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innovative solutions for Universal Design

DESIGN RESOURCE

3.2

Circulation

3.2 Signs

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1. Overview

Signs are a key element of environmental communication, and aid navigation and wayfinding both indoors and out. Signs can confirm that individuals have successfully arrived at their destinations. In unfamiliar environments, such as cities, or high stress environments, including hospitals and airports, signs provide crucial information for orientation, direction finding, safety and security (Calori & Vanden-Eynden, 2015). Signs also act to interpret the story of a location, create a sense of place for a particular setting, and convey a brand or community identity (Calori & Vanden-Eynden, 2015).

Steinfeld & Maisel (2012) propose that, designers should consider four key issues when designing or specifying graphic signs: font, arrangement, environmental factors (e.g., whether a sign is illuminated), and personal factors (e.g., the viewer's level of attention). It is imperative that the entire system is readable and legible by all users (Steinfeld, Maisel, & Lavine, 2012). Successful signage as part of an effective wayfinding system contributes to a sense of well-being, safety, and security. In line with the goals of Universal Design, good wayfinding supports environmental awareness, understanding, and wellness.

Sign Types

Identification: Identification signs display the name and the function of a space or building (Gibson, 2009). They help the user confirm that they have arrived at the end of their journey successfully (Calori & Vanden-Eynden, 2015). Identification signs can also be placed at the beginning and end of routes to point out entrances and exits to other destinations (Gibson, 2009). Additionally, they can be used to identify the purpose, contents and occupants of rooms, which helps in decision making and maintaining situational awareness. For example, who should use a particular restroom, who occupies a particular office or which doorway is an emergency exit.

Directional: Directional signs provide cues and guide users to their destinations. They assist the user to decide on the route they should take to and from entrances, decision points, and destinations (Gibson, 2009). Directional signs typically use arrows or similar symbols to identify and highlight important routes (Calori & Vanden-Eynden, 2015).

Orientation/Operational: Orientation or operational signs present information about the environment's function. They provide users with an overview of the surroundings, typically through the use of maps and directories (Gibson, 2009). Signs containing maps should be oriented in the same way through the building or site to help avoid confusion (Gibson, 2009).

Warning: Warning signs alert users to hazards or safety procedures (Calori & Vanden-Eynden, 2015).

Regulatory/Prohibitory: Regulatory or prohibitory signs advise users to the rules of a particular location. Regulatory signs that are mandated by law but provide little useful information should be unobtrusive while still getting the message across (Gibson, 2009). If they are too intrusive, they can create visual clutter and prevent users from perceiving more important information.

Interpretive: Interpretive signs provide facts and insights on the meaning of a place or object. These can include historical (Calori & Vanden-Eynden, 2015) or educational

information, and can increase the users' awareness of the significance of the location or site.

Honorific: Honorific signs are typically used to provide recognition of donors. They are also installed as cornerstones on buildings signifying notable names (Calori & Vanden-Eynden, 2015).

Sign Programs

A sign program, or *signage system*, guides us through a space. According to Calori & Vanden-Eyenden (2015), "the primary purpose of a sign program is to communicate information about a given environment to users of that environment…via graphics displayed on physical sign objects or hardware." Important factors in planning the sign program include: arrival, departure, and decision points; and circulation pathways, both vertical and lateral (Gibson, 2009) (Calori & Vanden-Eynden, 2015). Plan drawings can be particularly helpful in identifying and planning sign locations within an environment (Calori & Vanden-Eynden, 2015). See Appendix A, Figure 1 for transportation pictograms recommended by AIGA, the professional association for design.

Calori developed the *Signage Pyramid Method* (Appendix A, Figure 2), comprised of three interrelated systems. The pyramid represents the balance between the three systems, which are separate elements but closely related to each other.

1. *Information Content System*: Includes the information displayed on signs; how the signs are worded; where the information is located; and how the various signs in the program work together.
2. *Graphic System*: Includes the two-dimensional graphic elements (typography, symbols, arrows, and colors); arrangement of graphic elements; and how the graphics are applied to signs.
3. *Hardware System*: Includes the shapes and sizes of the three-dimensional sign objects; the way the signs are mounted; the materials, finishes, and lighting used; and the relationship of the objects to each other and the environment (Calori & Vanden-Eynden, 2015).

Sign Characteristics

Context: The type of facility and the visitors' or users' state of mind (e.g., distracted, tired, jangled nerves; worried patients) are important when choosing colors and deciding on the size of fonts (Steinfeld et al., 2012). While large capital letters in day-glow yellow may be desirable to warn people about a dangerous area, such a sign is inappropriate in a health care waiting area.

