International Encyclopedia of Rehabilitation

Center for International Rehabilitation Research Information and Exchange (CIRRIE)
515 Kimball Tower
University at Buffalo, The State University of New York
Buffalo, NY 14214
E-mail: ub-cirrie@buffalo.edu
Web: http://cirrie.buffalo.edu

This publication of the Center for International Rehabilitation Research Information and Exchange is supported by funds received from the National Institute on Disability and Rehabilitation Research of the U.S. Department of Education under grant number H133A050008. The opinions contained in this publication are those of the authors and do not necessarily reflect those of CIRRIE or the Department of Education.

Signage

Bill Crandall, Ph.D
Smith-Kettlewell
Rehabilitation Engineering Research Center on Low Vision and Blindness

Introduction

Effective mobility depends upon proper orientation; for the non-disabled public this is accomplished by printed signs which provide general information, identification and directions. In the broadest sense, signs comprise a menu of choices; they present travelers with the options available at any given point in their environment. In addition, signage acts as a form of memory for travelers, "reminding" them about important characteristics of the environment. Signage is such a prevalent and integrated component of the built environment that people who cannot read or understand conventional signage are at a significant disadvantage in their ability to conduct even the most ordinary activities unassisted.

Definitions

Signage

(Origin: *sign* + *-age* (Dictionary.com, n.d.)) is a collective term (a noun) referring to signs in their various forms. We can begin with signage as: *The design or use of signs and symbols; graphic designs, as symbols, emblems, or words, used especially for identification or as a means of giving directions or warning*. (American Heritage® Dictionary, n.d.) To this list can be added: "information, orientation, regulations, or restrictions".

Sign

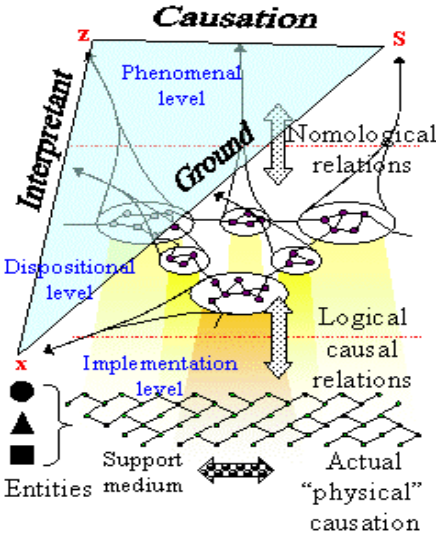
(The Latin *signum* (Online Dictionary of Language Terminology, n.d.) *–mark* or *symbol*) (itself, is a large and complicated concept running from the linguistic and philosophical (the *semiotics* of de Saussure (Whobrey, 2001) and Peirce (Web Thesaurus, n.d.)) at one extreme to the more mundane "STOP" sign somewhere in the middle, to GPS systems for personal "blind" navigation (a possible variant of "Accessible Signage") at the other extreme.

Semiotics

In the highly abstract field of semiotics the word "sign" means that something is being indicated. The growl of a dog is a sign of threat that can be read by humans and dogs alike. A symbol, by contrast, is one thing that represents or stands for another thing. For example, the word "tree" can be an abstract indication; "tree" represents the idea of a tree. In a second sense, the word "tree" can be a concrete reference, as in the statement, "The old tree by the porch," where the word "tree" refers to the particular tree. The word "sign" is itself a sign recursively serving as a symbol to point to itself as something pointing. Ordinarily, however, all this is taken for granted, and upon reading or hearing the word "sign" one

simply look to see where or to what it is pointing. So, in general, it means something is being communicated to some person, persons, animal, or machine such as a computer.

Figure 1



Peirce's triadic semiotic between objects (x), their phenomenal experience as signs (S), and their dispositional affect (z) on a mind (Whobrey, 2001). Semanticists might well consider this diagram, itself, to be a *sign*. (http://www.genericminds.com/mildai/index.shtml)

Synonyms

A thesaurus lookup of *sign* yields an entire page of synonyms (Web Thesaurus, n.d.) ranging from *gesture* to *ratify*, and from *communicate* to *subscribe*. Also: *That by which anything is made known or represented; that which furnishes evidence; a mark; a token; an indication; a proof* (Collective International Dictionary of English, n.d.)

Variants

A sign can be a simple noun, as in "stop sign," or a verb, as in "sign off." It can indicate a specific physical object, such as the sign on a government building reading "Post Office," or it can be abstract, such as its meaning in the phrase, "It's a sign of the times. When used as labels, signs tell us not only "What" but also "Where".

Table 1. A non-exhaustive list of variants in common use

(modified here for brevity, taken from WordNet (Miller GA, 2009))

Noun

1. **sign** - a perceptible indication of something not immediately apparent (as a visible clue that something has happened); Clue
2. **sign** - a public display of a message; Poster
3. **sign** - any nonverbal action or gesture that encodes a message; Drumbeat
4. **sign** - structure displaying a board on which advertisements can be posted; Sandwich board

5. **sign** - (astrology) one of 12 equal areas into which the zodiac is divided; Zodiac
6. **sign** - (medicine) any objective evidence of the presence of a disorder or disease; Vital sign
7. **sign** - having an indicated pole (as the distinction between positive and negative electric charges); Polarity
8. **sign** - an event that is experienced as indicating important things to come; Omen
9. **sign** - a gesture that is part of a sign language; Signing
10. **sign** - a fundamental linguistic unit linking a signifier to that which is signified; "The bond between the signifier and the signified is arbitrary"--de Saussure
11. **sign** - a character indicating a relation between quantities; Plus sign

Verb

1. **sign** - mark with one's signature; write one's name (on); Sign away
2. **sign** - approve and express assent, responsibility, or obligation; Ratify
3. **sign** - be engaged by a written agreement; Countersign
4. **sign** - engage by written agreement; Contract
5. **sign** - communicate silently and non-verbally by signals or signs; Whistle
6. **sign** - place signs, as along a road; sign an intersection
7. **sign** - communicate in sign language; "I don't know how to sign, so I could not communicate with my deaf cousin" - "He communicated his anxieties to the psychiatrist"
8. **sign** - make the sign of the cross over someone in order to call on God for protection; Bless

Symbols as Signs

Symbol

An arbitrary sign (written or printed) that has acquired a conventional significance. Something visible that by association or convention represents something else that is invisible: "The eagle is a symbol of the United States." (Miller GA, 2009)

Signs may have very specific shapes which in themselves are messages to the audience and form a set of rules that should be followed when developing signage (Wikipedia, n.d. a).

Figure 2. Sign made of Symbols within a symbol: "Stop Ahead": A Semanticists' delight.

The shape and color of a sign gives you a clue about the information contained on the sign (US Manual of Uniform Traffic Control Devices, n.d.).

