

Visual Signage and Academic Library Wayfinding

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Abstract

Many academic libraries use the Library of Congress Classification (LCC) system to organise their collections, but few academic library users are familiar with the LCC system or, in libraries with open stacks, able to use it to aid wayfinding and locate known items or discover areas for strategic browsing. This is especially true for students, and despite librarians' efforts, the problem persists. In order to increase accessibility at Weber State University's Stewart Library in Ogden, Utah, and to help users navigate the library to locate and discover resources, faculty librarians, graphic designers, a circulation specialist, and technical services personnel collaborated to design and test symbols and signs for a visual signage system founded on highly respected principles of accessibility and universal design. A set of symbols to represent the major LCC headings and other library collections was created and tested with users via surveys and focus groups. The revised symbols were then colour coded to physical areas of the library and incorporated into a variety of identification, directional, and navigational signs together with verbal subject headings or captions to enable wayfinding. User testing of the signage and student feedback in a questionnaire during a needs assessment demonstrated the overall efficacy of the system which, with the symbols, can be adapted to other open-stack libraries and classification systems.

Keywords: visual signage; signage system; wayfinding; symbols; universal design

1. Introduction

Academic libraries often face difficulties when it comes to helping students navigate and locate resources on the shelves. The vast quantity of information available is as much a hindrance as it is a benefit to researchers, and it can be difficult to direct a user to a specific needed item. Librarians have studied user wayfinding and issues of signage effectiveness, but users still struggle. To make matters worse, wayfinding tends to be perceived as the responsibility of an institution as a whole, and is rarely ascribed to any specific role or position (VanderKlipp, 2013).

Many academic libraries use the Library of Congress Classification (LCC) system, both in and outside of the United States, including Oxford's Bodleian

Library, St. John's College libraries of Cambridge University, Aberystwyth University in Wales, King's College London libraries, University of Victoria in Canada, and Scotland's University of Edinburgh. However, in libraries with open stacks, wayfinding is often complicated by complex shelving layouts. Neither the LCC, nor most stack arrangements, are intuitive to users. Poor signage tends to make matters worse in terms of navigating the library spaces and locating a specific item on a shelf due to small, unclear, or incomplete signs. Poorly designed signage systems leave users with questions at their point of need rather than answers. Students and other users frequently struggle to use the LCC system to navigate open library stacks to find known items, or to locate specific subject areas for browsing – often regardless of library orientation lessons, “how to” web pages or pamphlets, or even signage indicating stack ranges.

By designing symbols that can be used in addition to call numbers on signage, the ways users can find information can be enhanced because symbols are more intuitive than call numbers. Symbols can assist those who may not understand how call numbers work, those with language barriers, and visual learners. By using recognizable symbols, such as a painter's palette and brushes, users can perceive they have found the Fine Arts section in the library, without having to know or care that the LCC class for Fine Arts starts with the letter N. However, because each endcap sign can also provide the corresponding LCC class letter, those that do know the LCC class for Fine Arts is letter N are still included in the sign. Signs also have a verbal descriptor that tells users what the symbol represents. For example, in addition to the artist's palette and LCC class (N), the Fine Arts sign includes the verbal description “Fine Arts.” The descriptor is presented in both in English and in Spanish, the most frequently used language other than English in the area. Situated in Ogden, Utah, Weber State University is situated within a community where 30.3% of the population identifies as Latinx (United States Census Bureau, 2022); in the 2022–2023 academic year, 11.8% of the student body reported Latino/a/x ethnicity, more than twice the rate of any other non-white student population (Weber State University, n.d.b). Therefore, having bilingual signage ensures that the majority of our community members can find and access information.

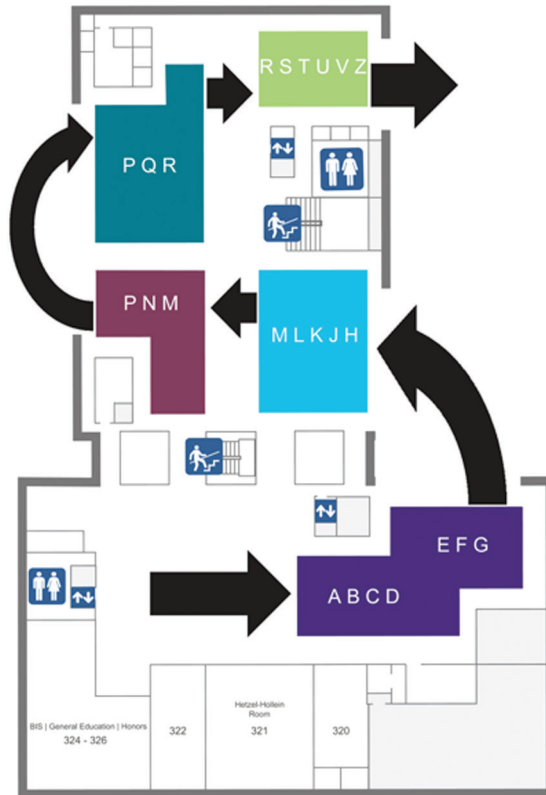
This paper describes a successful attempt to improve student navigation and wayfinding in an academic library by designing and implementing a visual

signage system that uses images to illuminate LCC classes. This project helped make both LCC and the signage system more useful to users seeking both known items and areas to browse. Libraries using Dewey Decimal, Superintendent of Documents (SUDOC), and other classification schemes can also use the symbols to improve wayfinding; the set was designed with LCC in mind, but many categories are similar across a wide range of schema. The symbols include little if any text, making them easy to adapt for signage for non-LCC collections or specialised local subject headings, descriptions, and captions.

This project uses symbols first developed by Pellissippi State Community College (PSCC) in a project by Jennifer Mezick, Laurel Winters, and Miranda Kispert as a starting point for the development of a new signage system (Mezick et al., 2015, 2016). The PSCC library suffered from an overabundance of signage and a circular stack arrangement. The aim of that project was to create visual signage to facilitate navigation within the library for purposes of locating specific known items by call number, and for finding appropriate areas for browsing and resource discovery. It was limited, however, by the lack of user input. Further, there was no professional graphic designer on the team, so students in an advanced graphic design class developed the symbols. This resulted in a unique collaboration, but also ultimately a group of symbols with little cohesiveness rather than a true set, and some concerns about user interpretation. It met the needs of that institution at the time, but there was also potential for further development and improvement. At Weber State University, Stewart Library's users faced similar common barriers to successful resource discovery, including difficulty with navigating the library and using call numbers to locate resources. The majority of the circulating collection is on the third floor, with no public-facing service desks, small end-cap signs which display only call number ranges, and stacks arranged in an "S" pattern from A at the south end of the building to Z at the north end (Figure 1).

Rather than adopting the symbols designed at Pellissippi State Community College (2014), which are available under a Creative Commons license, the research team used them as the basis for an initial round of testing to collect information and inform the design of new symbols. Several considerations contributed to this decision. One issue was the lack of stylistic cohesiveness of the original group of symbols, which was created by an advanced graphic

Fig. 1: Weber State University S-shaped stack arrangement. The Stewart Library stack arrangement puts A-G at the south end ascending west to east, H-P in the middle (east to west), and P-Z at the north end (west to east).



design class where each student designed four to six symbols. This design process also caused some inconsistencies among the symbols including size and shade of black. Another issue was respect for copyright: the names of the students who designed the symbols as a group were known, as well as their instructor, but individual symbols could not be attributed to the individual creators, making specific attribution impossible. The lack of user input in the original design process was also a concern, as was the need to represent additional collections in the Stewart Library, including government documents, reference, maps, the young people's collection, curriculum, media, and current periodicals.

The project aims to improve on PSCC's work by collecting user feedback and performing user testing before, during, and after the design process to increase recognisability and mitigate concerns with new and existing symbols. It incorporates elements of universal design, accessibility, and utility, and expands it to produce a more robust system for library navigation and wayfinding.

2. Literature Review

Wayfinding is not always intuitive but, for frequent users of a space, even complicated buildings become familiar quickly and the initial discomfort and confusion are difficult to recall. This can make improving signage systems, or assisting new users, a challenge for library personnel who have worked in a building for a substantial period of time (Eaton, 1991). Previous wayfinding studies are limited (Mandel, 2017), but typically demonstrate that successful wayfinding is a function of the inherent complexity of the space or spatial configuration (such as circular stacks), semantic organisation and expectations, the user's experience or familiarity with the space, the availability of wayfinding aids, and even differences between users (Duran, 2016; Kuliga et al., 2019; Li & Klippel, 2012; Stempler, 2013; Zaugg et al., 2016). All of this is complicated by trying to use an unfamiliar classification system.

The wayfinding difficulties of undergraduates are well-documented. Many students are uncertain of how books are arranged in academic libraries, even after receiving library instruction in their first year or a library orientation session (Bosman & Rusinek, 1997; Hegarty, 2014; Kinsley et al., 2016; Murphy et al., 2013; Rakshikar & Powdwal, 2020). In many cases, the only factor librarians can control is the quality and availability of wayfinding aids. A preliminary study on the topic found that library users rely heavily on two wayfinding strategies in libraries: gathering environmental cues and using that information to achieve their goals, and remembering prior experiences in similar situations and extrapolating from those to achieve their goals (Mandel & LeMeur, 2018). If libraries are to meet users where they are, it is imperative to provide users the cues they seek by posting useful, accessible signage at point of need, and eliminate extraneous signage to minimise their cognitive load.

That said, there is some debate over which wayfinding aids are most effective, with some studies showing signage, particularly signs with both verbal and graphic information, is most effective and/or most frequently used (Kinsley et al., 2016; Misenhelter, 2017; Singer & Ritz, 1996; Zaugg et al., 2016), and others showing students prefer to receive help from librarians when they encounter wayfinding difficulties (Schoonover & Kinsley, 2014). While the authors agree that getting help from a librarian is always a good idea, improving wayfinding benefits all library users, including those who prefer not to ask for help.

Ideally, a signage system reduces barriers and aids in wayfinding. It also serves to “market an area’s resources, alter negative perceptions, [and] evoke a sense of history and character” (Kennedy, 2010, p. 14). Unfortunately, many library signs fail in one or more of these goals. Authors call out the overabundance of signage in general, and call particular attention to signs that are wordy or jargon-heavy, badly placed, outdated, negative, unattractive, intimidating, overwhelming, unprofessional, or posted to head off frequent questions. Many library signs are posted out of librarians’ frustration with common questions, errors, and issues, but do little to address the root of a problem or, in fact, help the users (Barclay & Scott, 2012; Eaton, 1991; Eichelberger et al., 2017; Fawley, 2012; Howe & Wilsher, 2014; Schmidt, 2015; Stempler & Polger, 2013; White, 2010). One author describes an endcap signage system where each sign shows a map of the entire floor and a list of classes that correspond to each stack range which, while highly informative, results in potentially intimidating signage (Fabbrizzi, 2014). Another provides a new perspective on how today’s students, in particular, use signage – or rather, don’t: almost anything, it appears, is preferable to being seen reading a sign or blocking the flow of traffic to read a sign near the door (Eichelberger et al., 2017).

Many authors offer suggestions for improvements to library signage, including posting signs strategically along search routes, keeping signage minimal, careful selection of fonts and images, avoiding excessive highlighting, using simple layouts that allow information to be absorbed at a glance, and having consistency between signs (Barclay & Scott, 2012; Eaton, 1991; Fawley, 2012; Hahn & Zitron, 2011; Hegarty, 2014; Mandel, 2013; Murphy et al., 2013; Schwartz, 2014). Misenhelter (2017) proposes a three-step action plan: redesigning signage for clarity and concision, employing a colour code to aid navigation, and using symbols for subject areas to tap into users’ native visual literacy skills.