Hierarchy: The most important information within the hierarchy of the sign system should be the easiest to perceive. This can be achieved through emphasis on size, placement, and color of the graphical elements. Calori and Vanden-Eynden (2015) suggest making a list of all destination elements within a project, and ranking them in order of importance from the perspective of the environment's user to help determine sign content and organization (Calori & Vanden-Eynden, 2015).

Proximity: It is helpful to organize and display information on signs in a meaningful way. Proximal arrangement, for example, is a good option for listing a set of destinations on signs, i.e. the order in which the user will encounter them (Calori & Vanden-Eynden, 2015).

Flexibility: Permanent signage can increase the difficulty of keeping signage systems accurate, especially when conditions in the environment change frequently. Modular signs that can be

updated inexpensively and easily provide more flexibility. Digital signage allows changes to be made relatively easily and facilitates providing the same information in audible form.

2. Issues to Consider

Visual Impairment / Low Vision: Low vision refers to vision that is not correctable by glasses, contact lenses, surgery, or medication and often impacts an individual's ability to complete daily tasks (National Institute of Building Science, 2015). A variety of factors can lead to visual impairments, including aging, injury and disease, each of which has varying effects on the visual system, thereby creating a variety of signage accommodative needs (National Institute of Building Science, 2015). When designing accommodations for this population, it is important to consider that many of the affected individuals have acquired these visual impairments after birth and may not have yet adapted to their reduced vision (National Institute of Building Science, 2015). Signage that is designed for individuals with low vision must accommodate those who read by sight, by Braille, and by raised characters (U.S. Department of Justice, 2010). Raised characters are important to individuals who have become blind later in life, have lost sensitivity in their finger, or are included in the 90% of blind individuals that have never learned Braille (Humrickhouse, 2012).

When accommodating those that read by sight, background and character colors on signage should have a high contrast value, text should be large enough to be legible to users and should have little to no glare. Contrast is defined by the level of variation between light and dark values (e.g. white characters on black background). Character sizing and spacing values can be found on Table 1, in Section 4 of this document. Glare is identified by the light reflectance value (LRV), which is often assigned by the manufacturer and is defined by the percentage of light that is reflected off of the surface. For a material to have low glare, its LRV value will be below 20%.

Color blindness or protanopia, limits a person's ability to identify color variations. In the most extreme cases in which individuals have lost their central vision, they may have complete colorblindness, leaving them to only see in black and white (National Institute of Building Science, 2015). In addition to using blacks and whites for signage, Legge and Runin (1989) found that greens or grays were most successful in increasing visibility for individuals with limited color recognition (Legge & Rubin, 1986).

Advanced Aging: Aging adults frequently experience difficulty orienting and navigating within the environment (Iaria, Palermo, Committeri, & Barton, 2009),(Harris & Wolbers, 2012). Confusion is often magnified by varying degrees of vision loss. Although not all older people have significant vision loss, there are some very common age related changes in the eye that reduce contrast sensitivity, acuity, color perception, and even lead to blindness (i.e. cataracts, macular degeneration, glaucoma and diabetic retinopathy) (Illuminating Engineering Society, 2012). More frequent signs integrated along the path of travel can aid navigation both indoors and outdoors, and help compensate for low vision and cognitive decline (Harris & Wolbers, 2012). Color can also help users to identify and memorize environmental cues and support wayfinding by implementing a color-coding scheme to all signage (Davis & Weisbeck, 2016),(Karen Kim, 2016). Strategies used for accommodating persons with low vision such as increased character size, high contrast, and low levels of glare, are also effective when designing for older individuals.

Variations in cognitive ability, literacy, and language comprehension: A signage system that is understandable and legible by all users is a fundamental part of environmental communications and navigation. To accommodate comprehension for persons with cognitive limitations, signs should provide only essential information to reduce visual noise and complexity. As mentioned above, signage strategies that follow the rules of *hierarchy* and *proximity* as well as employ color-coding systems can help to support users in wayfinding. Symbols should be used in coordination with written text to accommodate users that have limited reading comprehension skills or for those individuals that do not speak the native language of their location.

3. Related Standards

2010 ADA Standards for Accessible Design: Section 703 - Signs defines the *minimum* sign regulations for tactile and visual signs in the United States. It addresses character size, stroke thickness, spacing, contrast, finish, tactile characteristics, symbols, and location.

ISO 16069:2004 Graphical Symbols -- Safety signs -- Safety way guidance systems (SWGS) describes the general design and application principles relating to visual components used when creating a safety way guidance system (SWGS). These principles are valid for electrically powered and for phosphorescent components, while providing information relating to environment of use, choice of material, layout, installation, and maintenance.

ISO 17398:2004 Safety colors and safety signs -- Classification, performance and durability of safety signs describes requirements for a performance-based classification system for safety signs in terms of expected service environment, principal materials, photometric properties, means of illumination, fixing methods, and surface.