Figure 3. In signage, shapes and colors can mean a lot

A red circle with a slash is a REGULATORY sign communicating the do not's: enter, turn, U-turn, pedestrians, or parking.
http://mutcd.fhwa.dot.gov/htm/2003r1r2/part2/part2b1.htm

The pentagon shape with the point to the top is a WARNING for us to watch for school children.
http://mutcd.fhwa.dot.gov/htm/2003r1r2/part2/part2c.htm

Green GUIDE signs direct travelers to the right exit to cities, airports, park-and-ride stations, and other destinations.
http://mutcd.fhwa.dot.gov/htm/2003r1r2/part2/part2d1.htm

Blue rectangle or square SERVICE signs are a welcome sight for travelers who need a break from the road.
http://mutcd.fhwa.dot.gov/htm/2003r1r2/part2/part2f.htm

CONSTRUCTION signs are orange diamonds specifically used only to WARN drivers about construction and work zone activity.
http://mutcd.fhwa.dot.gov/htm/2003r1r2/part6/part6f1.htm

Brown RECREATION signs direct us to areas of public recreation and cultural interest.
http://mutcd.fhwa.dot.gov/htm/2003r1r2/part2/part2f.htm

Wayfinding

Wayfinding is spatial problem solving where the goal is to reach a destination. It consists of three interrelated processes (Arthur P and Passini R, 1992):

- Decision making and development of a plan of action.
- Decision execution at the right place in space.
- Information processing comprising environmental perception and cognition.

The complex activity of wayfinding may be thought of as a chain of tasks that must take place in a specific order. And, like any chain, it is only as strong as the weakest link; any broken link can significantly delay the trip. The frustration brought about by these delays and the effort needed to locate the proper information may be sufficient to prevent the traveler from attempting this trip again. For an unfamiliar trip, the trip must first be planned, including routes and schedules.

Principles of Universal Design

Definition

Universal Design: The design of products and environments to be usable by all people, to the greatest extent possible, without adaptation or specialized design. A user-friendly approach to design in the living environment where people of any culture, age, size, weight, race, gender and ability can experience an environment that promotes their health, safety and welfare today and in the future (Stahr R, n.d.).

Seven properties of Universal Design

a. Equitable Use
   The design is useful and marketable to people with diverse abilities.

b. Flexibility in Use
   The design accommodates a wide range of individual preferences and abilities.

c. Simple and Intuitive Use
   Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

d. Perceptible Information
   The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

e. Tolerance for Error
   The design minimizes hazards and the adverse consequences of accidental or unintended actions.

f. Low Physical Effort
   The design can be used efficiently and comfortably and with a minimum of fatigue.

g. Size and Space for Approach and Use
Appropriate size and space is provided for approach, reach, manipulation, and use

(State Center for Universal Design, 1997)

Figure 4: Logo for Universal Design Summer course at The Vienna University of Technology

Caution: Some disabilities - like total blindness - require solutions (like Braille printing) that are outside the general "Universal Design" model.

> "Universal design puts emphasis on providing facilitators and eliminating barriers to activity and participation. But, there will always be a need for assistive technology and specialized services." (Steinfeld E, 2010)

Types of Disabilities-Related Signage

The large number of those in the US who are impacted to a greater or lesser amount by disabilities is reflected in the prevalence of its four main divisions: Of the 301,290,332 US population (2007 numbers), 2.2 % had a hearing disability, 1.8 % had a vision disability, 4.1 % had a cognitive disability and 5.1 % had an ambulatory disability. Taken together, this represents 13.2 % of the total population (Rehabilitation Research and Training Center on Disability Statistics and Demographics, 2009).

Blindness and Low Vision

When traditional sources of information are not accessible, persons with disabilities must frequently rely on information, directions or assistance from other travelers. In addition to the problem of finding another traveler who is willing to provide information, directions or assistance, they are unable to quickly determine whether the person is someone they are comfortable interacting with, or who appears likely to be able to provide reliable and usable information.

Persons with visual disabilities cannot use traditional signs and maps for orientation. They must rely on other cues such as sounds and touch, and usually need additional information when using a facility for the first time. For some this could mean training by an

Orientation and Mobility Specialist and then relying on memory in order to continue to be oriented in future use of that facility. For others, they must currently navigate novel public spaces by asking for directions from sighted persons who may or may not have reliable information, or they must travel with a sighted person, which is not always practical. These inadequate solutions are also a barrier to independence. Even if these travelers could locate tactile signs provided in a format accessible to them (i.e., read a sign in raised print or if they had been trained to read Braille), these accessible signs could not be placed everywhere in the travel environment.

The US Census Bureau's 2005 Household Economic Studies found "Nearly 7.8 million people age 15 and older had difficulty seeing words or letters in ordinary newspaper print, including 1.8 million being completely unable to see [such words or letters]" when using their corrected vision (Brault M, 2008).

Macular degeneration, cataracts, diabetic retinopathy, and glaucoma are eye-related diseases that disproportionately target older people in a way that those 75 years or older are four times more likely to report vision loss than those 18 to 44 years (Prevent Blindness America, 2008).

With a population rapidly shifting to larger proportions of people in older age groups, the number of people who have difficulty reading print emergency egress signs can be expected to increase rapidly as well. Most people with severe visual impairments are 65 or over, a group growing twice as fast as the overall population. There is a per-decade increase of 1 to 2 million persons over 65 with functional limitations in seeing (Schmeidler E and Halfmann D, 1997) defined as difficulty seeing ordinary newsprint. The most spectacular emerging trend is the exponential growth of the over-85 age group, which has grown 10 times as fast as the overall population during the past century (Brabyn et al., 2006). Projections by the U.S. Census Bureau indicate a four-fold increase in the population age 85 and over from 5.3 million in 2006 to nearly 21 million by 2050 (Federal Interagency Forum on Aging-Related Statistics, 2008). Some researchers predict that death rates at older ages will decline more rapidly than is reflected in the U.S. Census Bureau's projections, which could lead to faster growth of this population. Vision deficits are one of the first impairments seen in aging; approximately 10% of the over 85 group is legally blind and over 20% have low vision (Brabyn et al., 2000).

Visual Print Signage

Regulations for Visual Signage usage are exemplified in the Americans With Disabilities Act Accessibility Guideline (Americans With Disabilities Accessibility Guideline, 2005)

Specifications for print characters

- Characters and their background shall have a non-glare finish. Characters shall contrast with their background with either light characters on a dark background or dark characters on a light background.
- Signs are more legible for persons with low vision when characters contrast as much as possible with their background.