There is a tension between the need to provide enough information and giving too much. Users are helped by signage that explains the layout of a collection or explains a call number, but overwhelmed by signage that is text-heavy, cluttered, or designed to help only part of the user population. In some cases, endcap signage that includes subject headings is a good compromise between too much and not enough information (Carr, 2006; Hahn & Zitron, 2011; Hegarty, 2014). Mandel and Johnston (2019) helpfully published a how-to for performing a signage inventory, but regardless of the quantity of signage in general, students consistently call for “bigger, better, updated, and more prominently placed signage” (Kinsley et al., 2016, p. 16). Duran’s 2016 study found that among three types of signage – orientation or “you are here” signs, directional or “go this way” signs (often with arrows), and identification signs, such as room numbers indicating arrival – and users *stated* that they used directional signage most, but only the use of orientation signage reduced wrong turns. Su et al. (2022) demonstrated that users paid more attention to identification signage, or what they called ‘informational signage,’ than to landmarks or directional signage such as hanging signs or bump point signs, but orientation signage wasn’t mentioned and didn’t appear to be included in the study.

Students themselves prefer images to text on signage, some even stating that they will not pay attention to a sign without an image or with too much text; students “want and expect the image to convey the meaning” of the sign (Polger & Stempler, 2014, p. 86). In 2005, the Oakland Public Library in California successfully adopted a system of symbol-based shelf signs to help users with intellectual disabilities navigate the shelves and facilitate browsing (Nakao, 2005), but symbols can be confusing, and not all are universally understood. A picture may be worth a thousand words, but incomprehensible symbols do not aid wayfinding, and symbols for vague or abstract concepts are more difficult for users to interpret than general-purpose symbols, as demonstrated in studies of the effectiveness of healthcare symbols (Hashim et al., 2014; Joy Lo et al., 2016). Some symbols depend on context for their meaning, and some ideas are too abstract or complex to be effectively represented with a single symbol sans text, in which case a layered symbol approach may be useful or even necessary (Zender, 2006).

Likewise, although the use of colour on library signage is underrepresented in the literature, several studies demonstrate that there is a role for it. Colour

has been shown to aid wayfinding in school and academic libraries, and has frequently been suggested by study participants as a way to improve signage (Almeida & Tidal, 2022; Bosman & Rusinek, 1997; Eaton, 1991; Helvacioğlu & Olguntürk, 2009; Mandel, 2013; Misenhelter, 2017; Stempler, 2013). However, there can be downsides of using colour as well.

It is important to avoid pitfalls such as poor contrast between text and background colour that can result in low readability, or that can render a sign unreadable for those with colour vision deficiency (colour-blindness), such as red font on a black background (Barclay & Scott, 2012; Humrickhouse, 2012; Johnston & Mandel, 2014; Toji, 2012; Young, 2010). Overall, the use of colour is considered desirable and visually attractive and can be a potent wayfinding aid when used appropriately, but designers must use caution and consider the visual abilities of their users as well as sound design principles. Similarly, captions or other text can render signs useless for some users unless multiple languages are included. Almeida and Tidal (2022) noted that in their study, language barriers and miscommunication between library personnel and ESOL students (English for speakers of other languages) were two of the things with the biggest impact on successful task completion. Finally, although there are how-to resources available, such as Spina's 2020 article, the design process is iterative (Jalees, 2020), and the lack of training in graphic design for librarians is a common issue, necessitating consultation with professional designers, collaboration with outside departments, and/or asking for appropriate training, usually outside of the scope of one's job description (Wakimoto, 2015; Wismer, 1988).

3. Methods

Four methods were used to collect information to support the design and implementation of the symbols and signage system. First, a survey gathered user perception and recognition data about the initial set of symbols. Second, focus groups provided insight into the second draft of the symbols and addressed concerns and issues raised by the survey. Third, user testing was implemented to check the efficacy of the signage. Finally, a questionnaire collected information about the helpfulness of the signage as part of a larger needs assessment in the library.

3.1. Survey

The first survey, in 2018, was designed to explore user perceptions of PSCC's symbols with the addition of several new symbols for library collections and a new symbol for Education (L), after its original symbol was repurposed for the Curriculum Collection (Figure 2), and to test for recognizability and confusion. The survey included symbols and captions for the LCC classes and collections:

- A – General Works (such as works spanning many categories without preferencing any)
- B – Philosophy, Psychology, & Religion
- C – Archaeology & Biography
- D – World History
- E – United States History
- F – History of the Americas
- G – Geography & Anthropology
- H – Social Sciences
- J – Political Science
- K – Law
- L – Education
- M – Music
- N – Fine Arts
- P – Language & Literature
- Q – Science
- R – Medicine
- S – Agriculture
- T – Technology, Handicrafts, & Photography
- U – Military Science
- V – Naval Sciences
- Z – Typography & Information Science
- CRK – Curriculum Kits (bundles of curriculum materials for students of education)
- CRM – Curriculum Collection
- GOV – Government Documents (the library is an official repository for selected items)
- MCF – Microform Collection (including microfilm and microfiche)
- MDA – Media Collection (including materials such as CDs, DVDs, and VHS tapes)
- MDK – Media Kits (bundles of media items, usually for students of education)
- OVS – Oversize Collection (large format books that don't fit in their usual shelving area)
- YPL – Young People's Collection (for students of education)

Fig. 2: First draft of symbols. The symbol set used in the 2018 survey, based on Pellissippi State Community College’s symbols (2014).

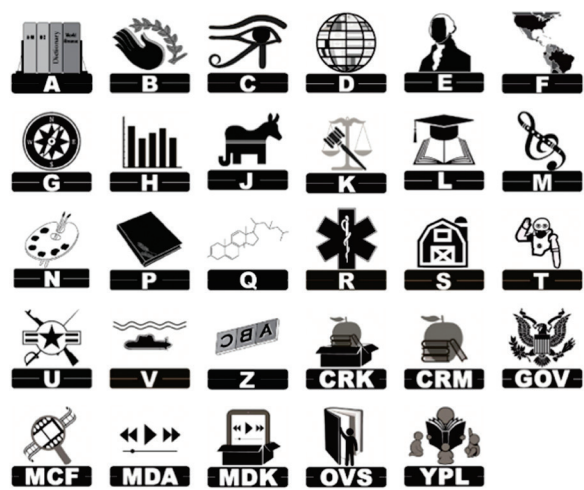
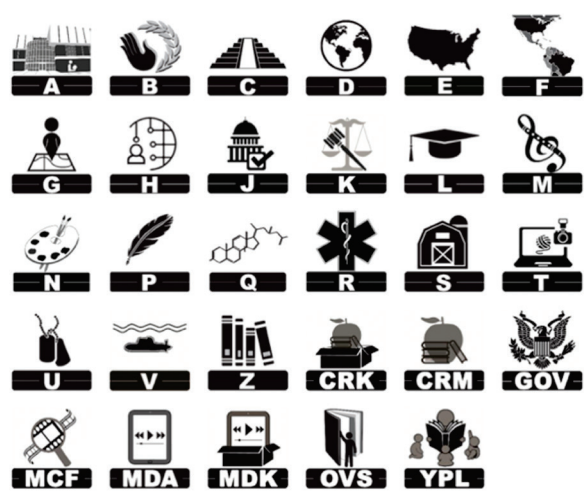


Fig. 3: Second draft of symbols. The second draft of the symbol set, used during Focus Group Testing.



The 2018 survey first asked participants to match topic areas (e.g., subject heading or collection) with the best choice from the complete set of symbols. In order to collect data about all 29 of the initial symbols without overwhelming participants, five nearly identical surveys were constructed, each asking participants about only six of the symbols. Each survey also had two versions: one that included the LCC class letter for each symbol (e.g., N for Fine Arts, as shown in Figures 2 and 3), and one without class letters, to examine whether they were helpful or confusing, for a total of ten iterations of the survey. These questions were followed by three open-ended questions:

- Is there anything that you like about any of these symbols, or the symbols as a set?
- Do you have any concerns about any of these symbols?
- Do you have any suggestions for improving these symbols?

3.2. Focus Groups

Focus groups during the spring of 2019, after the symbols were revised to address areas of confusion or concern raised by survey results, provided feedback on the second draft (see Figure 3). Questions for the focus groups were designed to illuminate preferences where multiple symbols were shown for a topic area. An additional goal was to gauge the success of revisions. In total, six questions were posed to each focus group:

1. While being shown the complete set of symbols (Figure 3), participants were asked:
 - a. What do you think these images are meant to be pictures of?
This question was intended to identify those symbols that participants had trouble identifying, not merely connecting with a topic area.
 - b. Choose the symbols that best matched given topic areas.
2. While being shown a limited set of only three symbols (Figure 4), participants were asked to choose the symbol that best matched a given topic area. This was designed to get deeper insight into areas of confusion discovered through the surveys.
3. While being shown two possible captions for a symbol, participants were asked which made more sense. This question was designed to address concerns about verbal descriptions and make the best decisions for the project.

Fig. 4: Focus group topic-specific symbol matches.

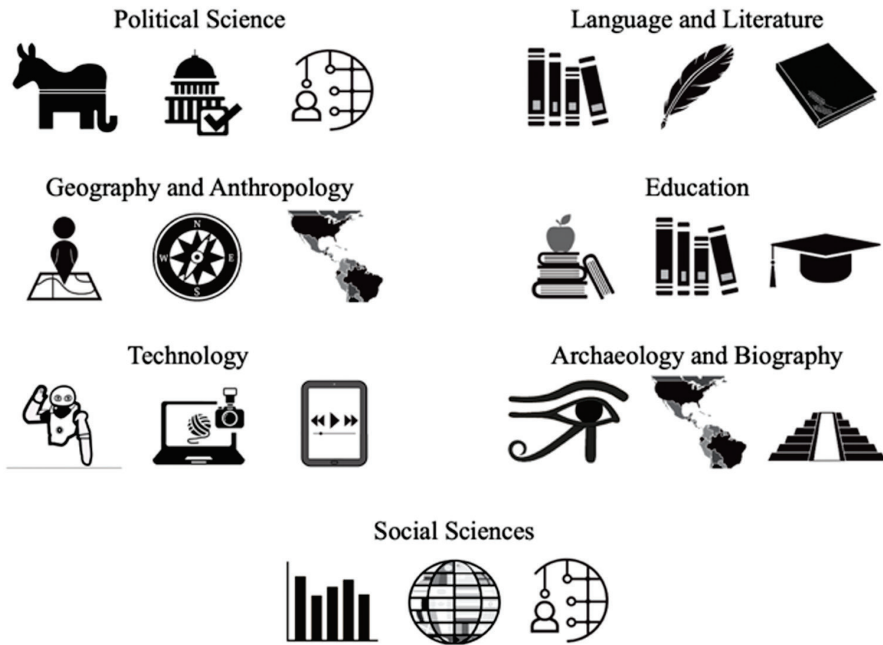
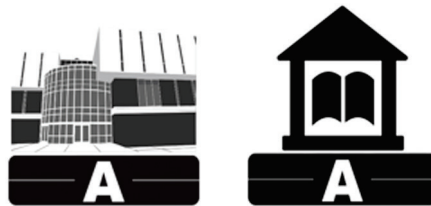


Fig. 5: Focus group symbol options for general works.



