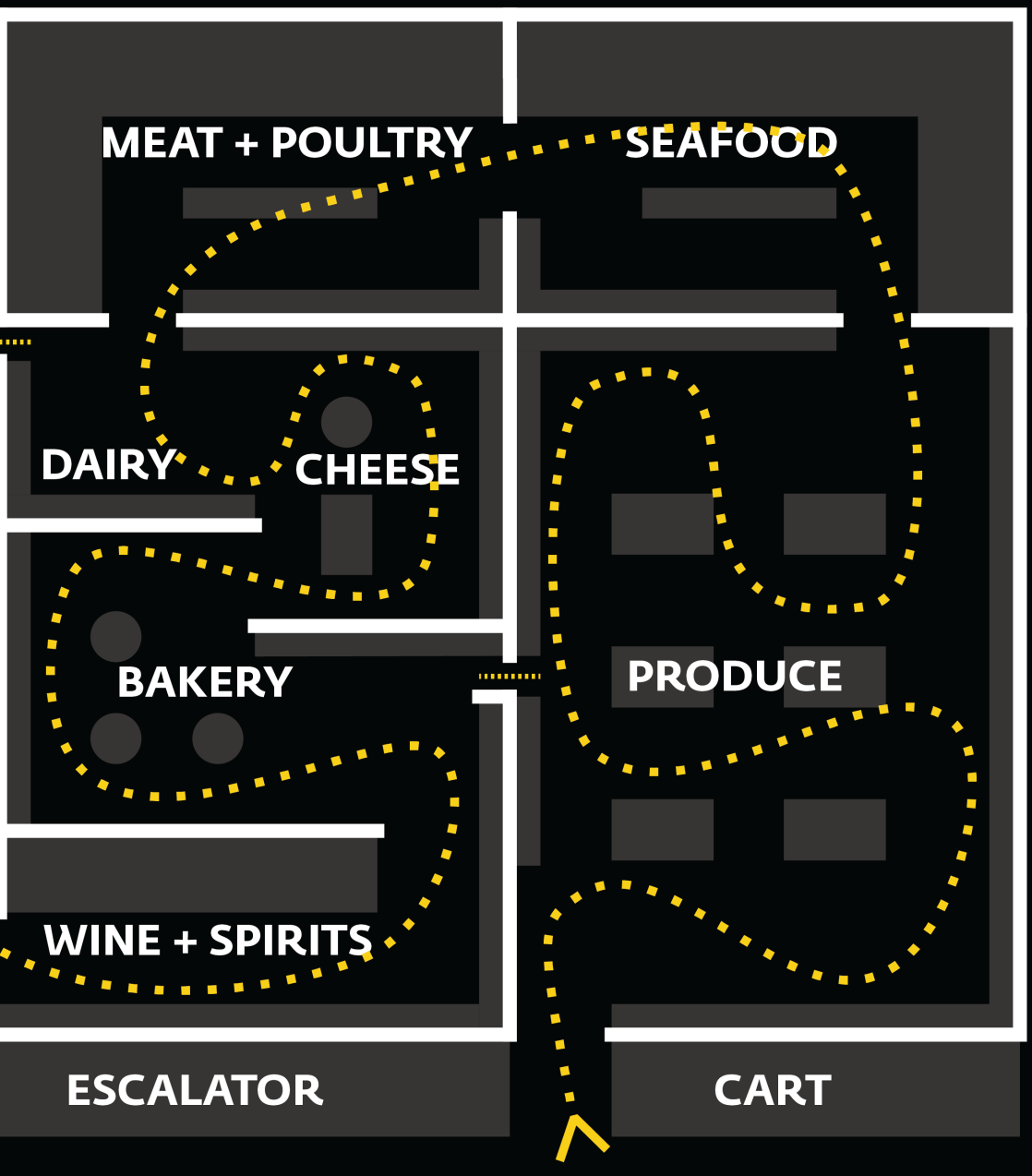
ROUTE PLANNING | To establish primary visiting sequence, the first step in the design was to study the proportions of a traditional grocery store and rearrange the layout along a singular spine.