ISO 23601:2009 Safety identification -- Escape and evacuation plan signs lists design principles for signs identifying emergency escape plans that contain information on fire safety, escape, evacuation, and rescue.

Society for Experiential Graphic Design (SEGD) is an association of design professionals that exists to educate, connect, and inspire a global multidisciplinary community through graphic and informational design. The Society has many best practice examples and resource articles on its website.

4. Measurement and Verification

Light Reflectance Value Formula

ADAAG signage guidelines require a contrast to character background of 70%. To calculate this value, designers can input the manufacturer assigned LRV values for desired colors and materials into the following equation:

$$Contrast = (B1 - B2) \times 100 / B1$$

B1 = light reflectance value (LRV) of lighter area

B2 = light reflectance value (LRV) of darker area

Recommended Text Characteristics for Large Format Application in Buildings – For recommendations see Appendix A, Table 1.

For character size, spacing and line spacing measurement parameters see Appendix A, Figure 3.

5. Design Considerations

i. *Signs are readable from the expected viewing distance and not obstructed by objects.* To ensure maximum visibility of signage and informational displays, the information presented on signage should be clear, concise, and absent of non-essential information. The most important characteristics in signage legibility are character size/spacing, line spacing and character contrast to background. *See Appendix A, Table 1*

ii. *Signs do not produce direct glare and are protected from reflected glare.* Non-glare materials help to prevent reflection, making the information on the sign easier to see. Signs with matte finishes can help reduce the likelihood of glare occurring. Adjacent lighting is a factor in sign placement and orientation, as artificial and natural lighting surrounds the surround the sign can impact glare. Artificial lighting can improve the legibility of signs, but must not produce glare *(Miller & Lewis, 2005)*. The light reflectance value, or LRV, is a value (ranging from 0-100%) that represents the amount of light reflected off of a material. The lower the value, the less reflective the material, meaning a decreased risk of reflected glare, yielding improved visibility. LRV values lower than 20% are recommended for minimal glare. LRV formula and online calculator can be found in the previous section, *Measurements and Verification*. *See Appendix A, Figure 4*

iii. *Signs provide all information in visual and tactile and/or audible format, including room purpose wherever signs provide room numbers.* Fewer than 15% of the blind and visually impaired population read Braille, leading to the majority of this population will rely on the tactility of signs to help identify a location or destination (Ross & Kelly, 2009). All capitalization lettering, larger lettering sizes, and appropriate mounting heights make tactile use easier for the blind. *See Appendix A, Figure 5*

iv. *Signs with an audio component have a headphone jack and volume control.* Kiosks and digital directory systems with a headphone jack allow users to locate various objects and location no the premises. This functionality would be specifically helpful for those with visual impairments. A system such as Step-Hear enables users to access information about a location and assists with orientation.

v. *Selected signs use pictograms and/or more than one language.* Pictograms and symbols communicate information visually, and aid in identifying services (Gibson, 2009). Pictograms are especially helpful for limited-reading populations and for those who do not speak the native language of the location (Gibson, 2009),(Pat Matson Knapp, 2013). The pictograms developed by the AIGA for the United States Department of Transportation, are considered standard for wayfinding, (see figure 2) and are available for free download, here. Additionally, the SEGD offers full sets of universal symbols for Accessibility, Healthcare, Recreation, and Transportation also available with no charge. *See Appendix A, Figure 1*

vi. *A directory lists building users and room numbers under an organizational heading (e.g., company, department, specialty, etc.).* A locator map designed in proximity to the directory listing is helpful for users to find specific locations quickly and easily (Calori & Vanden-Eynden, 2015). *See Appendix A, Figure 6*

vii. *Signs at intersecting routes are perpendicular to the direction of travel from all approaches to the intersection.* To ensure maximum visibility of signage and informational displays for all users, signs should be positioned perpendicular to people's movement and sight (Calori & Vanden-Eynden, 2015). *See Appendix A, Figure 7*

viii. *Signs at intersecting routes provide navigation information (e.g., arrows guiding to range of room numbers, organizational headings, areas of primary function, etc.).* Directional signs should be located to minimize backtracking, and should be placed along long paths and at decision points (U.S. Department of Justice, 2010),(Calori & Vanden-Eynden, 2015). *See Appendix A, Figure 7*

ix. *Selected signs link to additional online resources (e.g., QR Code).* Online resources and QR codes help users interact with the environment. These can be especially helpful in the event of important announcements or changing conditions.

x. *Smart signs are provided on the premises (e.g., signs with radio frequency identifiers, near field communication, or other technology that allows communication with a personal computing device).* Visitors have the ability to scan a sign and listen to the visual information in an audio format. This feature is particularly helpful for the blind or those with low vision. When a user scans a sign, this can open an application that then provides the person with additional information about that location. RFID signs can also help guide users through a building when placed along a path or route.

xi. *Signs located in dark areas or outdoors are backlit, reflective, and/or directly illuminated.* Lighting can add visibility and readability to signage. Reflective signage is especially helpful for use in outdoor environments, including traffic and roadway signage (Calori & Vanden-Eynden, 2015).