4. While being shown two symbols (Figure 5), participants were asked to choose the one that best fit the topic, “General Works” (LCC class A). This question was designed to address concerns about representing this vague concept and avoid user confusion.
5. While being shown two sets of possible symbols for a given selection of topic areas (Figure 6), participants were asked which set they preferred. These questions were designed to address concerns about cohesiveness and confusion.

Fig. 6: Focus group symbol pair options. Images of the symbols were incorporated into focus group questions to collect information on areas of concern or confusion illuminated by the survey.

**General Works and Typography
and Information Science**



**World History, United States History,
and History of the Americas**



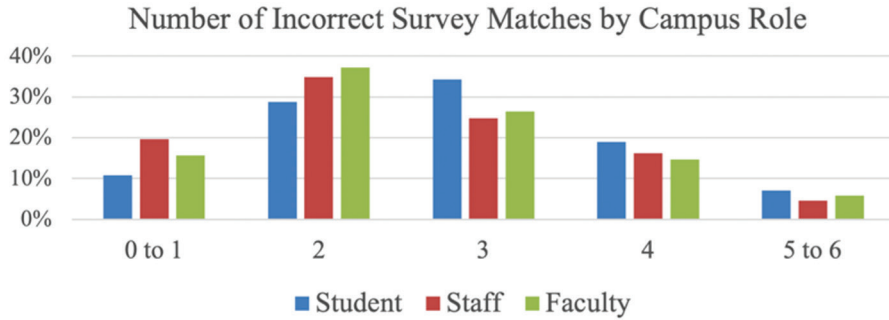
6. While being shown the complete set of symbols, participants were asked four open-ended questions to uncover any other concerns not yet considered:
 - a. What problems did the symbols cause for you?
 - b. Are there any issues you feel like you might have with any of the symbols?
 - c. Do you feel like they make sense as a set?
 - d. How could we improve these?

3.3. User Testing

Three rounds of in-person user testing of the signage system were conducted using the final draft of the symbol set (Figure 7). Round 1 gathered baseline data before the system was installed. Round 2 was conducted after the major components of the system were installed (Endcap Signs, Entrance Signs, and Floor Signs). Round 3 was conducted after the complete signage system was installed (Floor Maps, Elevator Signs, Elevator Maps, and Bump Point Signs).

The in-person testing employed methods similar to prior studies, including task scenarios, think-aloud protocols, and a post-task debriefing interview (Almeida & Tidal, 2022; Mandel, 2020; Mezick et al., 2015, 2016). Participants were timed as they completed two tasks:

Fig. 7: Number of symbols incorrectly matched to topic areas in 2018 survey by campus role.



1. Browsing a topic area: Participants were given a subject and asked to find its location in the library. Subjects were selected to test different physical areas in the library, including U.S. History (E), decorative arts (in the Fine Arts section, N), Political Science (J), botany (in the Science section, Q), and nursing (in the Medicine section, R).
2. Locating a book: Participants were given the title, author, and call number for a book and asked to retrieve it. Books were again selected to test different physical areas in the library, and included books about Greek philosophy (in the Philosophy section, B), Cervantes' *Don Quixote* (in the Literature section, P), biology (in the Science section, Q), and electrical engineering (in the Technology section, T).

Testers shadowed participants and took notes during each of the tasks. Participants all started in the second-floor lobby for the browsing task, and near the top of the stairs on the third floor for the locating task. They were also allowed to take advantage of any and all resources available, including signage, reference desk staff, and catalogue computers. A series of follow-up questions were asked after they performed the tasks:

1. Tell me about the path you took to locate each book and what you saw that helped you.
2. What did you see that confused you or made it more difficult to find the books?
3. Did you look for something to help you locate the books (such as a sign) that wasn't there?

4. What is your overall impression of the signs on the ends of the shelves?
5. Did the words and numbers on the signs help you find the books?

Two additional follow-up questions were asked in Rounds 2 and 3, when signage was in place:

6. Did the colours help you find the books?
7. Did the pictures on the signs help you find the books?

3.4. Needs Assessment Feedback

In early 2025, additional feedback was solicited from library users about the signage as part of a library-wide needs assessment. Information was collected via a short questionnaire and focused on the helpfulness of various design aspects of the different types of signage within the system. Samples of two main types of signage – floor signs and endcap signs – were shown separately and followed by several questions:

1. Do the pictures on these signs help you when you are trying to find something in the library?
2. Do the maps on these signs help you when you are trying to find something in the library?
3. Does the colour coding on these signs help you locate books on the shelf and/or areas to browse?
4. Do the subject captions on these signs help you locate books on the shelf and/or areas to browse?
5. Do the call letters (A, B, C, etc.) provided on these signs help you locate books on the shelf and/or areas to browse?
6. Overall, do these signs help you find what you are looking for when you visit the library? Please explain (open-ended).

Aspects unique to a specific type of signage, such as floor sign maps and lists of subject descriptions on endcap signs, were addressed in their respective sections. The questionnaire ended by asking participants to select aspects of the signage that they found most useful or would like to improve, such as titles and captions, pictures and symbols, colour coding, or maps, and finally by offering an opportunity to provide open-ended feedback.

4. Results

The results of each method of testing the symbols and signage system are given separately. Complete response rates and demographic data are included in Appendices A and B.

4.1. Survey Results

There were 487 respondents to the ten iterations of the survey to gather feedback on the first set of symbols in 2018, with between 42 and 58 for each iteration (see Figure 2). Complete demographic data for survey responses and symbol matching are included in Appendices C and D. Overall, in terms of selecting the intended symbols to match topic areas, faculty and staff outperform students (Figure 7), with 39.7% of students selecting zero, one, or two incorrect matches, as opposed to 53% of faculty and 54.6% of staff. Older participants also outperformed younger ones (Figure 8), with 53.9% of those 26 years and older selecting zero to two incorrect matches, compared to 31.9% of 18- to 25-year-olds.

Success was higher among participants with English as a first language than for those for whom English was not a first language (Figure 9), with 41% of

Fig. 8: Number of symbols incorrectly matched to topic areas in 2018 survey by age.

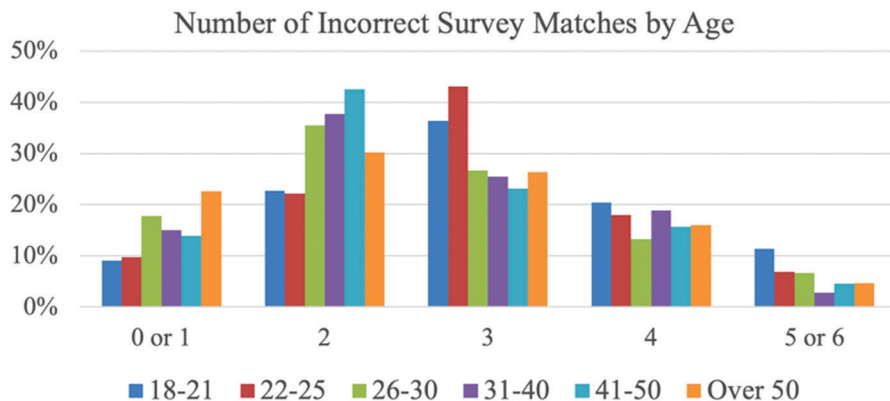


Fig. 9: Number of symbols incorrectly matched to topic areas in 2018 survey by primary language.

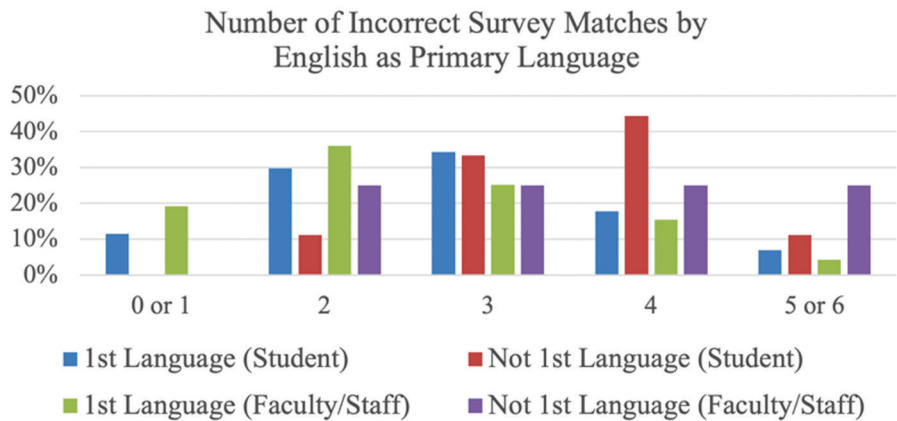
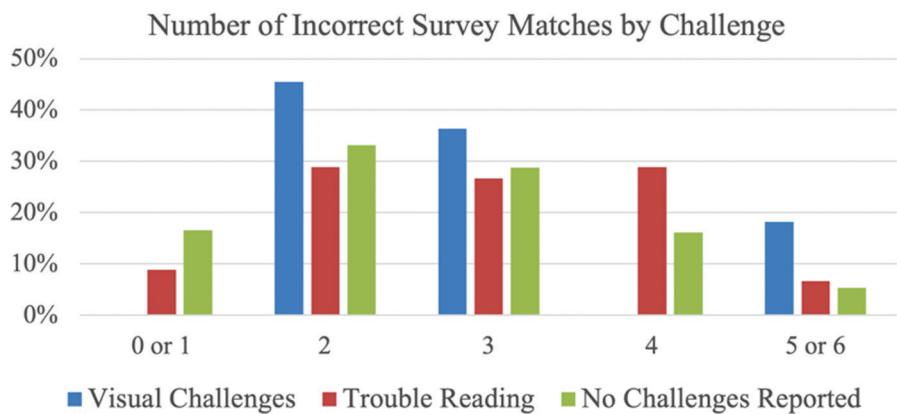


Fig. 10: Number of symbols incorrectly matched to topic areas in 2018 survey by challenge.



students and 55% of faculty and staff making zero to two incorrect matches, compared to 11% and 25%, respectively. Participants who reported neither visual challenges, such as colour-blindness, nor trouble with reading, incorrectly matched zero to two symbols 50% of the time, but those who reported visual challenges did so 45% of the time, while those who reported trouble with reading did so 38% of the time (Figure 10).

Fig. 11: Number of symbols incorrectly matched to topic areas in 2018 survey by library experience.