SEARCHING


GROCERIES
PHARMACY
FROZEN
PREPARED FOODS
CHECKOUT
FLOWERS
CAFE
SERVICE
MAIN CIRCULATION
SHORTCUT
0
10 FT

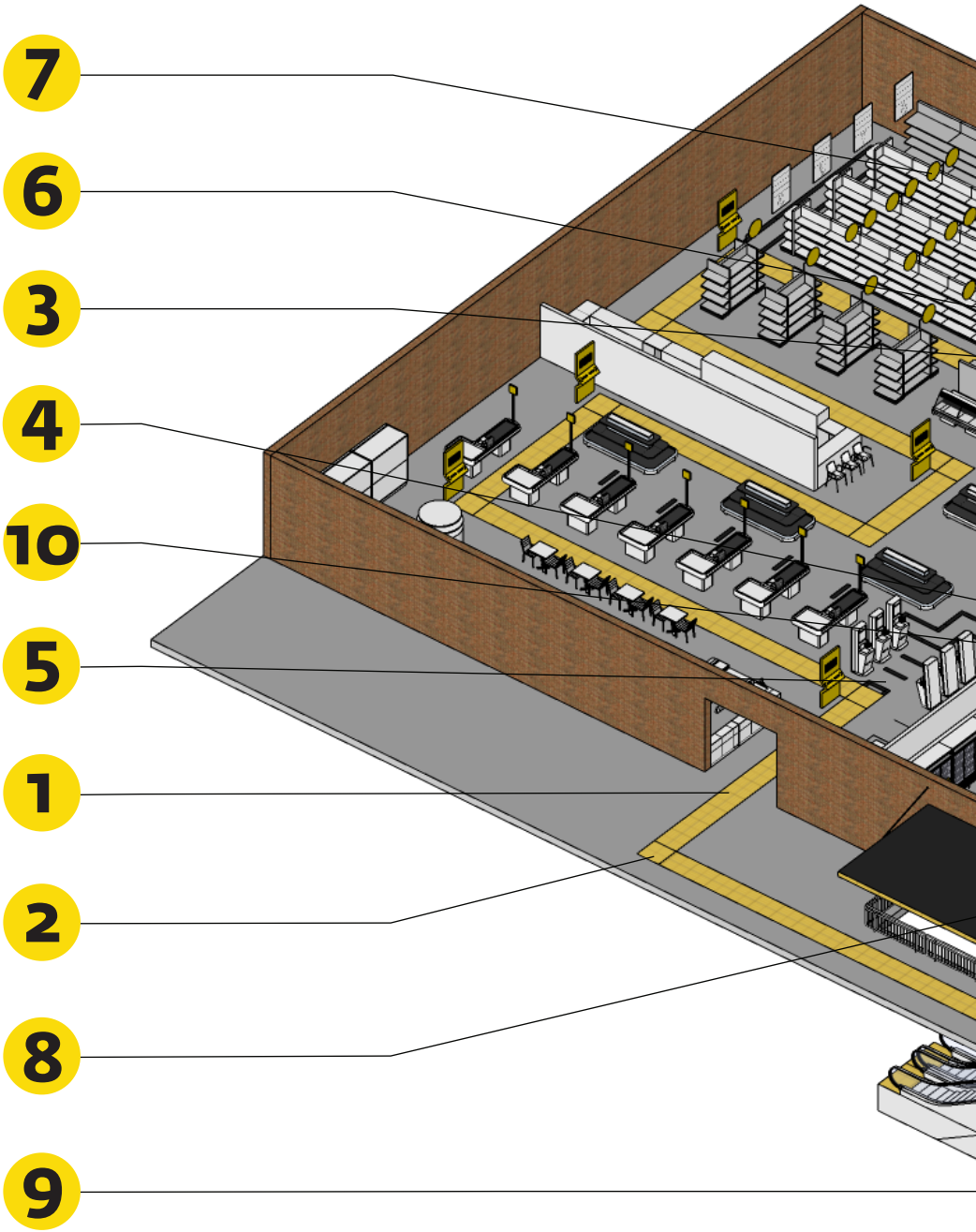
BROWSING



BROWSE FIRST, SEARCH NEXT | As most grocery stores start with departments that visitors shop by "browsing", like produce and meat, the sequence flows along this habit, with shortcuts that allow alternative route planning.

4.3 Vision-Loss-Friendly Design

Based on the information needed, the following implementations make the store navigation more inclusive and intuitive.