- Additional factors affecting the ease with which the text can be distinguished from its background include shadows cast by lighting sources, surface glare, and the uniformity of the text and its background colors and textures.
- Characters shall be uppercase or lowercase or a combination of both.
- Characters shall be conventional in form. Characters shall not be italic, oblique, script, highly decorative, or of other unusual forms.
- Characters shall be selected from fonts where the width of the uppercase letter "O" is 55 percent minimum and 110 percent maximum of the height of the uppercase letter "I".
- Stroke thickness of the uppercase letter "I" shall be 10 percent minimum and 30 percent maximum of the height of the character.
- Character spacing shall be measured between the two closest points of adjacent characters, excluding word spaces. Spacing between individual characters shall be 10 percent minimum and 35 percent maximum of character height.
- Spacing between the baselines of separate lines of characters within a message shall be 135 percent minimum and 170 percent maximum of the character height.
- Minimum character height shall comply with Table 703.5.5. Viewing distance shall be measured as the horizontal distance between the character and an obstruction preventing further approach towards the sign. Character height shall be based on the uppercase letter "I".

Table 2: Viewing distance versus character size in visual printed signage

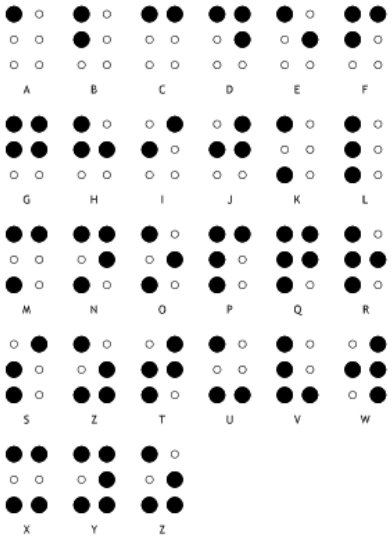
Horizontal Viewing Distance	Minimum Character Height
less than 72 inches (1830 mm)	5/8 inch (16 mm)
72 inches (1830 mm) and greater	5/8 inch (16 mm), plus 1/8 inch (3.2 mm) per foot (305 mm) of viewing distance above 72 inches (1830 mm)
less than 180 inches (4570 mm)	2 inches (51 mm)
180 inches (4570 mm) and greater	2 inches (51 mm), plus 1/8 inch (3.2 mm) per foot (305 mm) of viewing distance above 180 inches (4570 mm)
less than 21 feet (6400 mm)	3 inches (75 mm)
21 feet (6400 mm) and greater	3 inches (75 mm), plus 1/8 inch (3.2 mm) per foot (305 mm) of viewing distance above 21 feet (6400 mm)

Braille

Braille Education

Within the educational system in the United States, a person who has vision insufficient for reading print at about 18 pt type during the elementary school years is likely to be taught to read Braille as a primary reading medium. A recent report from the National Federation of the Blind (2009) indicates that approximately 10% of the 1.3 million people who are legally blind are able to read Braille and approximately 10% of blind children are learning it. (National Federation of the Blind, 2009)

Figure 5: Braille representation of English alphabet



Regulations for Braille usage are exemplified in the Americans With Disabilities Act Accessibility Guideline

- Braille dots shall have a domed or rounded shape.
- The indication of an uppercase letter or letters shall only be used before the first word of sentences, proper nouns and names, individual letters of the alphabet, initials, and acronyms.
- Braille shall be positioned below the corresponding text. If text is multi-lined, Braille shall be placed below the entire text. Braille shall be separated 3/8 inch (9.5 mm) minimum from any other tactile characters and 3/8 inch (9.5 mm) minimum from raised borders and decorative elements.
- Where a tactile sign is provided at a door, the sign shall be located alongside the door at the latch side.

(Americans With Disabilities Accessibility Guideline, 2005)

Early Development

"The Braille system was based on a method of communication (originally called night writing) in Napoleonic France as a way for soldiers to silently

and without light communicate at night. The original system was too complex for soldiers to learn, and was rejected by the military. In 1821 while at the National Institute for the Blind in Paris, Louis Braille identified the major shortcoming of this code; the finger "could not encompass the whole symbol without moving, and so could not move rapidly from one symbol to another. His modification was to use a 6 dot cell — the Braille system — which revolutionized written communication for the blind." (Wikipedia, n.d. b)

Figure 6: Information in Braille on hand rail

Raynes Rail, Coco Raynes Associates, Inc
http://www.raynesassociates.com/rail_index.html

"Although the ADA requires Braille, tactile letters, and consistent height placement for identification signage, finding these signs is a challenge for visually impaired visitors. Coco Raynes Associates, Inc. developed the Raynes Rail to provide the missing link between the entrance of a building and the desired location. The Raynes Rail combines continuous Braille messages on its inner face, with audio modules positioned at strategic locations. The Braille and audio information describe the entire floor plan and inform the visitor of what is ahead, such as offices, facilities, departments, elevator banks, and emergency exits, or warns them of physical changes in the corridor pattern, such as turns, ramps, or stairs."

Raised Print

Raised Print Education

Persons who become blind later in life may or may not become proficient Braille readers. Raised print is never taught as a primary reading medium, although most persons who are blind, including those born blind, are taught (or teach themselves) to read raised capital letters.

Regualtions for Raised Print are exemplified in the Americans With Disabilities Accessibility Guideline

- Raised characters shall be 1/32 inch (0.8 mm) minimum above their background.

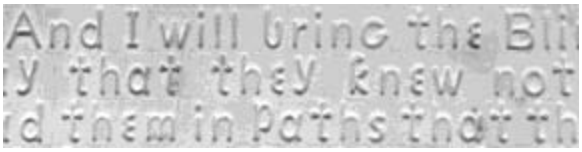
- Characters shall be uppercase.
- Characters shall be sans serif. Characters shall not be italic, oblique, script, highly decorative, or of other unusual forms.
- Characters shall be selected from fonts where the width of the uppercase letter "O" is 55 percent minimum and 110 percent maximum of the height of the uppercase letter "I".
- Character height measured vertically from the baseline of the character shall be 5/8 inch (16 mm) minimum and 2 inches (51 mm) maximum based on the height of the uppercase letter "I".

(Lohoner H, n.d.)

Early developers

boston line

In the 1830s, *Boston Line Type* was developed by Samuel Gridley Howe (above) as raised-letter printing for the blind. Many blind people found Roman letters difficult to use and all such systems were eventually superseded by Braille. Howe's legacy lives on in Boston's Perkins School for the Blind which he founded.



Philadelphia Line

The compatible PHILADELPHIA LINE fonts were inspired by another raised-print font, this one developed by Julius Friedlander (above) and adopted in 1837 by his Philadelphia school, now the Overbrook School for the Blind.

(Lohoner H, n.d.)