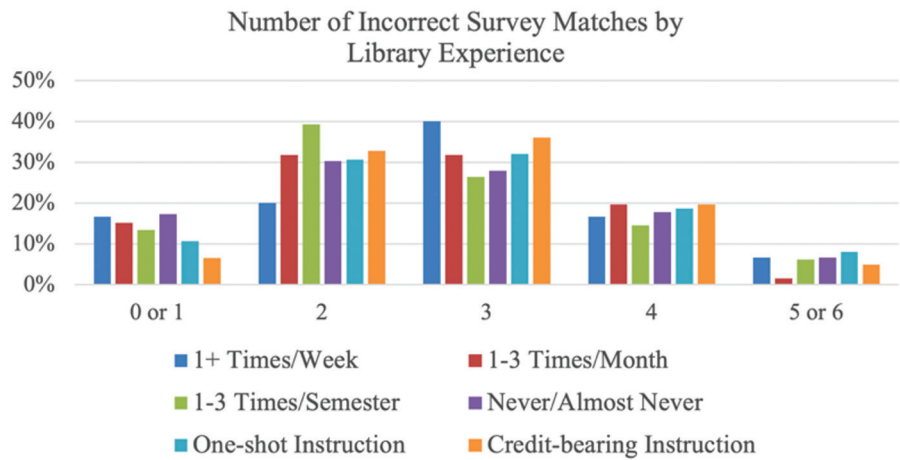
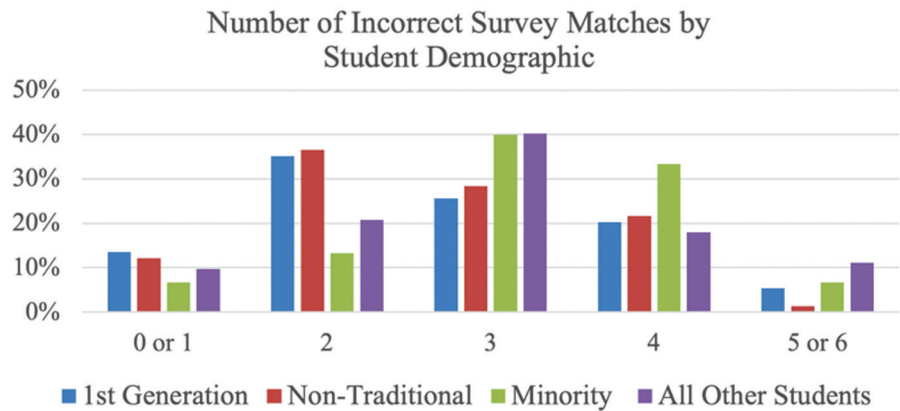


Fig. 12: Number of symbols incorrectly matched to topic areas in 2018 survey by student demographic.



Library experience did not appear to impact success, with 49% of lower-use participants making zero to two incorrect matches, and 40% of those reporting frequent use or greater experience selected zero to two incorrect matches (Figure 11). Non-traditional and first generation students outperformed minority students and all other students, with 48.7% and 48.6% selecting zero

Table 1: Symbols and topics incorrectly matched by survey participants.

Call letter and subject	<i>n</i>	Participants matching incorrect symbol to this subject	Times this symbol was matched incorrectly to another subject	Major revision before focus group
A – General Works	90	40%	157	yes
B – Philosophy, Psychology, & Religion	82	56.1%	26	no
C – Archaeology & Biography	96	57.3%	51	yes
D – World History	89	29.2%	77	yes
E – United States History	111	27%	82	yes
F – History of the Americas	91	41.8%	93	no
G – Geography & Anthropology	86	88.4%	20	yes
H – Social Sciences	91	95.6%	10	yes
J – Political Science	85	61.2%	7	yes
K – Law	89	10.1%	20	no
L – Education	111	58.6%	49	yes
M – Music	89	2.2%	22	no
N – Fine Arts	109	24.8%	8	no
P – Language & Literature	87	92%	27	yes
Q – Science	89	4.5%	26	no
R – Medicine	94	1.1%	5	no
S – Agriculture	87	12.6%	3	no
T – Technology, Handicrafts, & Photography	76	88.2%	7	yes
U – Military Science	89	24.7%	7	yes
V – Naval Science	106	19.8%	12	no
Z – Typography & Information Science	96	76%	10	yes
CRK – Curriculum Kits	81	51.9%	34	no
CRM – Curriculum Collection	89	69.7%	85	no
GOV – Government Documents	86	30.2%	62	no
MCF – Microform Collection	98	30.6%	60	no
MDA – Media Collection	84	75%	12	yes
MDK – Media Kits	96	36.5%	85	no
OVS – Oversize Collection	85	40%	39	no
YPL – Young People's Collection	112	11.6%	34	no

to two incorrect matches, respectively, as compared to 20% and 31% respectively (Figure 12).

Besides examining who made the most incorrect matches, the team wanted to know which symbols were most frequently incorrectly matched with

their topic, and which symbols were most frequently selected as incorrect matches for other topics. Blank answers were removed before calculating the percentage of incorrect matches. Some symbols, such as those for Medicine (R) and Agriculture (S), had low instances of being incorrectly matched and incorrectly selected. Others, such as Curriculum (CRM) and Archaeology & Biography (C), had fairly high rates in both areas. Some, however, were high in only one area or the other, such as Social Sciences (H), which was rarely selected as the correct symbol for its topic area, and General Works (A), which was often incorrectly selected as the match for other topic areas (Table 1).

In response to open-ended questions, participants shared concerns about the symbols, including both design choices and imagery. Symbols mentioned and causes for concern included:

- C – Archaeology & Biography: The “eyeball with an arrow pointing to it” was deemed “weird,” and the representation of the imagery was unclear.
- E – United States History: the bust representing George Washington, the first American president, was problematic because it appeared to be in blackface.
- J – Political Science: The half donkey, half elephant image was difficult to decipher, and the representation of the imagery was unclear. One participant saw it only as a donkey, and worried that it would make people in other political parties uncomfortable.
- P – Language & Literature: Without a caption or prompt, the representation of the “black book with barley on it” imagery was difficult or unclear.
- T – Technology, Handicrafts, & Photography: The symbol was difficult to decipher and the robot imagery was unclear.
- U – Military Science: Images of guns and weapons were triggering, and the “Russian AK-47 behind the Military star” imagery was unclear.
- V – Naval Sciences: Without a caption or prompt, the submarine imagery was difficult or unclear.
- Z – Typography & Information Science: The symbol, meant to represent letters on a print-making block, was difficult to recognise or understand.

Some comments referred to the overall aesthetic or the cohesiveness of the symbols as a set. The symbols were called unprofessional, “dated,” and compared to clip art; one participant noted that “some look like they come out of a baby toy book.” As a set, the lack of cohesion was noted – participants called out the varying line weights, colouring, drawing style, and levels of detail.

4.2. Focus Group Results

After the first draft of symbols was revised, four focus groups were convened in 2019 to obtain further insight into user perceptions of the revised symbols (see Figure 3), with a total of 30 participants in groups of eight, nine, eight again, and five people. Students (37%), faculty (20%), and staff (43%) participated (Appendix A). Responses to prompts and the pursuant conversations revealed symbols which were difficult to identify, interpret, or connect to their topic area. Symbols which had been revised to good effect were also revealed, including several that were no longer difficult to identify or connect to their topic area.

Images that were difficult to identify included a line drawing of the Stewart Library (for General Works, A), a pair of stylised hands with laurel (for Philosophy, Psychology, & Religion, B), and a figure connected to a stylised network (for Social Science, H). The symbols for Philosophy, Psychology, & Religion (B) and Social Sciences (H) were also among those that were difficult for participants to connect to their topic areas when captions were not provided. Other symbols in this area included a ziggurat for Archaeology & Biography (C), a map with a pin for Geography & Anthropology (G), and a set of books on a shelf for Typography & Information Science (Z). The Great Seal, for Government Documents (GOV), was often mistaken as being the symbol for Political Science (J).

In response to questions about which of several symbols they preferred for specific topic areas, participants were largely in agreement, and several that were difficult to identify or connect to topic areas were nevertheless preferred over alternatives:

- General Works (A): open book inside a building
- Archaeology & Biography (C): stylised eye
- United States History (E): Map of the U.S. showing states
- Social Sciences (H): figure connected to a stylised network
- Typography & Information Science (Z): books on a shelf with grey “labels” on the spines

Other preferred options reflected new and revised symbols that participants no longer had difficulty connecting to a topic area:

- World History (D): globe
- Geography & Anthropology (G): map with a pin
- Political Science (J): Capitol-style building with ballot-style checkmark
- Education (L): mortarboard graduation cap
- Language & Literature (P): quill pen
- Technology, Handicrafts, & Photography (T): laptop with camera and ball of yarn

Using dog-tags as the symbol for Military Science (U) was another choice that mitigated confusion and difficulty. When asked for specific ideas for improvement, participants suggested keeping the General Works (A) symbol generic, making the Geography & Anthropology (G) symbol more like a map, adding details or lines to the globe and map for the World History (D) and United States History (E) symbols, adding a second figure to the Social Sciences (H) symbol and making it less like a computer chip and more like a genealogy or more “sciencey” or using a family group with radiating connections, and adding a squiggle to the Language & Literature (P) symbol to show that the quill pen is writing. Suggestions for new or revised symbols included, for Archaeology & Biography (C), using a person with a stone tablet, putting a person on the ziggurat, or a bust of King Tut, and a typewriter or printing press for Typography & Information Science (Z). It was also suggested, again, to improve consistency between symbols, such as line weight, style, and use of shadows.

4.3. User Testing Results

After the second draft of symbols was revised, a beginning draft of the signage system was developed (including only Endcap Signs, Entrance Signs, and Floor Signs) and tested in 2020. The final draft of the signage system, with all its components, was developed between 2021 and 2023, and tested in 2023. There were four participants in Round 1 testing (baseline/no signage), three in Round 2 (partial system), and seven in Round 3 (full system). All participants were students (Appendix A), and most had some library experience (Appendix B). Specifically, all in the Round 1 (baseline) testing and two out of three in the Round 2 (partial) testing reported taking a library class, and two in each round also reported having a library session with another class as well. In Round 3 (final) testing, library experience was

Table 2: Participant time and search time calculations for user testing tasks.

Task, round, and participant	Target area	Total time	Control time	Search time
Task 1: Find area to browse				
Round 1: Baseline				
Participant 1.1.A	N	2:51	0:36	2:15
Participant 1.1.B	E	16:45	1:06	15:39
Participant 1.1.C	J	4:58	0:48	4:10
Participant 1.1.D	R	8:08*	1:25	6:43*
Average				7:12
*Participant did not complete task				
Round 2: Partial				
Participant 1.2.A	N	1:18	0:36	0:42
Participant 1.2.B	E	1:15	1:06	0:09
Participant 1.2.C	R	1:55	1:25	0:30
Average				0:27
Round 3: Final				
Participant 1.3.A	N	2:30	0:36	1:54
Participant 1.3.B	E	1:32	1:06	0:26
Participant 1.3.C	J	2:18	0:48	1:30
Participant 1.3.D	R	12:20	1:25	10:55
Participant 1.3.E	Q	2:15	0:58	1:17
Participant 1.3.F	N	1:54	0:36	1:18
Participant 1.3.G	R	5:20	1:25	3:55
Average				3:02
Task 2: Locate book on shelf				
Round 1				
Participant 2.1.A	B	1:59	0:21	1:38
Participant 2.1.B	Q	2:10	0:33	1:37
Participant 2.1.C	T	2:12	0:55	1:17
Participant 2.1.D	P	1:18	0:08	1:10
Average				1:26
Round 2: Partial				
Participant 2.2.A	B	17:29	0:21	17:08
Participant 2.2.B	Q	7:14	0:33	6:41
Participant 2.2.C	P	9:29	0:08	9:21
Average				11:03
Round 3: Final				
Participant 2.3.A	B	2:07	0:21	1:46
Participant 2.3.B	Q	5:04	0:33	4:31
Participant 2.3.C	T	3:12	0:55	2:17
Participant 2.3.D	P	3:52	0:08	3:44
Participant 2.3.E	B	5:21	0:21	5:00
Participant 2.3.F	P	3:24	0:08	3:16
Participant 2.3.G	P	3:08	0:08	3:00
Average				3:22

more limited: only two out of seven reported taking a library class, and two others reported having had a library session with another class; none had both.

In order to control for the difference in destination areas between task iterations and compare search time accurately and consistently between testing rounds, tasks, and participants, the team measured the time it took to walk from the starting point to the destination point for each task iteration, and that time was deducted from participants' *total* time to calculate actual *search* time (Table 2).