primary circulation

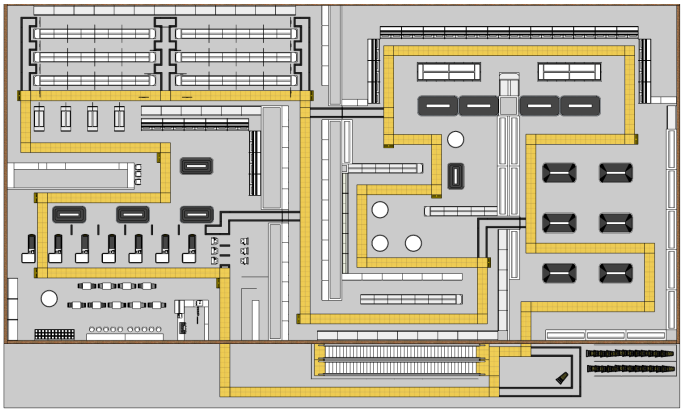
1 DIRECTION OF TRAVEL
2 NODE OF CHANGE

secondary circulation

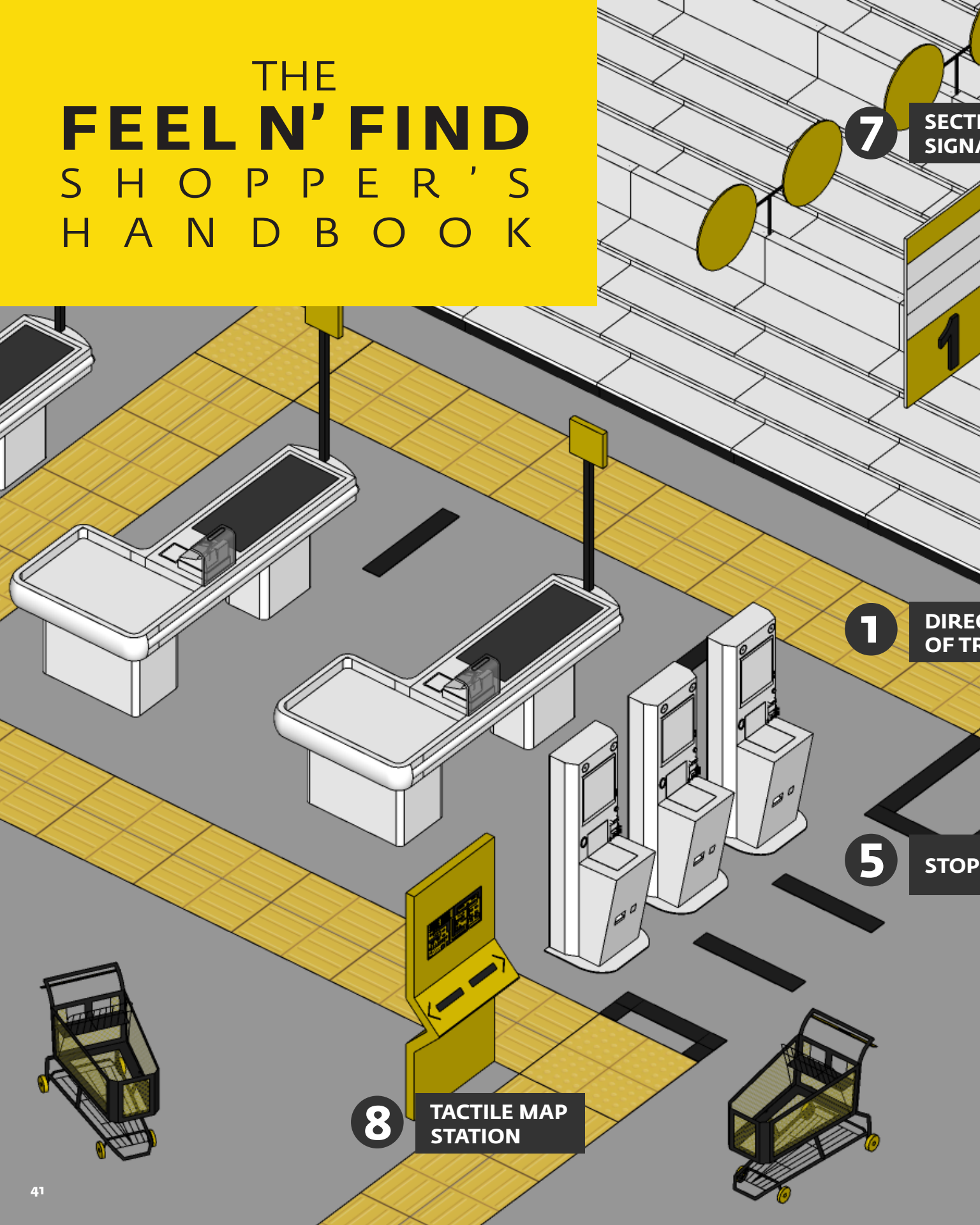
3 POINT OF ENTRY
4 SHORTCUT
5 STOP

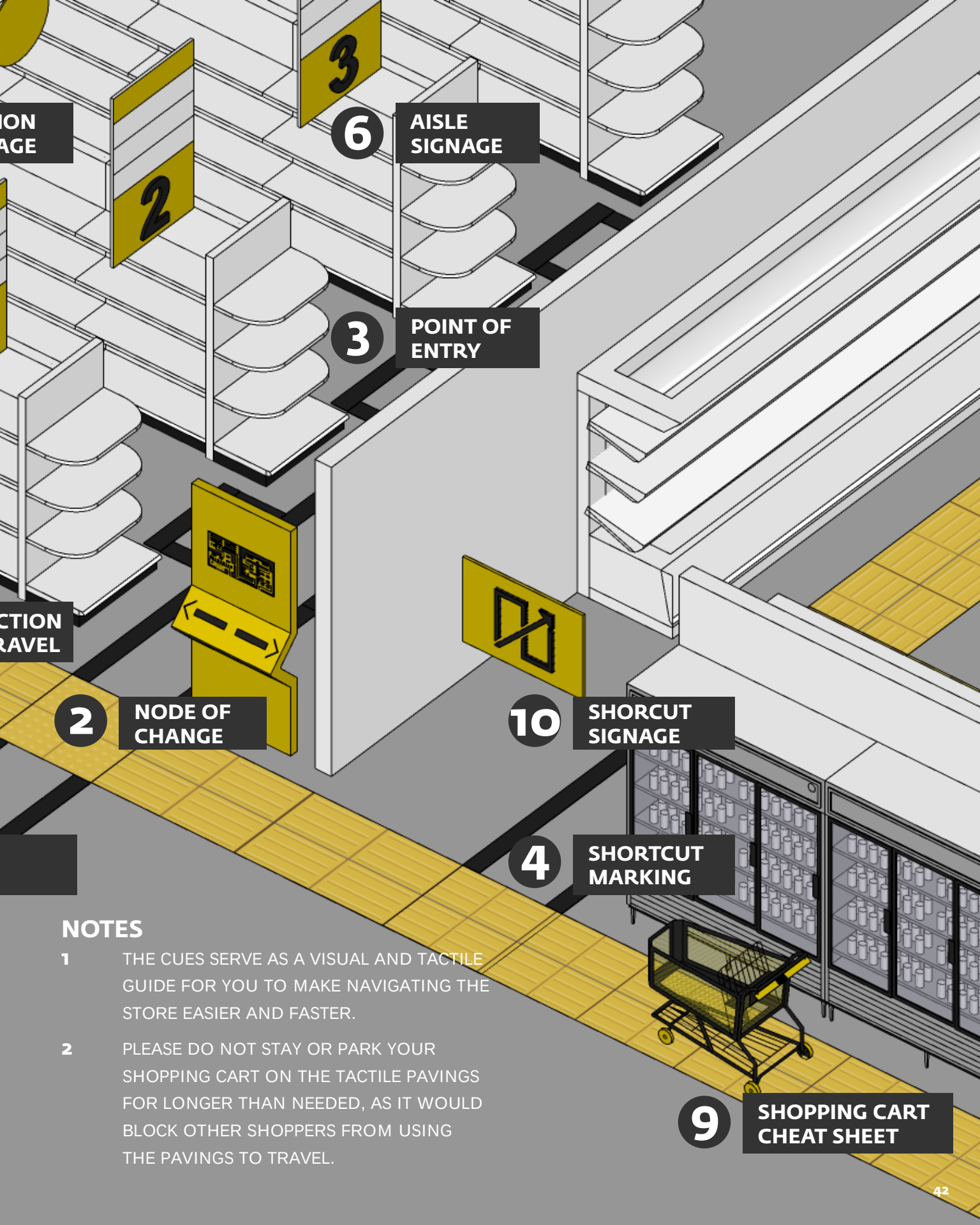
signage

6 AISLE
7 SECTION
8 MAP STATION
9 SHOPPING CART CHEAT SHEET
10 SHORTCUT



THE FEEL N' FIND SHOPPER'S HANDBOOK