Tactile Maps

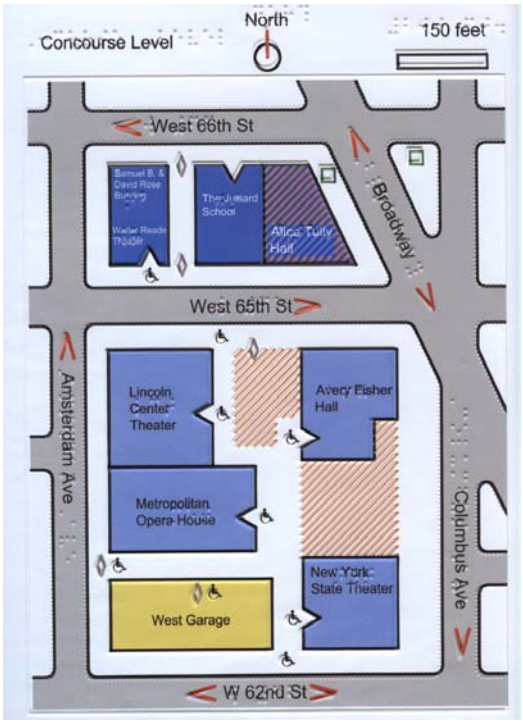
Accessible maps are available in several forms, and are useful for representing information about transit routes and facilities for a significant number of blind and visually-impaired transit riders. Tactile and audio/tactile maps can be used to communicate spatial and geographical information about transit networks, floor plans, landmarks, obstacles, and paths of travel. Tactile maps use raised lines and textures with Braille labels, while audio/tactile maps add a touch-sensitive technology to tactile maps capable of detecting the position of the user's hand or stylus, and provide audio information about the map element being touched. Use of both kinds of maps is increasing due to technological advances which simplify the map-creation process through use of geographic information systems (GIS) and computer-controlled embossing technologies. Strip maps – ordered lists of stations along a particular route with associated symbols representing station layout and connection information – are also extremely useful.

Accessible maps can be used to improve access by blind and visually-impaired travelers to:

- Information about transit routes – For example, a single map can be used to show where bus or train lines overlap or intersect to provide a tactile or large-print overview of a transportation network.
- Floor plans for stations or inter-modal facilities – Often a train station or terminal is difficult to navigate independently because a blind or visually impaired person lacks information about over-all layout and landmarks within the facility.
- Areas surrounding stations or inter-modal facilities – Like sighted people, blind and visually impaired travelers require information about how a station or other transit facility relates to the area around it. Accessible maps can be used to represent the immediate area around a station or other facility. Relevant information would include major streets, entrances to the transit facility, and other transit features such as bus stops and taxi stands.

Tactile, audio/tactile, and strip maps can be over-printed with large print and high-contrast visual information so that they can be used by travelers with low vision as well as those who are blind. Although most transit agencies do not have the required skills in-house to design and produce accessible maps, local transcribers and Orientation and Mobility specialists are generally available to do so under contract.

Figure 9: Tactile Map – Lincoln Center, NYC



Touch Graphics, Inc
http://www.touchgraphics.com/

Figure 10: Talking Tactile Map Kiosk (Whitehall ferry boat terminal, NYC)

GPS/GIS

Global Positioning System (GPS) is comprised of multiple space satellites and terrestrial receivers which provide the user with earth-based location coordinates. Geographical

Information (GIS) is used for 'capturing, storing, analyzing and managing data and associated attributes which are spatially referenced to the earth.' These two systems are combined to aid in navigation and are very popular in consumer map applications.

Many of these GPS/GIS systems allow the user to enter "Start" and "Destination" locations and have route information printed, graphically displayed or spoken. Many systems have a significant number of landmark locations (typically know as 'points of interest' such as the location of restaurants) stored for display on the user device. They also allow the user to personalize the system by adding new location information to the GIS database.

Significant growth in interest and use of location-based services has promoted the expansion of GIS applications and number and types of devices incorporating GPS/GIS. Useful consumer systems are now adapted to the portable computer, personal digital assistant (PDA) and mobile phone.

These GPS/GIS tools have been successfully adapted to the needs of people with disabilities and have become most effective for aiding wayfinding needs for people who have limited or no vision.

Figure 11: Trekker GPS unit designed for people with impaired vision

Trekker Breeze Humanware
http://www.humanware.com/en-usa/home

> "A simple GPS that can be controlled by one hand. It verbally announces names of streets, intersections and landmarks as you walk. Other features include: large, distinctive buttons that directly control functions, an intuitive interface, quick volume adjustment, Built-in speaker, eight hours of battery life. Supplied with a shoulder strap and carrying case."

Length: 127mm
Width: 51mm
Depth: 25mm
Weight: 0.2kg

Figure 12: Braillenote GPS unit designed for people with impaired vision

Sendero Group Stryder
http://www.senderogroup.com/index.htm

> "Sendero GPS packages come with the software, a storage card, audio tutorial, maps, over 13,000,000 Points of Interest in the U.S. and Canada, or other supported country, 1 future electronic upgrade and a Bluetooth GPS receiver with WAAS."

Tactile Walking Surface Indicators (TWIS)

Detectable Warning Surface is a type of Tactile Walking Surface Indicator (TWSI) as "a standardized surface feature built in or applied to walking surfaces or other elements to warn of hazards on a circulation path." It is a unique and standardized feature, intended to function much like a stop line and to alert travelers who are visually impaired to the presence of a hazard in the line of travel or at a platform edge. The surface is comprised of what are usually referred to as truncated domes.

Figure 13: "Truncated dome" warning tiles

Armor Tile
Detectable Warning Surface
http://www.armor-tile.com/

Travelers who have vision impairments, including total blindness, may fail to locate the edge of a transit platform, which can result in travelers falls onto the trackbed. They could also fail to detect rails on a level platform, and inadvertently walk or stand too near, or between, the rails.

Audible Pedestrian Signals (APS)

Accessible Pedestrian Signal — a device that communicates information about pedestrian timing in nonvisual format such as audible tones, verbal messages, and/or vibrating surfaces (US Department of Transportation, 2009)

Figure 14a: Polara Navigator unit photo showing vibrotactile arrow on the pushbutton

Polara Engineering, Inc.
http://www.polara.com/index.htm

Audible Pedestrian Signals – Units also is equipped with a locator tone to notify users that they need to push a button to actuate a pedestrian timing, and to aid in location of the pushbutton.

Figure 14b and 14c: Arrows indicate direction to which the audible message refers

Proximity Activated Audible Signage

Proximity audible devices announce when a person comes within range of the speaker unit. The units are satisfactory as labels. However, a problem with this strategy is that, since these signs are actuated when approached from any direction, they cannot usually use directions such as Straight ahead, Left or Right, because these terms would usually be ambiguous. These signs can seldom indicate a very precise location. They may also be objectionable to some people who do not need audible wayfinding information.