Overall, average actual search time to browse (Task 1) improved from Round 1 to Round 3 and, conversely, average actual search time to locate a known item (Task 2) roughly doubled. Notably, during Round 3, 71.4% of participants (five out of seven) began the tasks by using the signage system: 57% immediately utilised the Entrance Signs, and 14% used the Floor Sign on the destination floor. All participants who started by examining the Entrance Signs proceeded to also utilise the Floor Sign on the destination floor, and all participants used the Endcap Signs to facilitate their success.

During exit interviews, participants in Round 1 noted that the lack of signage made their searching more difficult: One got stuck in a dead end, and two others mentioned that signs with subjects or directions to subject areas would have helped. Round 2 and 3 participants, however, indicated that by and large most of what they needed was provided and their confusion came from other sources, such as expecting books to be organised alphabetically. Several wished for hanging signs in addition to those on walls and endcaps, and one – who got stuck in one half of the divided Medicine (R) section – wished for a sign indicating that the section continued. All said their overall impression of the signs was positive, and indicated that the words and numbers on the signs helped them. All but one also indicated that the pictures were helpful. Very few noticed the colours until prompted by the question, but two said they did help, and one noted that, upon reflection, they helped.

4.4. Needs Assessment Feedback Results

There were 31 respondents to the needs assessment questionnaire, and the response was largely positive. Components that were highly rated as helpful included pictures and maps on floor signs, at 80.6% and 74.2%, respectively. On endcap signs, pictures and subject description lists were each rated helpful by 74.2% of participants. The lowest rate of helpfulness across all areas was 48.4% for the colour coding on floor signs and maps, and it was still

Table 3: Needs assessment questionnaire results.

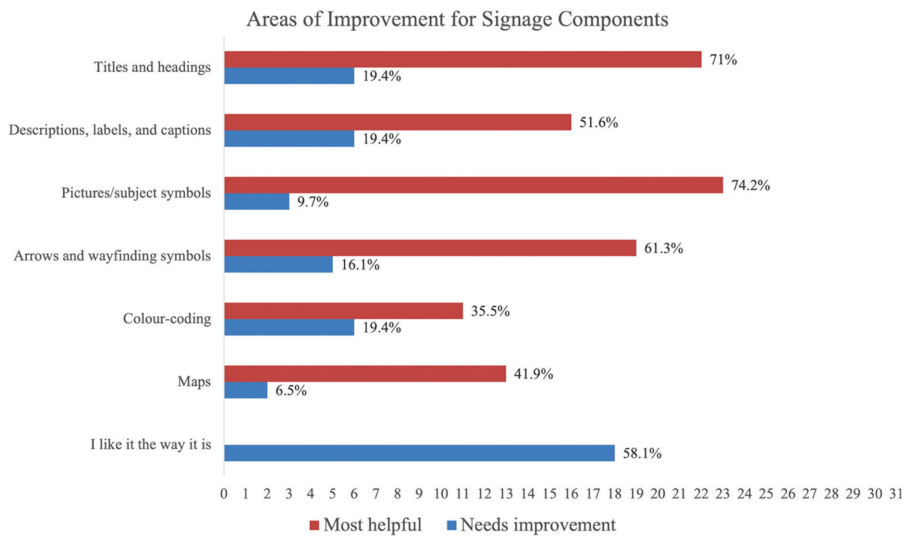
Feedback area (n = 31)	Do not help (%)	Helpful (%)	Neither hurt nor help (%)	Have not noticed (%)	Noticed but not used (%)
Floor signs and maps					
Pictures	3.2	80.6	6.5	0	9.7
Maps	3.2	74.2	6.5	3.2	12.9
Colour coding	0	48.4	12.9	12.9	25.8
Subject captions	6.5	64.5	0	6.5	22.6
Call letters	0	51.6	16.1	6.5	25.8
Endcap signs					
Pictures	3.2	74.2	3.2	3.2	16.1
Colour coding	0	58.1	12.9	12.9	16.1
Subject captions	0	67.7	9.7	9.7	12.9
Call letters	3.2	58.1	9.7	6.5	22.6
Subject description lists	0	74.2	6.5	6.5	12.9

considered more helpful than not helpful (0%) or neither (12.9%), while all others reported either not noticing or not using them. Similarly, the highest level of unhelpfulness across all areas was 6.5% for the subject captions on floor signs, but these were also considered more helpful than not, with 64.5% rating them positively (Table 3).

Open-ended responses reflected this as well, with 79.3% (23 of 29 who answered the questions) responding that the Floor Signs and Endcap Signs help them find what they are looking for when they visit the library – though it should be noted that the two who did not answer the question marked all components of the signs as “helpful” in other parts of the questionnaire. Most respondents discussed the helpfulness of the signs, and some explained that they hadn’t noticed or used them. Several mentioned using the signs primarily to locate study areas or classrooms, and three stated that they are helpful in general but not always for locating books. One respondent was particularly positive:

“Yes, these signs are so helpful. When I came here at first, I got lost. And, i am so introvert that I was not able to ask to people around there. So, while roaming here and there by being so clueless, I saw these signs and I got my answer for what I was looking for. Then after, I always used this until I became perfect. Now, I know a-lot more about here but also I get lost sometimes and I use these signs. Whoever made this, I am so grateful for them. Thanks!” [sic]

Fig. 13: Areas for improvement from needs assessment. More respondents in the Needs Assessment found signage components helpful than said they needed improvement.



Similarly, more respondents indicated helpful aspects of the signs than areas for improvement, with over half noting that they like the signage the way it was (Figure 13).

5. Discussion

The results from each phase of testing and feedback collection were used to inform the next phase, with survey data supporting decision making regarding designing new symbols, focus group input clearing up further concerns about ambiguity and clarity for signage design, user testing helping to refine signage, and needs assessment feedback to facilitate needed updates.

5.1. Survey Data and Designing the Symbols

Ultimately, participant age was the most predictive of participant ability to select the intended symbol for a given topic area in the survey. Those in the 18–21 and 22–25 age ranges underperform older participants, and faculty and

staff tend to be older than students, while among students, non-traditional, and first-generation students tend to be older than the general student population. Only 23% of non-traditional students, 49% of first-generation students, and less than 1% of faculty and staff reported being under the age of 26. The notion that age – or, perhaps, life experience – was the most important characteristic for interpreting the symbols indicated that they lacked the general recognisability necessary to be useful on signage that needed to appeal to and assist users of all demographics.

To decide which symbols to redevelop, the team considered the percentage of incorrect matches between a topic area and its symbol, the frequency with which a symbol was selected as the incorrect match for other topic areas, and responses to open-ended questions. A high rate of incorrect matches was considered indicative of a symbol that was difficult to recognise or an inappropriate representation of the topic area. High frequency of selection as a mis-match for another topic areas was considered indicative that the symbol was again a poor representation of its topic area, vague, or otherwise confusing, or that a representation resonated with users better for a different topic area – in short, that participants didn't know what it was supposed to be (see Table 1). User comments were also used to guide design decisions, particularly where symbols were offensive, triggering, or confusing.

This data-driven redesign resulted in a second draft of the symbol set (see Figure 3) with new symbols for 13 topic areas, including A, C, D, E, G, H, J, L, P, T, U, and Z, and MDA (Table 4). In addition, minor revisions such as changes to line weight or shading were made to three symbols for clarity or to increase consistency within the set, including Q (Science), S (Agriculture), and MDK (Media Kit Collection). Focus groups examined these new symbols to test design choices and disambiguation, and to expose new or persistent issues.

In some cases, symbols with high rates of misidentification or mismatching were not redesigned, instead relying on disambiguation through the redesign of other symbols that were frequently confused with that symbol or its topic area. Among these were B, Philosophy, Psychology, & Religion, which had a 56.1% rate of incorrect matches, but was infrequently selected as the incorrect match for other topics, primarily H, Social Sciences, and C, Archaeology & Biography, both of which were redesigned, which the team hoped would disambiguate B.

Table 4: Changes made to symbols based on survey data.

Call letter and subject	Participants matching incorrect symbol to this subject	Times this symbol was matched incorrectly to another subject	Description of change
A – General Works	40%	157	Changed from short row of books between bookends to line drawing of the Stewart Library
C – Archaeology & Biography	57.3%	51	Changed from a stylised eye to a ziggurat. User comments prompted this change in addition to incorrect matching.
D – World History	29.2%	77	Changed from a medallion of world flags to a simple globe-style map
E – United States History	27%	82	User comments about the inappropriateness of the original symbol, George Washington with blacked-out face, prompted the change to a simple black map of the contiguous United States.
G – Geography & Anthropology	88.4%	20	Changed from a compass to a figure-style pointer on a map
H – Social Sciences	95.6%	10	Changed from a bar graph to a figure with a stylised “network”
J – Political Science	61.2%	7	Changed from a two-headed half-elephant, half-donkey to a Capitol-style building with ballot-style checkmark
L – Education	58.6%	49	Changed from a mortarboard-style graduation cap on an open book to just a mortarboard
P – Language & Literature	92%	27	Changed from a closed book to a quill pen

Table 4: (continued)

Call letter and subject	Participants matching incorrect symbol to this subject	Times this symbol was matched incorrectly to another subject	Description of change
T – Technology, Handicrafts, & Photography	88.2%	7	Changed from a childish robot to an open laptop with a camera and ball of yarn. User comments prompted this change in addition to incorrect matching.
U – Military Science	24.7%	7	User comments about deep aversions to weapon imagery prompted the change from a gun and a sword with a star to a set of dog-tags
Z – Typography & Information Science	76%	10	Changed from a printing plate with backward type to books on a shelf. User comments prompted this change in addition to incorrect matching.
MDA – Media	75%	12	Changed from reverse/play/fast forward audio-visual controls to a mobile device displaying these controls

Another was F, History of the Americas, which had a 41.8% rate of incorrect matches and was frequently selected as the incorrect match for other topics, especially G, Geography & Anthropology, and C, Archaeology & Biography. However, E, United States History, was frequently selected as the incorrect match for this symbol, so rather than redesign F, the other two history symbols were redesigned to be more similar to this one, with the hope that they would create a useful and recognizable “history subset” within the symbol set, and disambiguate them from other topic areas.

CRM, Curriculum Collection, and CRK, Curriculum Kits, were two additional symbols with high rates of incorrect matches (69.7% and 51.9%,

respectively). In this case, however, frequently selected incorrect matches primarily consisted of the symbol for L, Education, and each other's symbol. Similarly, these symbols were only frequent selections for these same areas, though CRM was occasionally selected for A, General Works, and CRK was occasionally selected for OVS, the Oversize collection. With these things in mind, the team decided to redesign the symbols for L and A, largely removing the book imagery, to disambiguate them.

The symbol for OVS, the Oversize Collection, was borderline, with 40% incorrect matches but only 39 selections as the incorrect symbol for another area – primarily for A, General Works, C, Archaeology & Biography, H, Social Sciences, and P, Language & Literature, which were already selected for redesign, which the team hoped would disambiguate these symbols as well.