6. References

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7. Appendix A

Figure 1: *Transportation pictograms. Components of AIGA, the professional association for design.*

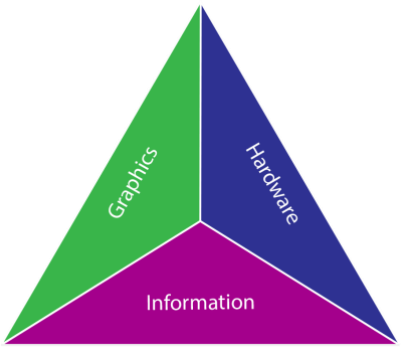

Figure 2: *Components of the Signage Pyramid Model (Calori, C., & Vanden-Eynden, D. 2015)*

Figure 3: M*easurements parameters. Image courtesy of New York City Transit Authority*

Figure 4*: On the left (© Kerun Ip) are directional signs printed on a wall that does not cast glare. On the right, the building maps are behind a reflective glass, causing glare*

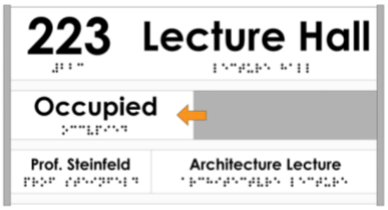

Figure 5*: Room designation sign*

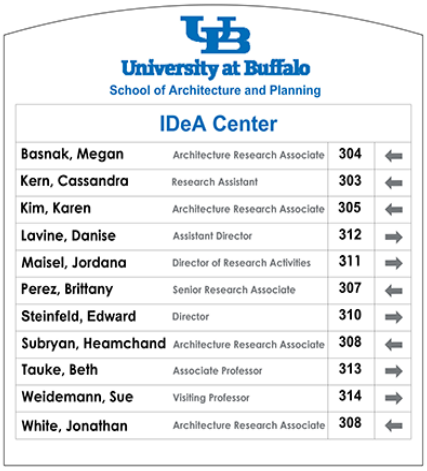

Figure 6*: Building directory sign*

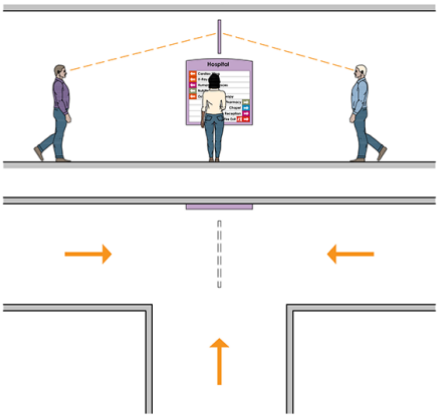

Figure 7*: Sign that is located at intersecting routes that are perpendicular to the direction of travel from all approaches to the intersection.*

Figure 8*: Back-lit tactile map*

Table 1: *Recommended text characteristics for large format applications. Compliments of Center for Inclusive Design and Environmental Access, University at Buffalo School of Architecture and Planning*

Characteristic	Recommendation	Research Needs
Letter Height	35 ft./in. (d:lh) (With vision loss, and dependent on the age group, may diminish to between 17 ft./in. to 22 ft./in. for the 85th percentile.)	Existing research on this variable is fairly strong.
Width to Height Ratio	0.7 : 1.0 (w:h)	Existing research for this is fairly strong and supports the use of 5:7 (w:h) character ratio.
Stroke Width to Height Ratio	1:5 (w:h)	Existing research for this is fairly strong and supports the use of 5:7 (w:h) character ratio.
Text Color	Green, yellow or gray letters on high contrast background	Existing research indicates that these two colors. provide the best legibility for readers with vision impairments. Red, yellow or green on high contrast backgrounds were read equally well by sighted users.
Font	• 5x7 for Uppercase • 7x9 for Lowercase	Existing research is fairly strong for highway signs but almost non-existent for persons with vision impairments reading commercial signs.
Inter-character Spacing	25 to 40% letter height	Existing research is fairly strong.
Inter-line Spacing	75 to 100% spacing	Existing research is fairly strong.
Case	Uppercase or mixed case for single words Lowercase for longer messages	Existing research is fairly strong.
Contrast Orientation	Positive contrast message (minimum 70%) Legibility is compromised when contrast approaches threshold	Existing research is strong for people without vision impairments. More research is required for persons with vision impairments.
Serifs Serif or sans serif Sans serif only for tactile signage per ADA	Existing research is strong but results are not conclusive. Variability occurs around first time observers and familiarity with font.	