Royal National Institute of the Blind
Speaking Sign
cservices@rnib.org.uk

"This self-contained unit can be used to warn, inform or alert a person to a situation by speaking a pre-recorded message. The message is activated by a Passive Infra-red Detector (PIR) that detects body heat. A loud, high quality, audio message of up to 4 minutes in length can be recorded onto the unit using the in-built microphone or through the auxiliary input socket. The recording will remain in memory even when the power source is removed. It is powered from the mains electricity supply by using the mains adapter provided. The electronics are housed in a light coloured robust, water repellant plastic moulded case. The case slides into a contrasting, black wall plate and is secured by two security screws. This reduces the risk of an unauthorised person removing the unit."

Empco-Lite
Elgin Molded Plastics, Inc.
http://www.empco-lite.com/barricade/ADA-Lite.htm

"When crosswalks or other pedestrian facilities are relocated, these units provide positive guidance for the visually impaired and disabled through temporary sidewalks. Motion detector picks up walking pedestrian from fifteen feet away. Easily program your message with built-in microphone and speaker. Record up to a 20 second message. Gives positive guidance to visually impaired through pathways with a **unique beeping sound**. Customize message for each location." Research on this topic: "Investigating Pedestrian Components in Temporary Traffic Control" http://tti.tamu.edu/documents/0-5237-1.pdf

Figure 15: Empco-Lite Proximity activated audible message for alerting pedestrians to a hazardous construction area

Remotely Activated Audible Signage

Step-Hear
Step-Hear Ltd.
http://www.step-hear.com

"The Step-Hear is an information and navigation reference point system, designed for the use of blind and visually impaired people. It consists of two units: Base and Activator. The Base is installed in key locations, with pre-recorded information. The Activator, held by the user, vibrates to notify that there is a Step-Hear nearby. Pressing a button on the activator will trigger the audible recorded information from the Base also providing proximity and directionality to the location."

Figure 16: Audible triggering with remote

Royal National Institute of the Blind
cservices@rnib.org.uk

REACT information system for people who are blind (Great Britain):

"Speaker units are set up around the chosen area. Individuals carry a key fob-type trigger device, which activates the speaker unit when within range. The audio message helps users to confirm their approximate location and orient themselves within their surroundings
Shop: http://www.rnib.org.uk/shop"

Figure 17: Audible triggering with remote

Pushbutton Audible Signage

Audible signs that have an activation push-button on the speaker unit activate messages. Assuming the user is directly facing the unit when the button on the unit is pressed, these devices can satisfactorily reference directions. However push-button activated signs, like tactile signs, have the weakness that they first must be located before they can be used.

Remote Infrared Audible Signage

Remote Infrared Audible Signage (Talking Signs®) is an infrared wireless communications system for people with print-reading disabilities. It provides human voice messages sent from an infrared transmitter ('sign') to those holding a hand-held infrared receiver. By scanning the environment with the receiver, users pick up various infrared message signals from transmitters in the environment. Since the light signals are directional, the user can find the exact location of the sign by walking in the direction from which the message is received.

Most RIAS announcements are unique, short, simple and straightforward. Messages can be generated in several ways: They can be stored internally as pre-recorded human speech (e.g., labeling the "Information Counter"); Messages can be generated real-time through high quality "sampled" text-to-speech (e.g., naming the "Next Stop" on transit vehicles); Messages can be delivered "real time" through a microphone (e.g., "The Richmond train has been delayed for 10 minutes"). Recently developed hardware is compatible with GPIB (IEEE 488) and Ethernet (IEEE 802.3) and supports the GSM/GPRS/EDGE RF wireless communications protocol for remote programming of messages and control functions of RIAS signs. RIAS is part of the ICC/ANSI 117.1 of 2003 Standard

Talking Signs, Inc
Talking Signs®
http://www.talkingsigns.com/

"Infrared remote signage is a wireless communication system that employs permanently installed transmitters and hand-held receivers. Human voice messages that identify landmarks and provide information are heard through a receiver carried by the traveler. People who are visually impaired, or are otherwise print disabled, scan for directional transmissions and find their way without asking for help. Talking Signs transmitters are

used in buildings, to identify approaching buses, on bus stops, at cross-walks, in malls, on storefronts, etc."

Figure 18: Talking Signs® Transmitter and Receiver

Deafness

Print signs/pictograms identifying communication amenities

Figure 19a: International Symbol of TTY

Figure 19b: Volume Control Telephone

Figure 19c International Symbol of Access for Hearing Loss

Regulations for Pictograms are exemplified in the Americans With Disabilities Accessibility Guideline (ADAAG)

- Pictograms shall have a field height of 6 inches (150 mm) minimum. Characters and Braille shall not be located in the pictogram field.
- Pictograms and their field shall have a non-glare finish. Pictograms shall contrast with their field with either a light pictogram on a dark field or a dark pictogram on a light field.
- Advisory: Signs are more legible for persons with low vision when characters contrast as much as possible with their background. Additional factors affecting the ease with which the text can be distinguished from its background include shadows cast by lighting sources, surface glare, and the uniformity of the text and background colors and textures.
- Pictograms shall have text descriptors located directly below the pictogram field.

(Americans With Disabilities Accessibility Guideline, 2005)

Figure 20: Pictogram consistent with the ADAAG

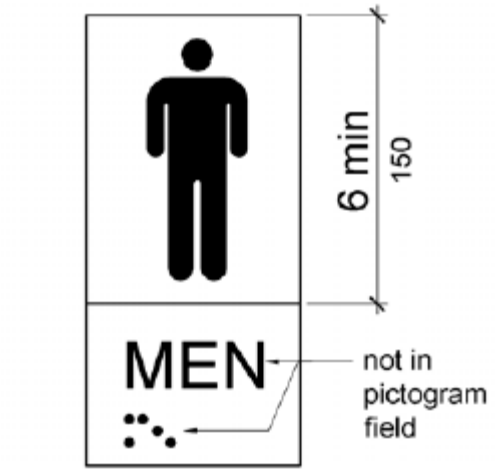


Figure 21: Sky Harbor (Seattle) Visual Paging System

Real-time variable message signs/paging

Variable message signs (VMS) also known as *changeable message signs* are commonly used in transportation to provide vehicle identification (headsigns and boarding-side signs), real-time passenger information, and next stop information. In transit facilities they are used to show boarding areas and estimated vehicle arrival times. They can show multiple messages that can be changed or updated at any time.

While it is required that "where public address systems convey audible information to the public, the same or equivalent information shall be provided in a visual format" [ref. ADA-ABA 810.7], there is currently no requirement that real-time traveler information be provided in a format accessible to travelers with vision impairments. Real-time transportation information provided by VMS is accessible to travelers who are hearing impaired, but not accessible to travelers who are severely visually impaired, although if character height is sufficiently large, proportions appropriate, spacing wide enough, and intensity is adequate, they can be legible to persons with low vision in acuity range of 20/70 to 20/150.

However, the same digital files that drive VMS can be used to drive remote infrared audible signs, making them accessible to any passenger who has a receiver, including travelers with cognitive disabilities such as dyslexia.