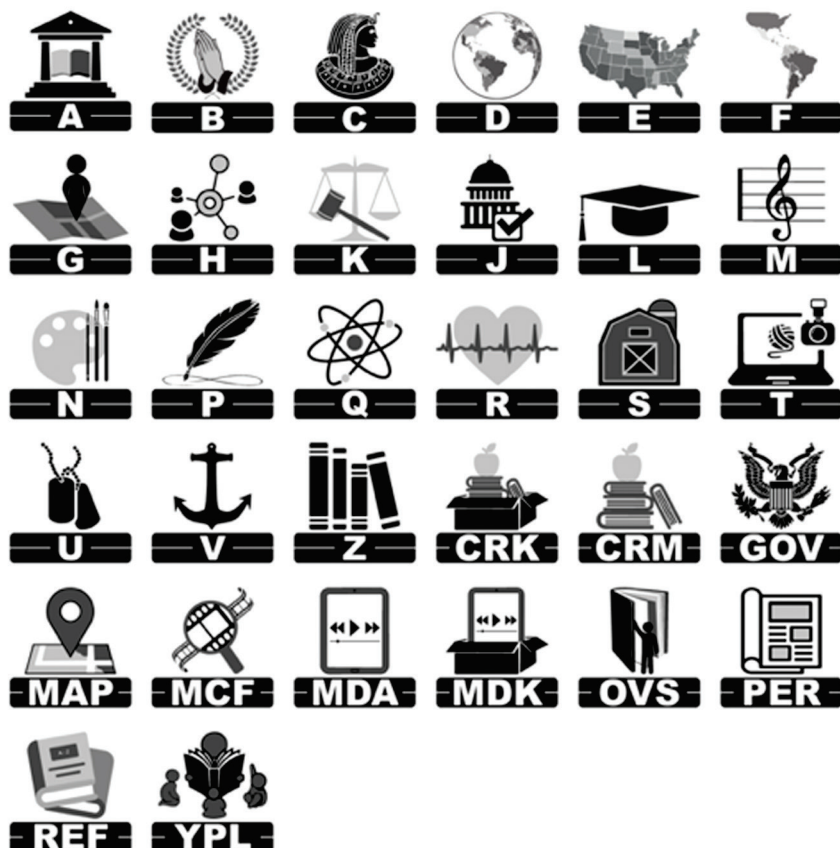
5.2. Focus Group Feedback and Designing the Signage

Data from the focus groups supported the further development and revision of the symbols for the final draft of the symbol set, which also included new symbols for the Reference, Periodical, and Map Collections (Figure 14), and which was used to develop the signage. This final symbol set is freely available, in individual files and multiple formats, as a collection in the Harvard Dataverse¹ for others to use, test, adopt, or adapt in their own visual signage systems and other projects.

Minor changes to symbols in direct response to participant comments included refining lines and adding detail to show countries and states in D, World History, E, United States History, and F, History of the Americas, which was also changed to show more of Canada and South America. On G, Geography & Anthropology, the map was given more shading and made to appear slightly folded to differentiate it further from the new symbol for the Map collection. The symbol for P, Language & Literature, was given an additional line to emphasize the writing function of the quill.

Other changes to increase consistency among the set, which was also suggested by the focus groups, included simplifying the symbol for K, Law, to help it match the rest of the set more, and giving the barn in the symbol for S, Agriculture, more shading. The symbol for V, Naval Sciences, was changed from a submarine to an anchor that better matched the style of the set and

Fig. 14: Final draft of new symbols. The final set of 32 symbols, used on signage and in In-Person User Testing.



would be easier to identify. The symbol for B, Philosophy, Psychology, & Religion, was changed to match the style of the set better and make the laurel wreath surround the hands on both sides. Finally, the apple in the symbols for CRM and CRK, Curriculum and Curriculum Kits, were made smaller and placed on top of the books instead of behind them, and the labels were removed from the spines of the books for Z, Typography & Information Science. The two remaining symbols from the original set were also changed to better match the final set as a whole as well as for the copyright considerations mentioned earlier: the symbol for M, Music, was changed from a

stylised clarinet-treble clef combination to a treble clef on a staff, and the symbol for N, Fine Arts, was changed from a paint palette with two brushes through it to a palette with three brushes next to it.

More extensive changes were made to the symbols for A, C, H, Q, and R to respond to focus group results and participant comments (Table 5).

No changes were made to the other symbols (J, L, T, U, GOV, MCF, MDA, MDK, OVS, and YPL).

When the design process for the signage began with the final set of symbols to represent subject areas, the team was unsatisfied with the library's existing signage, a shared a drive to make improvements, and a dedication to universal design. With the graphic designer on the team, the team created the new signage system with several specific goals in mind. First, the signs within the system should be cohesive and recognizable, using symbols, colours, fonts, language, and other design elements with consistency. Second, the system and each sign within it should rank high in usability and meet user needs clearly and functionally, following signage best practices as much as possible. Third, the system should be sustainable: easily iterated, modified, corrected,

Table 5: Changes made to symbols based on focus group data.

Call letter and subject	Reason for change	Description of change
A – General Works	Participants could not identify the library, indicated a preference for this symbol over the line drawing, and suggested a generic image	Changed from line drawing of Stewart Library to open book in generic open building
C – Archaeology & Biography	Participants had difficulty connecting the image to the topic area, but indicated a preference for the more Egyptian-style symbol over the ziggurat-style building and suggested using a bust of King Tut	Changed from ziggurat to bust in the style of an Egyptian pharaoh
H – Social Sciences	Participants could not identify the “network” but indicated a preference for the symbol with a figure over the other options and suggested additional figures and making it “sciencey” or using radiating connections	Changed from figure with stylised “network” to figures connected by stylised molecule
Q – Science	Participant comments regarding difficulty seeing the symbol due to fine lines	Changed from chemical structure to stylised atom
R – Medicine	Participant comments regarding the differences between the Rod of Asclepius, Caduceus, and Star of Life symbolism	Changed from Star of Life to stylised heart with pulse line

updated, or repaired to keep pace with growth and long-term changes as well as meet short-term needs. Finally, the signage must be accessible and follow seven Principles of Universal Design as much as possible, encompassing equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, and size and space for appropriate use (Center for Universal Design, 1997).

Like the Principles of Universal Design, Universal Design for Learning (UDL) is organised around key principles: engagement, representation, and action and expression. The Center for Applied Special Technology (CAST) created the UDL framework “to improve and optimise teaching and learning for all people based scientific insights into how humans learn” (CAST, 2024). This includes optimizing access to information in learning spaces such as libraries for people of all abilities by providing effective signage for navigation and wayfinding. CAST explains, “UDL is based on principles that empower everyone to have agency over their own learning... like fingerprints, no two brains are alike” (2025). This variety supports the need for multiple modes of engagement with wayfinding within the library stacks. Providing points of access via symbols, verbal descriptions, and LCC call numbers empowers users to choose wayfinding methods they prefer, and creates a more accessible and equitable library experience.

A visual signage system not only supports inclusive wayfinding, but also minimises the margin for error while navigating the stacks. For example, browsing can be frustrating if one wishes to find a subject area but does not know what classification range it falls under, but understanding the symbol used to represent the desired subject area minimises the potential for error, yet requires very little physical effort to engage with or understand. Additionally, in developing signs that fit spaces appropriately and can support those experiencing colour vision deficiency, those for whom the primary local language is not their first, those with library anxiety, or other challenges, these elements also meet universal design and UDL guidelines. Together the symbols, colours, captions, and other visual elements create a visual language which reduces barriers and is more inclusive than any single method.

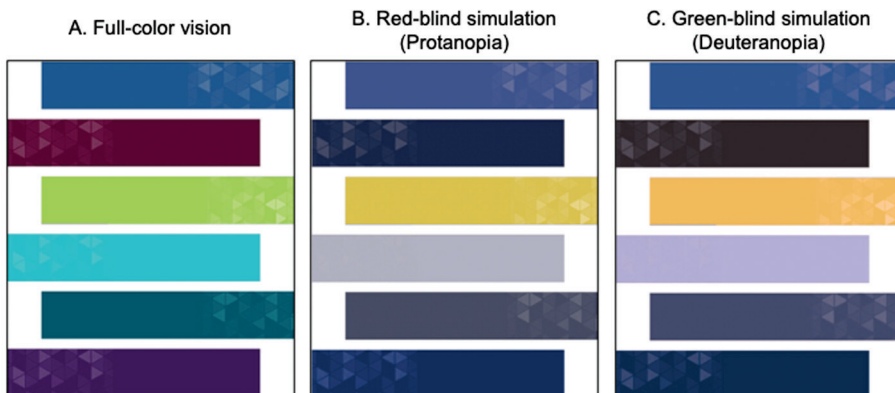
With these things in mind, the colour palette for the signage was selected with care and revised when testing showed problems with contrast. The final colour palette was selected to include and compliment the official Weber State University’s Wildcat Purple: blue, burgundy, lime green, aqua, and teal (Weber State University, n.d.a). Both the original and final colour palettes

were tested in Matthew Wickline’s online colour vision deficiency simulator, *Coblis* (2001), to be as sure as possible that users who experience common vision deficiencies such as Protanopia or Deuteranopia (red-green colour-blindness) would be able to take advantage of the colour coding. The simulator ultimately prompted the change to the final colour palette (Figure 15).

Fonts, wayfinding symbols, and other design elements were also selected with UDL in mind. The designer selected sans-serif fonts for all the signage, and chose common, simple pointers, arrows, and logos to represent directional information, stairs, restrooms, elevators, exits, and information desks. The designs intentionally minimised text, and where text was used, it was provided in English and Spanish. Similarly, to maximise inclusivity, signs and signage elements were designed to be a reasonable size for viewing up close or from afar, and printed signs were placed at a height to enable any user to read them easily.

To support the maintenance of the signage system, including the ability to iterate and update as needed to improve accessibility or keep up with collection changes, the signs were printed in-house on the library’s large-format printer. Materials, sign-holders, and other materials for the production and display of the signage system were also selected with maintenance in mind so that, if an item became unavailable from a particular vendor or in a particular design, they would not be irreplaceable or upset the overall function or look of the signage system.

Fig. 15: Final colour palette with colour vision deficiency simulations. The final colour palette, in full colour (A), and simulations of red-blind vision (Protanopia, B), and green-blind vision (Deuteranopia, C).



During the design of the signage system, three key types of signs were planned:

1. Navigation: Floor signs and maps posted at key points such as entrances, elevators, and stairs, to provide an overview of the collection, orientation to the space, and directions to the intended goal. Signs at entrances and main stairways were designed to be a large-format poster size, 24 × 36 inches (approximately 71 × 91.5 centimetres), while signs in elevators and at peripheral stairways were designed to be a medium-format poster size, 18 × 24 inches (approximately 45.75 × 71 centimetres).
2. Identification: Endcap signs posted on the ends of stack ranges to provide targeted information about the collection in the immediate area and guide users from the general area to the specific goal. These were designed to be 8.5 × 11 inches (approximately 21.5 × 28 centimetres) – small enough to fit side-by-side on the endcaps, and large enough to make the symbol and colour visible from a distance.
3. Bump point: Directional and orientational signs strategically posted in dead ends and other problem areas to help lost or confused users find their way with “Where am I?” and “Where should I go?” questions. These were designed to be a medium-format poster size, 18 × 24 inches (approximately 45.75 × 71 centimetres), though some were altered in height or width to adapt to specific spaces.

As part of a complete system, each sign can rely on the others for context, allowing for the minimalistic design while making it easier for users to parse new information and combine it with existing knowledge to more easily navigate the library, locate known items, and discover new resources. Using a complete signage system in lieu of individual signs also allows the signage to go beyond facilitating wayfinding and potentially become instructional. For example, including collection names on Entrance Signs, Floor Signs, and Elevator Signs helps users understand the range of content available in the library, with which many users are not familiar. Including subject captions in addition to LCC class letters (e.g., Medicine in addition to “R”) gives users insight into the classification system and call numbers, as well as a better idea of the academic subject areas available for their use.