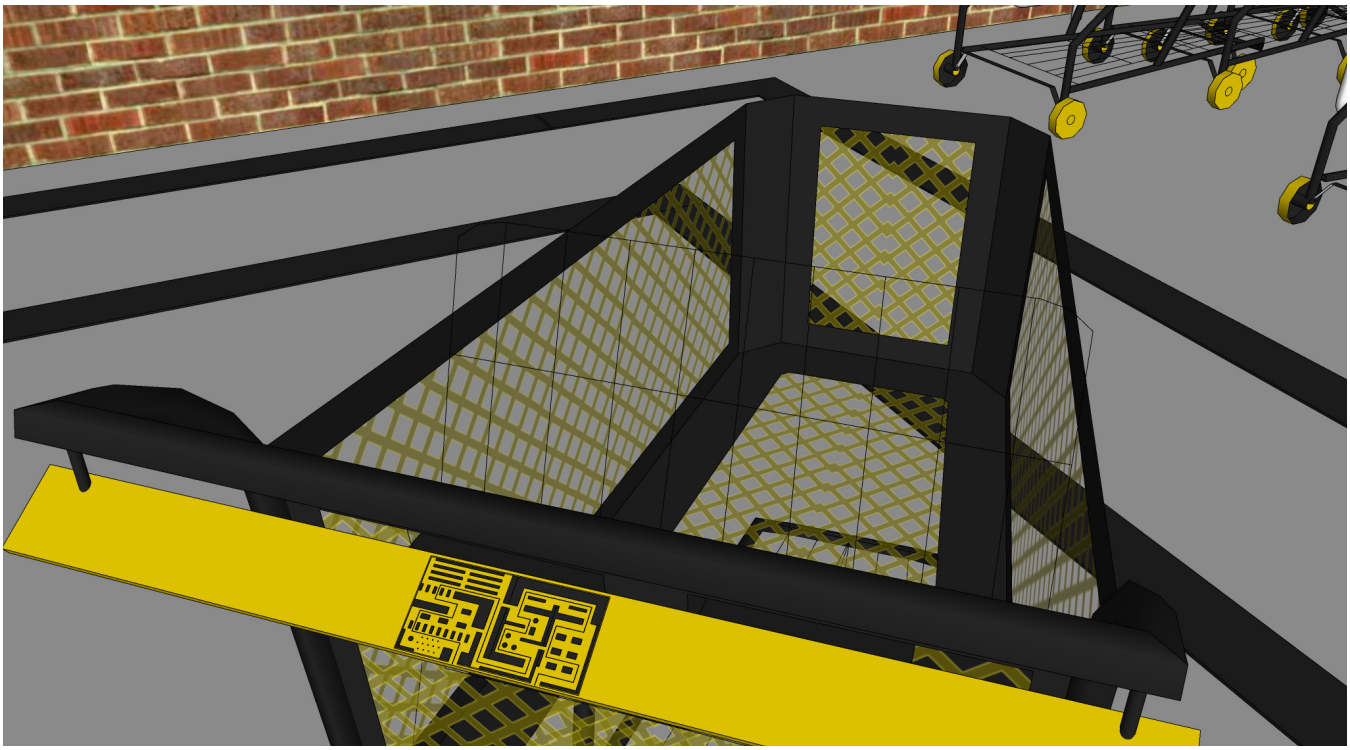




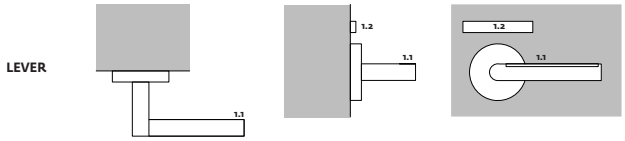
NOTES

1 THE CUES SERVE AS A VISUAL AND TACTILE GUIDE FOR YOU TO MAKE NAVIGATING THE STORE EASIER AND FASTER.

2 PLEASE DO NOT STAY OR PARK YOUR SHOPPING CART ON THE TACTILE PAVINGS FOR LONGER THAN NEEDED, AS IT WOULD BLOCK OTHER SHOPPERS FROM USING THE PAVINGS TO TRAVEL.