In addition to real-time traveler information, VMS can also be used to display emergency or "Out of Service" information to travelers with hearing impairments. If this information is also announced on a public address system or is available using remote infrared audible signage, it will also be accessible to travelers with vision impairments or cognitive disabilities.

Several technologies are currently used for VMS. Many of the VMS currently used in transportation are relatively inexpensive LED signs having low resolution. However, VMS using other technologies that have high resolution and that are as legible as conventional signs are becoming common in airports and commercial establishments. Low resolution VMS need to have characters that are approximately one-third larger than characters on conventional signs in order to be legible at the same distance to readers with unimpaired vision.

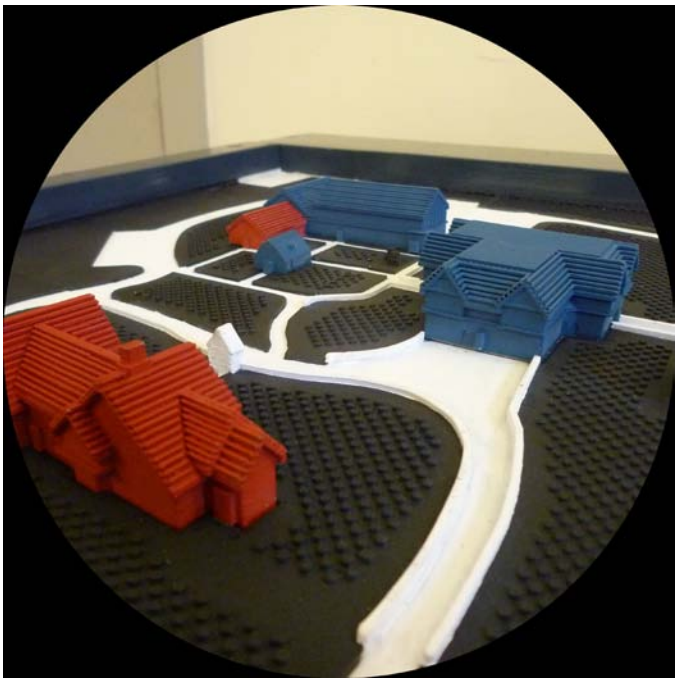
VMS's can display large amounts of information by either "scrolling" (new text enters from the top), "paging" (one screen of text is replaced with another) or 'streaming' (text 'crawls' across the display).

Perhaps the most complete review of parameters effecting VPM is US Access Board's *Synthesis on the Legibility of Variable Message Signing (VMS) for Readers with Vision Loss* (Garvey P, 2002). Here the various considerations of static print sign characteristics (e.g., letter width, font, contrast) have been supplemented with findings particular to these electronic signs such as location (in facilities, on vehicles and on highways) as well as characteristics as *text paging*, *streaming*, *scrolling* and *display time* and *speed*.

Deaf-Blind

Remote triggered alerting to door, telephone, baby crying by amplified sound and light. Audible Pedestrian Signals with vibrating cross indicator.

Figure 22: Tactile Model – Caroll Center for the Blind



Mobility

Signage for people with mobility impairments may not be technically different from that designed for the general population, but the informational content is specific for the specific needs of that population. For example, people with walking limitations (especially those using wheelchairs) face a different problem in travel; stairs, steep inclines, lack of lifts, lack of 'curb cuts', etc. can be a "Dead End" street for such travelers. Whereas it may not be difficult to stop someone on the street to ask for directions, they may not know the route that would best serve someone with a walker of a wheelchair.

If signs are, in general, designed to be used by people of average height, people using mobility aids may be required to look higher; wheelchair and scooter users because they are seated and users of crutches because they are more disposed than average to a downward gaze.

Figure 23: Print Sign marking accessible path of travel at UC Santa Barbara

Cognitive disabilities

Very little is known about the how to answer the signage-related information needs of people with some forms of cognitive disabilities (Below, see myriad divisions of this class of disabilities) although there is common practice for subsets of this population to benefit from pictograms (with or without auxiliary wording. See Figs. 22a, b and specialized pictogram products, below). One study (Crandall W et al., 1999) focused on the ability of a group of people having mental retardation to complete travel tasks in response to listening to audible messages through transmission of Remote Infrared Audible Signage (RIAS). Another study successfully employed a radio-based wayfinding technology to present cognitively disabled travelers with indoor travel instructions presented in experimental combinations of text, speech and images through a PDA (Liu A, et al., 2008). Here Liu, et al. eloquently describe the complexity of providing signage to satisfy the needs of such a diverse population – especially when more than one disability may be impacting a single individual.

Figure 24a: Oakland Public Library Dewey Decimal System (stack signage)

Figure 24b: 2012 Olympics pictograms

According to the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV) below are cognitive impairments or other disorders that may affect cognitive functioning (American Psychiatric Association, 2000):

Disorders usually first diagnosed in infancy, childhood, or adolescence

1. Mental retardation (Also known as Intellectual disability)
2. Learning disorders (i.e. Dyslexia)
3. Pervasive developmental disorders (i.e. Asperger's, Autism.)

Perhaps the major consideration for aiding this population has more to do with the physical design (Arthur P and Passini R, 1992) such that they include clearly defined paths and incorporate striking landmarks. Also, reducing the number of choices along a route and providing "information that does not require higher order [mental] manipulation" will reduce confusion and frustration.

Some of the wayfinding components operating at a rather high level and therefore impacting people with cognitive disabilities are (Arthur P and Passini R, 1992):

- Taking into account previous experiences.
- Reading and evaluating the environmental context.
- Trying to understand the spatial characteristics of the setting.
- Taking in information displayed on signs, maps, and indicators.
- Considering the time factor, the interest, or the security that goes with taking a given route.

Speaking Sign

cservices@rnib.org.uk

"This self-contained unit can be used to warn, inform or alert a person to a situation by speaking a pre-recorded message. The message is activated by a Passive Infra-red Detector (PIR) that detects body heat. A loud, high quality, audio message of up to 4 minutes in length can be recorded onto the unit using the in-built microphone or through the auxiliary input socket. The recording will remain in memory even when the power source is removed. It is powered from the mains electricity supply by using the mains adapter provided. The electronics are housed in a light coloured robust, water repellant plastic moulded case. The case slides into a contrasting, black wall plate and is secured by two security screws. This reduces the risk of an unauthorised person removing the unit."

Picture Exchange Communication System™ (PECS)

Pyramid Educational Consultants, Inc.
13 Garfield Way
Newark, DE 19713
Phone: 888 732-7462
Phone: 302 368-2515
Fax: 302 368-2516
http://www.pecs.com/
pyramidus@pecs.com

Picture Exchange Communication System™ (PECS) was initially developed for use with preschool autistic children but has expanded to include use by individuals of all ages with social communication deficits. "Instead of having children point to items in response to an adult request, children select an item or symbol and hand it to an adult in exchange for activity materials. To aid in the initiation process, verbal prompts are not used. Children progress from symbol discrimination to more advanced stages of actually forming simple symbol sentences.