Ideally, the system will guide a user from the door to the floor they need, and then to the specific stack, with help along the way regardless of the route they

take. Figure 16 shows the placement of signs throughout the Stewart Library when the full system is implemented:

- Navigation Signs placed at the entrances and main stairways (green stars) as well as in elevators (blue stars) give users an overview and floor-level destination.
- Bump Point Signs at the less-used outside of elevators, at the third-floor dead end, and the less frequented north stairway (yellow triangles) guide users along the way from beginning to destination and provide help at point of need.
- Identification Signs on the endcaps of the stacks in the collections let users know when they have arrived:
 - Curriculum, Government Documents, Media, Microforms, Oversize, and Young People's Collections on the first floor (1)
 - Reference and Maps on the second floor (2)
 - Current Periodicals on the second floor (3)
 - The circulating collection third floor:
 - a. LCC classes A-G (4)
 - b. LCC classes H-M (5)
 - c. LCC classes M-P (6)
 - d. LCC classes P-R (7)
 - e. LCC classes R-Z (8)

5.2.1. Navigation Signs

Navigation signs included Entrance Signs, Floor Signs, Elevator Signs, and Maps. "Where should I look?" and "You are here" headings signal each sign's purpose.

Entrance Signs (Figure 17), posted by each public entrance in both English and Spanish, give users an at-a-glance overview of the library's collections and where to locate them. Symbols, LCC class letters, and subject captions are colour coded to the area of the building where those subjects or collections can be located, which are also marked in the relevant colour on the maps; Endcap signs in each area likewise match the colour code. The colours change at natural breaking points where the floor layout shifts from one range of stacks to the next (see Figure 1). The goal of these signs is to provide a quick way for users to identify the area they are looking for, either by name

Fig. 16: Signage system implementation scheme. The fully deployed signage system includes Navigation Signs at entrances and stairways (green stars) and elevators (blue stars), Bump Point Signs (yellow triangles), and Identification Signs on endcaps (1–8).

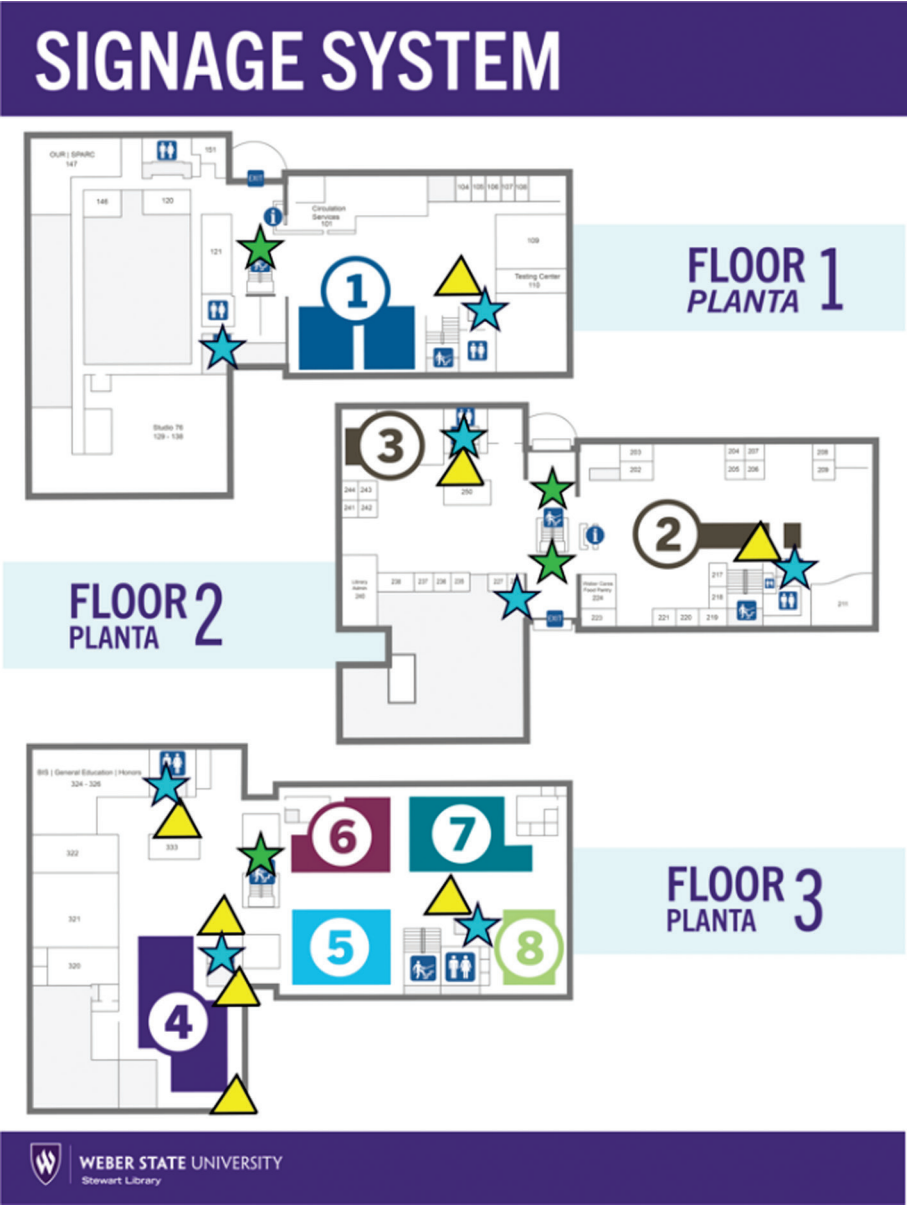
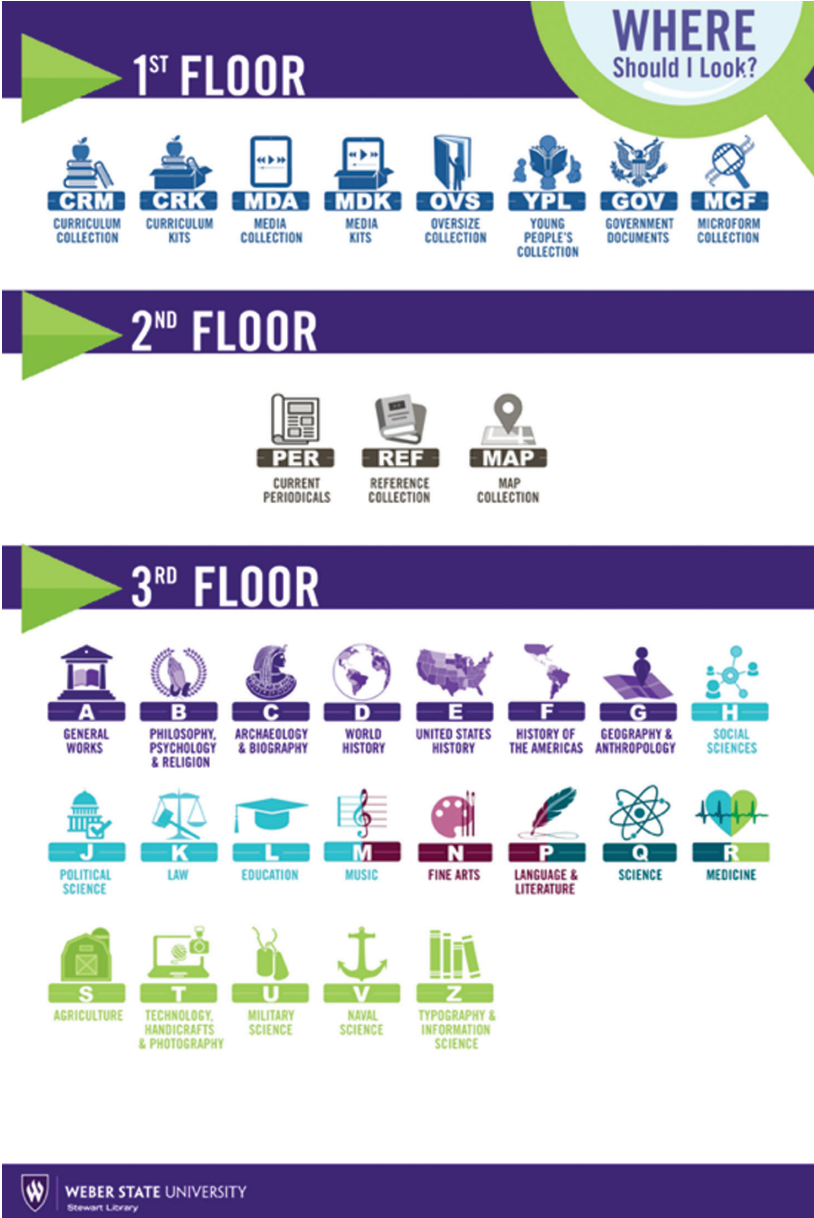


Fig. 17: English-language entrance sign. Entrance Signs have been placed near each of the library's public entrances, showing the collections and subjects available on each floor of the library. Additional signs are in Spanish.



or collection for browsing, or by call number for locating known items, and a starting point (the floor number) for navigating toward the desired location.

Floor Signs and Floor Maps (Figures 18 and 19) are dual-language signs, paired to show users the subjects and collections available on each specific floor, and where to find them relative to the sign location near the main stairwell. The Stewart Library is long rather than square, and oriented north-to-south with the main stairwell near the middle of the building, so symbols on the Floor Signs are grouped together and oriented on the sign based on whether they can be found on the north or south end of the building.

Each section of the sign is indicated by a plain header (South/Sur or North/Norte), with an arrow pointing toward the indicated areas. Floor Maps highlight the user's location and indicate stack ranges with blocks of colour which are coded to match the symbols on the Floor Signs and Endcap Signs. The goal of these signs is to pick up where Entrance Signs leave off and guide users to the specific area where the collection or subject they are searching for can be found once they've reached the appropriate floor.

Elevator Signs and Elevator Maps (Figures 20 and 21) are dual-language signs addressing the same goals as the Floor Signs and Floor Maps, but from the perspective of the elevators. Instead of only one floor, they show all three floors of the library to help elevator passengers to navigate regardless of where they get on or off. Arrows are oriented to reflect the layout of the library based on which wall of the elevator they are posted on, and thus the user's orientation, but cardinal directions are omitted due the signs' location at the periphery of the building, rather than its centre.

5.2.2. Identification Signs

Endcap Signs identify the items available in any given stack range. These signs pick up where the navigation signs leave off and guide users from the general area to the specific stack they are looking for. Each sign features the relevant symbol for items shelved on that stack, either for a collection, such as the Young People's Collection (Figure 22) or the LCC class(es) shelved there, such as Medicine (R) (Figure 23). The colour code ensures Endcap Signs coordinate with the Entrance Signs, Floor Signs and Maps, and Elevator Signs and Maps. The Endcap Signs for the LCC classes in the circulating collection

Fig. 18: Floor sign on third floor.