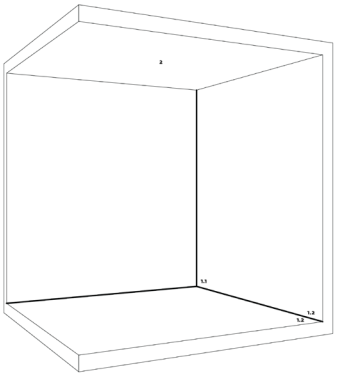
BROWSING | Developed from the dictionary entries (sampled on the right), the system of browsing signals the circulation path, node of change, direction of shortcuts, and location reference to the entire store, so that people with visual impairment have enough references to align their path of travel despite navigating in an open space.



control *finger interface*

1 ROOM DESCRIPTION TAG *<tactile>* provide tactile tag of room descriptions on/near the control interface

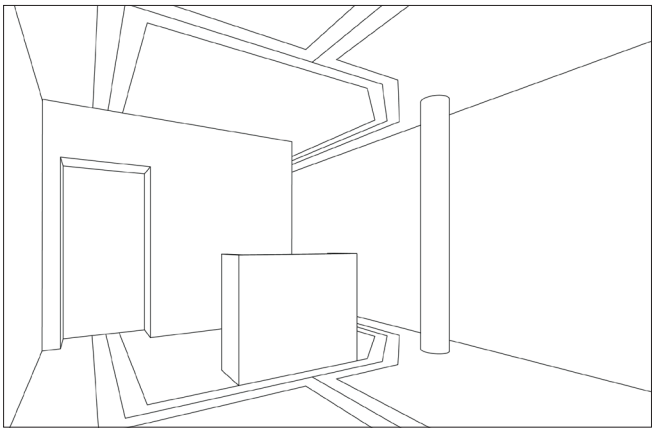
2 CALIBRATION MARKINGS *<tactile>* provide tactile markings and addtional explanations for calibrations



room *space definition*

1 BOUNDARIES *<visual>* highlight the boundary following the guidelines of EDGES.

2 LIGHTING *<visual>* distribute even lighting in space; provide the appropriate task-specific light at the location of need.

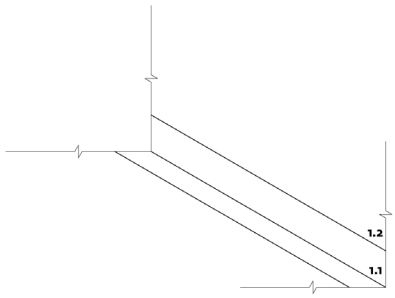


lobby *open space*

1 PATHS OF TRAVEL

1.1 *<tactile/visual>* indicate PATHS OF TRAVEL following guidelines for TRAIL.

1.2 *<visual>* place lights or baffles on the ceiling that is consistend with the floor patterns to add visual emphasis.

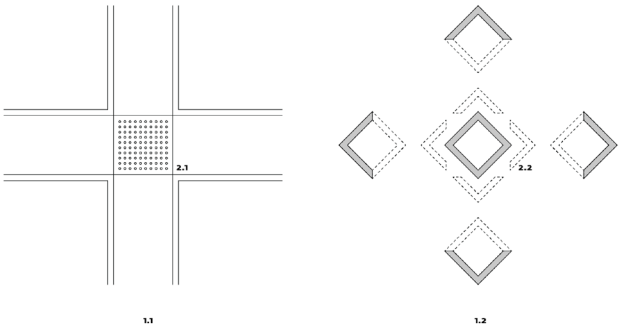


on combination surfaces *edge*

1 BOUNDARY *<visual>*

1.1 in case where the two surfaces share colors with low contrast, distinguish the boundary in high contrast with either color or light.

1.2 contrast the two surfaces with different color, material, lighting, or a combination of these elements to achieve high contrast.



trail *path indication*

1 NAVIGATION SYSTEM (to lead)

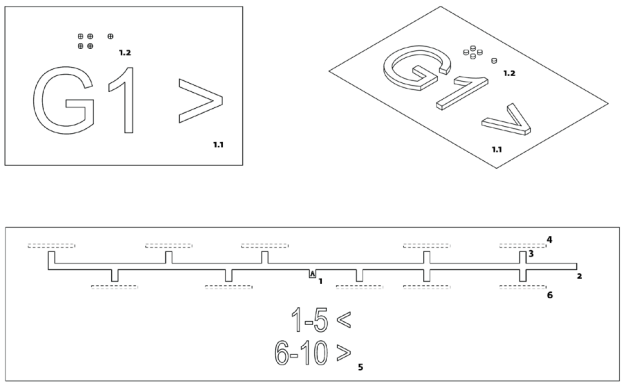
1.1 *<tactile>* indicate the main circulation with patterns made from different materials

1.2 *<visual>* integrate navigational pattern into carpets or other floor systems; large stickers with high contrast can also be used.

2 NODE OF CHANGE (to prompt decision-making)

2.1 *<tactile>* place truncated cones or other tactile paving to provide tactile feedback.

2.2 *<visual>* additional arrow-like patterns can be used to indicate the directions of options.



tactile map *finger interface*

1 THE CURRENT LOCATION *<tactile>* indicate the traveller's current location with an tactile arrow pointing in the direction of travel.