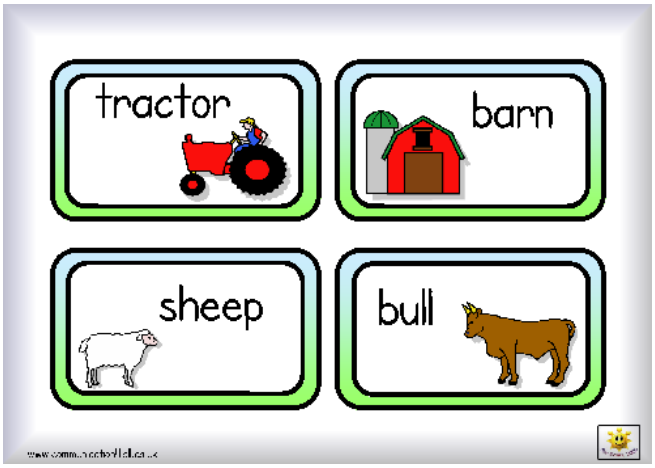
Figure 25: Grocery PECS

Figure 26: Needs PECS

Word Cards

"Some non-verbal children have achieved functional communication of first words by means of word cards. When visual representations or product labels are paired with written words children receive additional visual cues. Several may be joined together for instructional sequences."

Figure 27: Word Cards

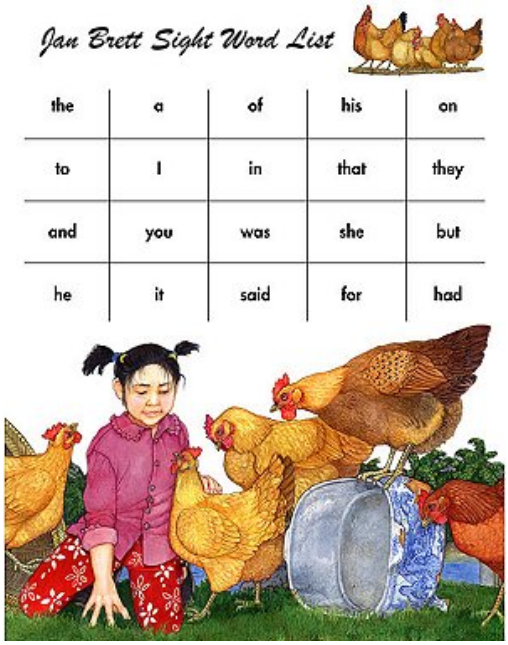


Dolch Word Lists

http://www.janbrett.com/games/jan_brett_dolch_word_list_main.htm
http://www.mrsperkins.com/dolch.htm

"The Dolch words are the 220 most frequently found words. Students who learn these words have a good base for beginning reading. Many of these words cannot be sounded out because they do not follow decoding rules. These words must be learned as sight words."

Figure 28: Dolch Word Lists



Other cognitive disorders (Due to Alzheimer's, traumatic brain damage, or another medical condition)

1. Delirium

2. Dementia
3. Amnesia
4. Cognitive disorder NOS (not otherwise specified)

Cases of dementia are especially difficult because of ancillary factors standing in the way of being able to effectively employ signage. “The elderly and Alzheimer patients in particular, tend to look at the ground. Signs, as they stand, are not in their visual field.” In residential institutional settings, attaching a personal photograph to the resident’s door is helpful to those who having severe of dementia, do not respond to name or number signage (Passini R et al., 2000).

Best Practices

Text Characteristics

Lighthouse International
New York City
http://www.lighthouse.org/accessibility/design/accessible-print-design/readable-type/

a. Point size - Depending on the typeface, type size should be 16 to 18 points, printed with the highest level of contrast.
b. Font family and style - Simple non-decorative fonts in standard roman style are most effective.
c. Letter spacing - Text with close letter spacing presents special difficulties for readers who are visually impaired.
d. Leading - Or spacing between lines -- should be wide enough to allow the reader to easily locate the next line of text while reading.
e. Contrast - White on a dark or black background, and black on a white background, are the easiest to read for people with impaired vision, research shows.
f. Color - People with impaired vision almost always have color vision deficits as well. Designers need to take steps to ensure that colors contrast effectively for this audience. Color vision deficits cause difficulties in discriminating colors on the three most important perceptual dimensions of color: hue, lightness and saturation. Colors are best chosen to differ dramatically on all three dimensions.

"Ensuring print legibility presents a creative challenge to the design community and prompts us to re-examine what we do. It also reminds us to keep audience needs top of mind when we design."

(Lighthouse International, n.d.)

Other Considerations

a. Be clear
b. Be simple
c. Be consistent – this means the same picture or symbols
d. Should always mean the same thing
e. Use clear print

f. Have big letters
g. Have good contrast between the words and the colors – for example use black letters on a yellow sign
h. Should not reflect the light so they are hard to see

(Barker P and Fraser J, 2000)

Example Standards and Regulatory Controls

Americans with Disabilities Accessibility Guideline (ADAAG)

> "A general principle of ADA regulations is "**equivalent facilitation**." This important principle permits alternative designs and technologies to be used to provide access so long as they provide substantially equivalent or greater accessibility to and usability of transportation facilities and vehicles. Equivalence is determined by the DOT on a case-by-case basis."
>
> "Requirements for accessible communication in transportation stem from the ADA. The Architectural and Transportation Barriers Compliance Board, commonly referred to as the Access Board, is charged with writing regulation to implement this legislation. The Access Board writes "minimum guidelines and requirements," for buildings and transportation which must be adopted by the Department of Justice (DOJ) and the Department of Transportation (DOT), each of which is responsible for incorporating into their accessibility standards provisions that are consistent with the Access Board's minimum guidelines and requirements. These departments have typically adopted the minimum guidelines and requirements by reference in their standards, and added a few additional requirements."
>
> "The ADA is civil rights law. Enforcements of ADA requirements and other provisions of the law are through private suit or by Federal agencies, when discrimination is alleged."

(Americans With Disabilities Accessibility Guideline, 2005)

International Standards Organization (ISO)

> "ISO is the world largest standards developing organization. Between 1947 and the present day, ISO has published more than 18 000 International Standards, ranging from standards for activities such as agriculture and construction, through mechanical engineering, to medical devices, to the newest information technology developments."

Two ISO committees have special relevance for signage in disabilities:

ISO/TC 173/SC 07, "Accessible design for assistive products", produced a standard for Audible Pedestrian Signals (ASP) a technology which has a major benefit to people with limitations in vision when crossing streets.

ISO/TC 173/WG 08</ "Tactile walking surface indicators" is developing a standard for warning and directional markings that are detected under foot or through the cane of people with limitations in vision.

(International Standards Organization, n.d.)

Manual on Uniform Traffic Control Devices (MUTCD)

The functions of signs are to provide regulations, warnings, and guidance information for road users. Words, symbols, and arrows are used to convey the messages.

Table 3: US Manual on Uniform Traffic Control Devices; Signs

Shape	Signs
Octagon	Stop
Equilateral Triangle (1 point down)	Yield
Circle	Grade Crossing Advance Warning
Pennant Shape/Isosceles Triangle (longer axis horizontal)	No Passing
Pentagon (pointed up)	School Advance Warning Sign (squared bottom corners) County Route Sign (tapered bottom corners)
Crossbuck (two rectangles in an "X" configuration)	Grade Crossing
Diamond	Warning Series
Rectangle (including square)	Regulatory Series Guide Series Warning Series
Trapezoid	Recreational and Cultural Interest Area Series National Forest Route Sign

(US Department of Transportation, 2009)

References

American Heritage® Dictionary of the English Language. n.d. Signage. 4th ed. Available online: http://dictionary.reference.com/browse/signage.

American Psychiatric Association. 2000. Diagnostic and Statistical Manual of Mental Disorders. 4th ed., text revision. Washington (DC): American Psychiatric Association. Available online: http://www.psychiatryonline.com/DSMPDF/dsm-iv.pdf

Arthur P, Passini R. 1992. Wayfinding. People, Signs and Architecture. New York: McGraw-Hill Book Company.

Barker P, Fraser J. 2000. Sign Design Guide: a guide to inclusive signage. London: JMU and the Sign Design Society.

Brabyn J, Haegerstrom-Portnoy G, Schneck M, Lott L. 2000. Visual impairment in older people under everyday viewing conditions. Journal of Visual Impairment and Blindness 94:741-755.

Brabyn J, Seelman K, Panchang S. 2006. Aids for people who are blind or visually impaired. In: RA Cooper, H Ohnabe, DA Hobson, editors. An introduction to Rehabilitation Engineering. Taylor & Francis Group. p. 288-311.

Brault M. 2008. Americans With Disabilities: 2005. In: Current Population Reports. Washington (DC): U.S. Census Bureau. p. 70-117. Available online: http://www.census.gov/prod/2008pubs/p70-117.pdf.

Center for Universal Design (CUD). 1997. North Carolina State University. Available online: http://www.design.ncsu.edu/cud/about_ud/udprinciplestext.htm

Collective International Dictionary of English. n.d. version 0.48. Available online: http://www.dict.org/bin/Dict?Form=Dict3&Database=gcide

Crandall W, Bentzen B, Myers L. 1999. Remote Signage Development to Address Current and Emerging Access Problems for Blind Individuals. Part II. Smith-Kettlewell Research on the Use of Talking Signs® for Use by People with Developmental Disabilities. NIDRR #H133G60076. The Smith-Kettlewell Eye Research Institute.

Dictionary.com. 2010. Unabridged Based on the Random House Dictionary. Random House, Inc.

Federal Interagency Forum on Aging-Related Statistics. 2008. Available online: http://www.agingstats.gov/agingstatsdotnet/main_site/data/2008_Documents/Population.asp.

Garvey P. 2002. Synthesis on the Legibility of Variable Message Signing (VMS) for Readers with Vision Loss. University Park (PA): The Pennsylvania Transportation Institute, Pennsylvania State University.

International Standards Organization (ISO). n.d. Available online: http://www.iso.org/iso/about/the_iso_story.htm

Lighthouse International. n.d. Simple Steps to More Readable Type. Available online: http://www.lighthouse.org/accessibility/design/accessible-print-design/readable-type/.

Liu A, Hile H, Kautz H, Borriello G, Brown P, Harniss M, Johnson K. 2008. Indoor wayfinding: Developing a functional interface for individuals with cognitive

impairments. Disability and Rehabilitation: Assistive Technology 3:(1)69-81. Available online: http://dx.doi.org/10.1080/17483100701500173

Lohoner H. Harolds Fonts. Available online: http://www.haroldsfonts.com/boston-phila.html.

Manual on Uniform Traffic Control Devices for Streets and Highways. 2009. US Department of Transportation. Chapter 2A - General. Available online: http://mutcd.fhwa.dot.gov/pdfs/2009/pdf_index.htm.

Miller G. 2009. WordNet - About Us. WordNet. Princeton University. Available online: http://wordnet.princeton.edu

National Federation of the Blind. 2009. The Braille Literacy Crisis in America: Facing the Truth, Reversing the Trend, Empowering the Blind. A Report to the Nation by the National Federation of the Blind, Jernigan Institute.

Online Dictionary of Language Terminology. n.d. Sign. Available online: http://www.odlt.org/ballast/sign.html.

Passini R, Hélène P, Rainville C, Tétreault M-H. 2000. Wayfinding in a Nursing Home for Advanced Dementia of the Alzheimer's Type. Environment and Behavior 32(5):684-710.

Prevent Blindness America. 2008. Vision Problems in the U.S.: Prevalence of Adult Vision Impairment and Age-Related Eye Disease in America, update to the 4th ed. Schaumburg (IL): Prevent Blindness America.

Rehabilitation Research and Training Center on Disability Statistics and Demographics (StatsRRTC). 2009. Annual Compendium of Disability Statistics Compendium. Hunter College: Rehabilitation Research and Training Center on Disability Demographics and Statistics. Available online: http://www.disabilitycompendium.org.

Schmeidler E, Halfmann D. 1997. Statistics on Visual Impairment in older persons, disability in children, and lie expectancy. Journal of Visual Impairment and Blindness 91:602-606.

Stahr R. n.d. Universal Design Alliance. Available online: http://www.universaldesign.org/universaldesign1.htm.

Steinfeld E. 2010. Universal Design. In: JH Stone, M Blouin, editors. International Encyclopedia of Rehabilitation. Available online: http://cirrie.buffalo.edu/encyclopedia/article.php?id=107&language=en

United States Access Board. 2004. ADA and ABA Accessibility Guidelines for Buildings and Facilities, Section 101, Federal Register July 23, 2004 and amended August 5, 2005. Provisions for Signage in the Americans With Disabilities Accessibility Guideline (ADAAG). Section 703. Signs. Available online: http://www.access-board.gov/ada-aba/final.cfm#a703

US Manual of Uniform Traffic Control Devices. n.d. Available online: http://mutcd.fhwa.dot.gov/Signs/index.htm.

Web Thesaurus. n.d. Available online: http://www.visualthesaurus.com/

Whobrey D. 2001. Minds and Machines 11(3):307-346.

Wikipedia. n.d. a. Signage. Available online: http://en.wikipedia.org/wiki/Signage.

Wikipedia. n.d. b. Braille. Available online: http://en.wikipedia.org/wiki/Braille.