2 FLOOR PLAN *<tactile>* provide a simplified floor map indicating the main travel paths.

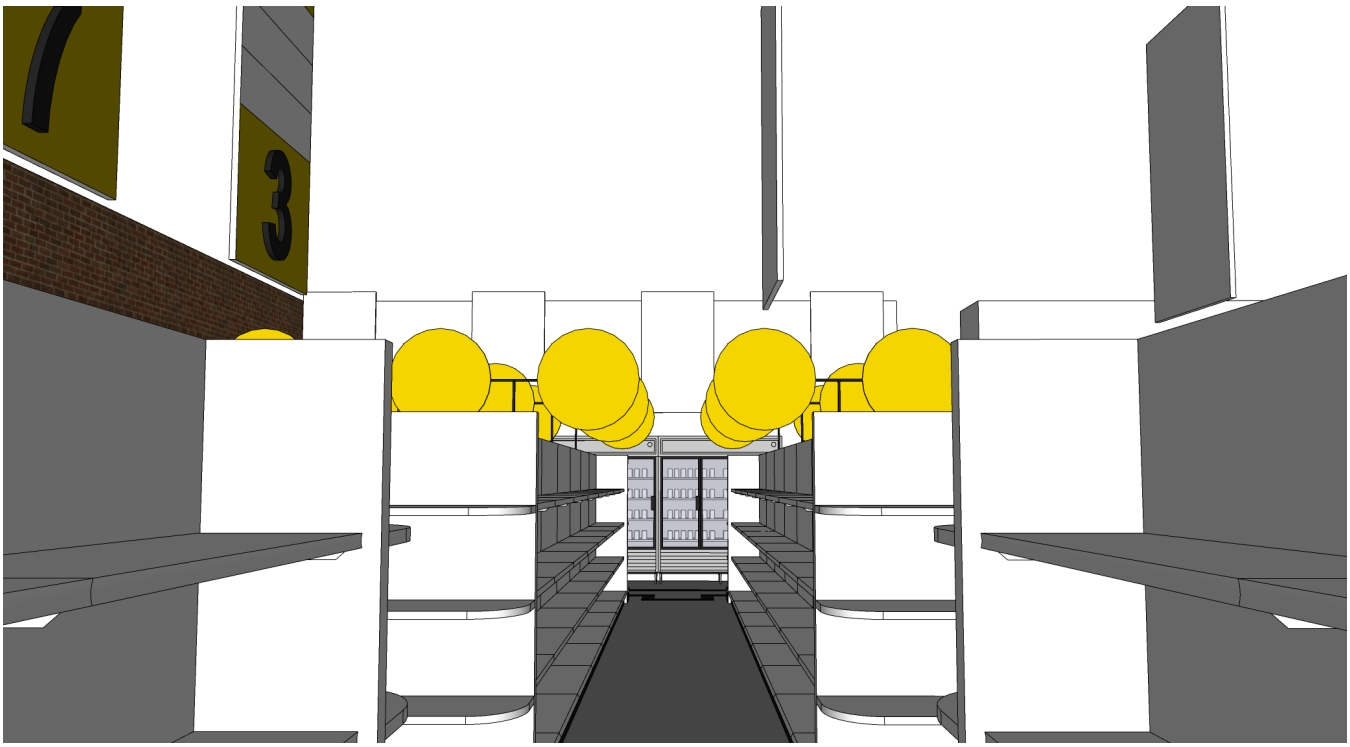
3 DECISION NODES *<tactile>* mark the location of openings, maps, water fountains, and other interfaces

4 DESCRIPTION TAGS *<tactile>*

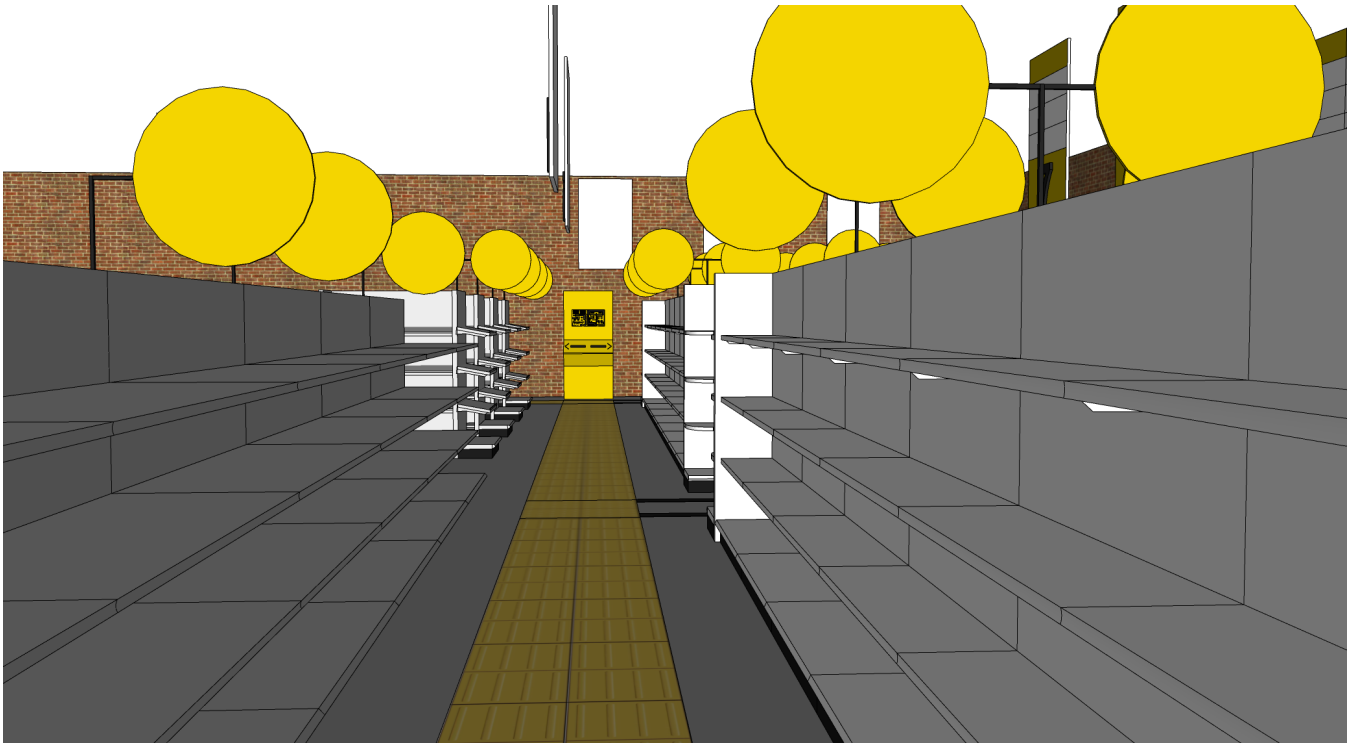
4.1 provide general orientation information of the FLOOR PLAN, like zones and departments.

4.2 provide additional information of the DECISION NODES, like room numbers and names.

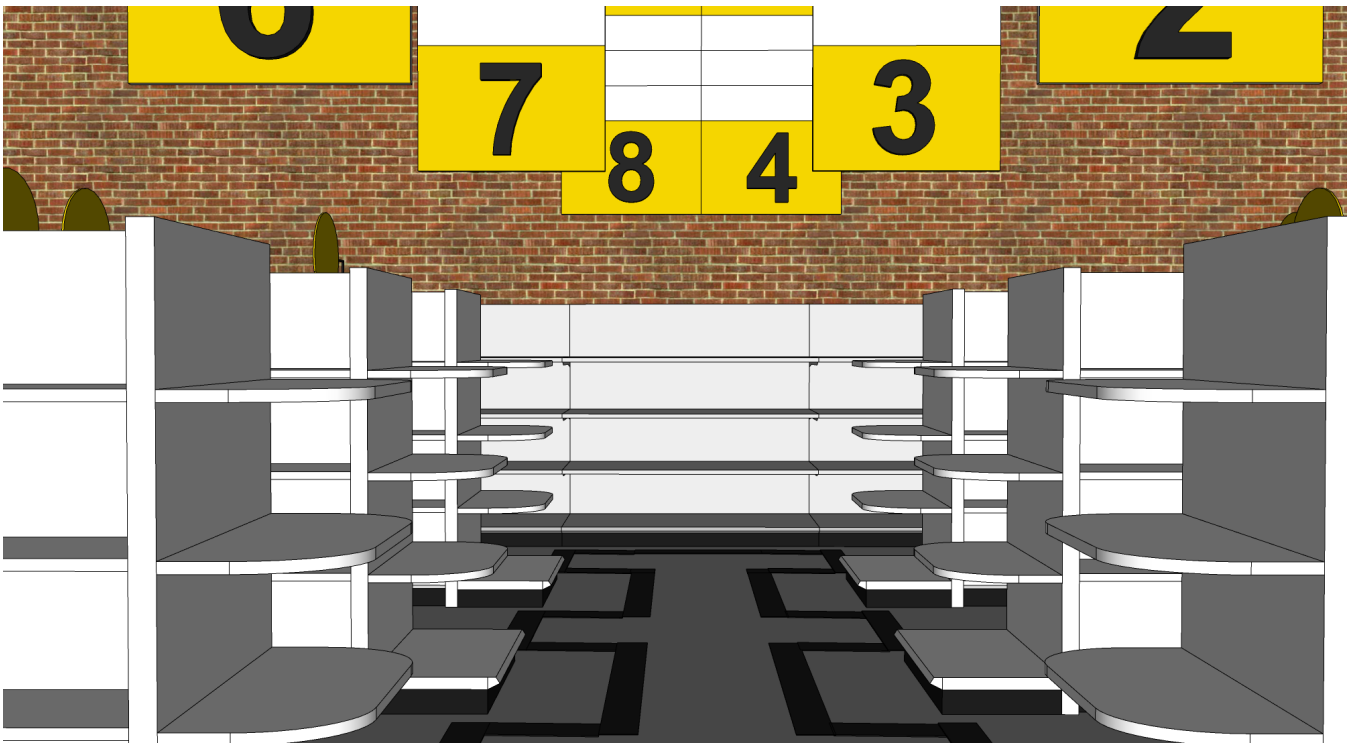
SEARCHING | The system of searching includes three steps: (1) turn from main circulation, (2) identify aisle entry, and (3) confirm shelf section; the sequence is shown counterlockwise.



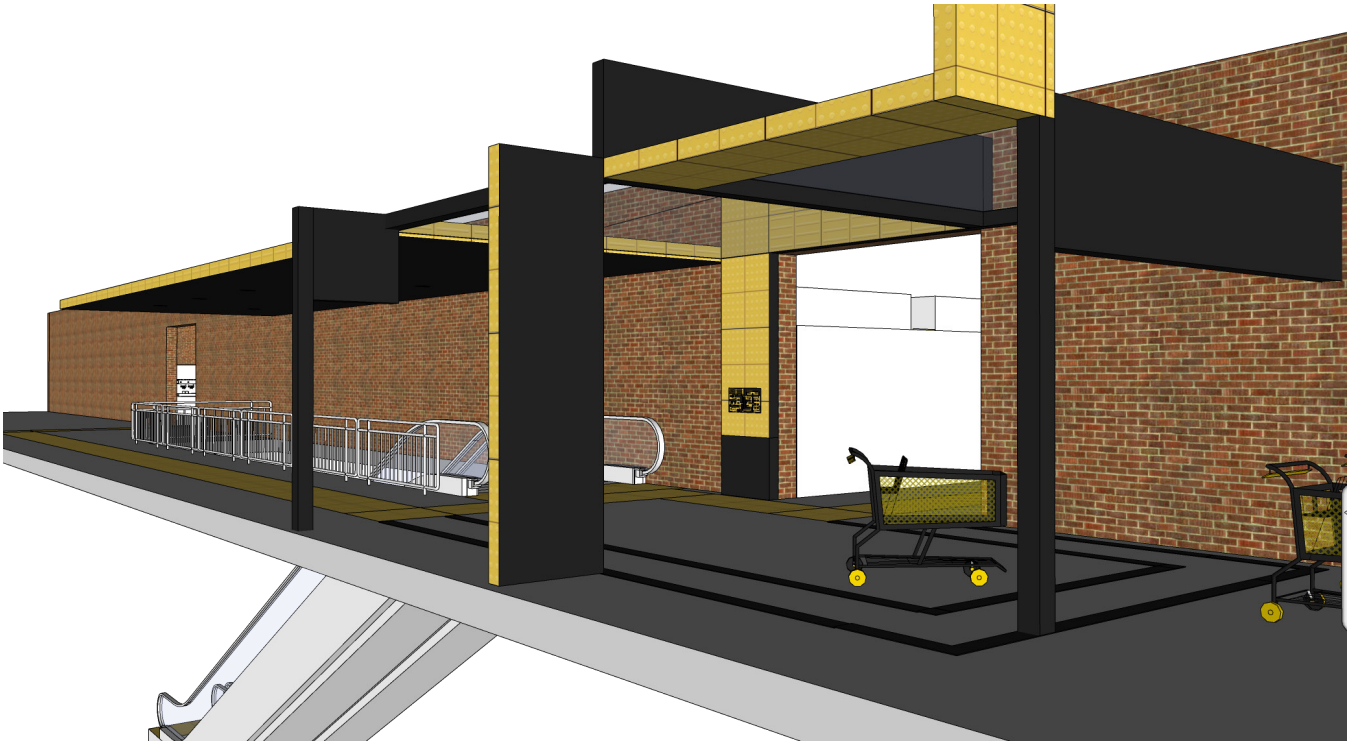
3 CONFIRM SHELF SECTION



1 TURN FROM PRIMARY CIRCULATION



2 IDENTIFY AISLE ENTRY



ENTRY AND EXITS | Designed for entering from the escalator that connects the store with underground parking, the playful entry canopy is wrapped with the yellow tactile tiles in accordance with the wayfinding systems in the store, making a statement of inclusion. The exit loops back to the same canopy to complete the circulation sequence, avoiding confusions on the point of entry - a common difficulty for people with visual impairment.

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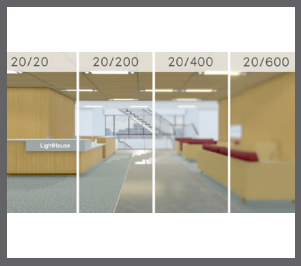

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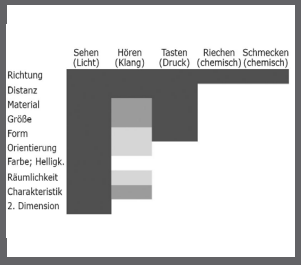

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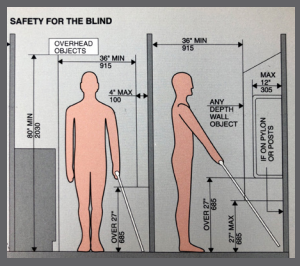

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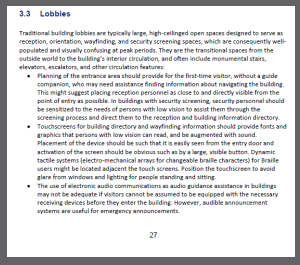

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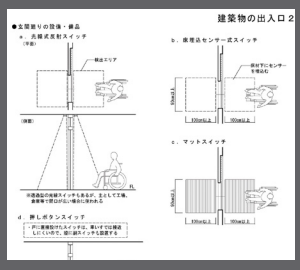

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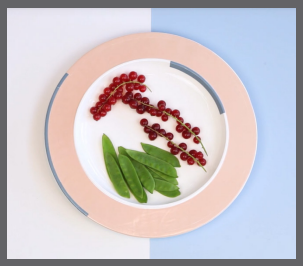

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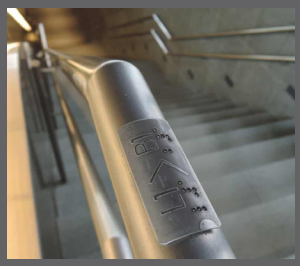

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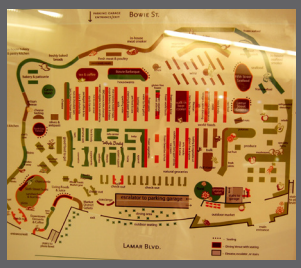

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