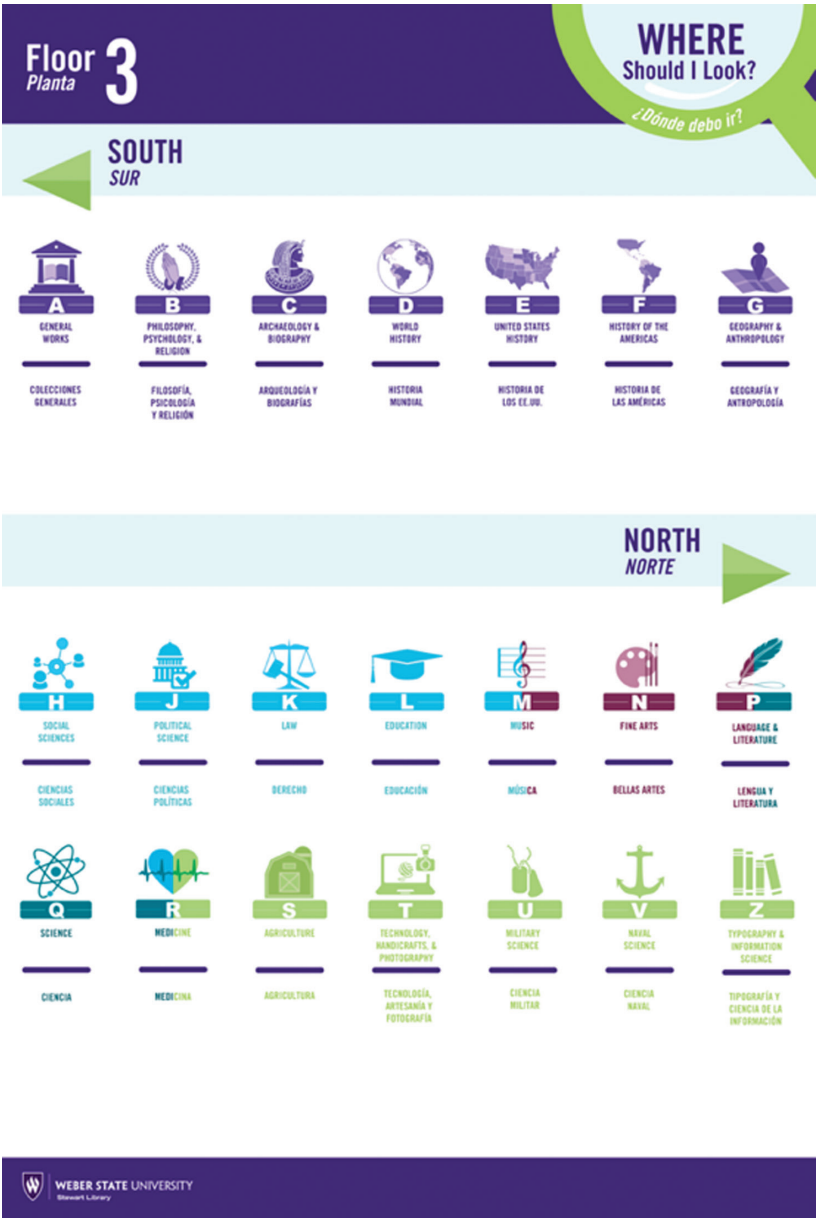


Fig. 19: Floor map on third floor. Floor Signs and Floor Maps are paired and placed at the landing of the stairs on each floor to show the location of the user and the collections/subjects available on that floor, in English and Spanish. Subject symbols and map locations are colour coded.



Fig. 20: Elevator sign in central elevator.

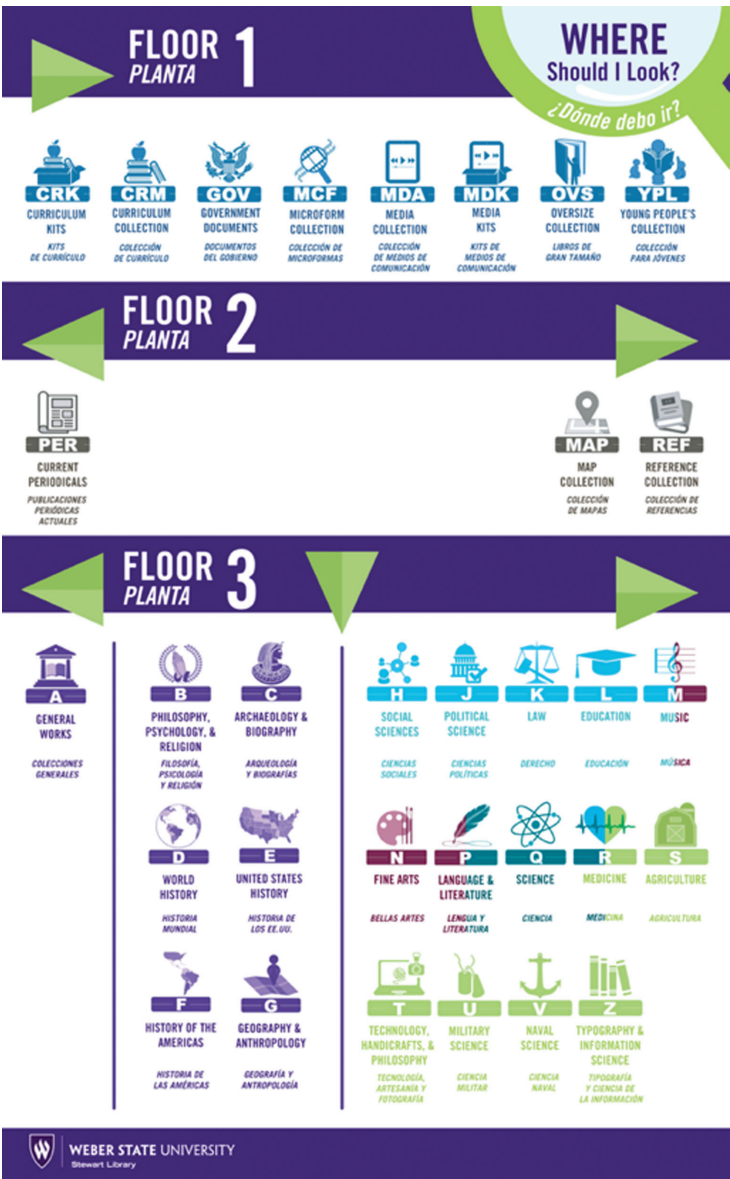


Fig. 21: Elevator map in central elevator. Elevator Signs and Elevator Maps are placed in each elevator and oriented to the location of the user and the collections/subjects available on each floor, in English and Spanish. Colour coding of collection symbols with map locations is visible in these signs.



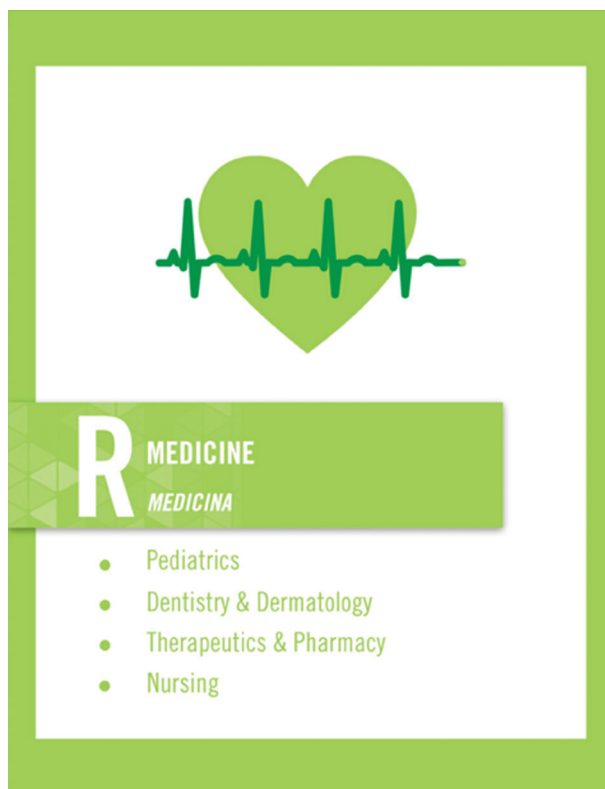
Fig. 22: Endcap sign: young people's collection.



also include a short list of subheadings shelved on the stack – for example, the Medicine Endcap Sign in Figure 23 has four subheadings: Paediatrics, Dentistry & Dermatology, Therapeutics & Pharmacy, and Nursing – to help users identify the specific stack they need within the range. The Reference Collection is large enough by itself that additional information may be helpful to users, so under the large Reference Collection symbol, the symbols for LCC classes on each stack are provided in a smaller size along with their subject headings (Figure 24). This allows users to navigate not only between subjects but within them, discovering more narrow topics after locating the area where the broader subject is shelved.

Call number ranges and other information, such as how-to or contact information, was deliberately omitted from endcap signs to keep text minimal

Fig. 23: Endcap sign: medicine (R) section.



and balance white space, and because call number range-finder signs were already mounted on stacks in permanent holders (Figure 25).

5.2.3. Bump Point Signs

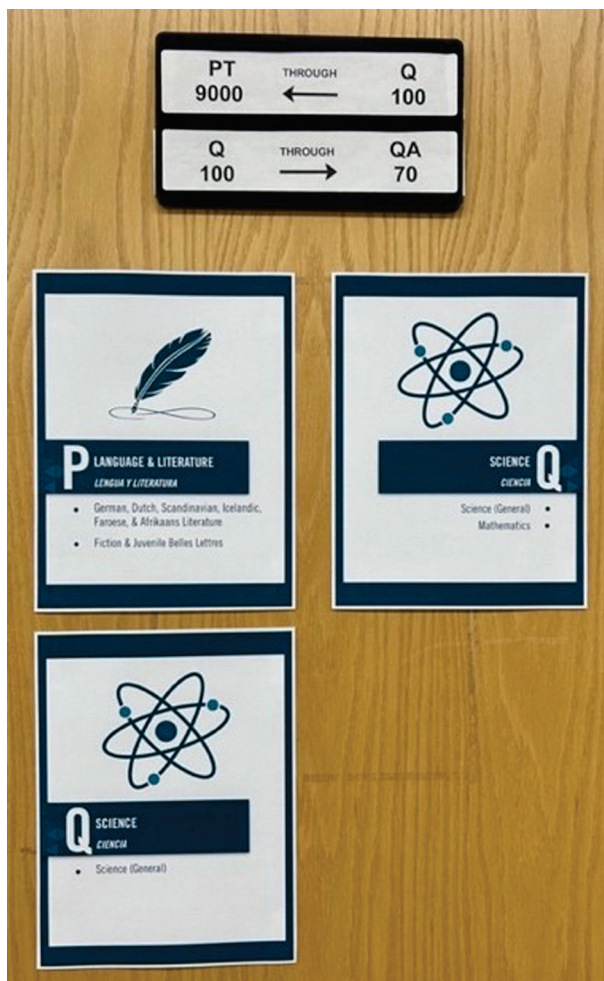
Bump Point Signs pick up the slack where the Navigational Signs do not reach and Identification Signs can't help. These are placed at key decision-making points in a route, such as coming out of an elevator, to help users navigate to desired areas from peripheral spaces on each floor. The system implemented in the Stewart Library includes Bump Point signs outside each elevator that are similar to the Navigational Signs, showing the direction to collections on that floor, and oriented to the direction a user will be facing

Fig. 24: Endcap sign: reference collection.



upon exiting the elevator. Bump Point Signs are also important where users encounter dead ends or confusion, such as when navigating between stack ranges; an example of this in the Stewart Library is the A-G range on the southern half of the third floor, which is set apart from the other four ranges, laid out counterintuitively, and appears to stop at a blank wall where the G (Geography & Anthropology) section ends – a dead end bump point. The dead-end Bump Point sign here (Figure 26) uses a “You are here” format and displays a map with colour-coded symbols in their respective colour blocks, rather than solid-colour blocks with no symbols, to combine maximum way-finding support (e.g., which subjects are on the third floor, where they are in relation to the user’s location, and routes to get there) with minimal text. The goal of these signs is to give users just-in-time directions on the path to their desired goal, or at point of need, before they get lost or frustrated.

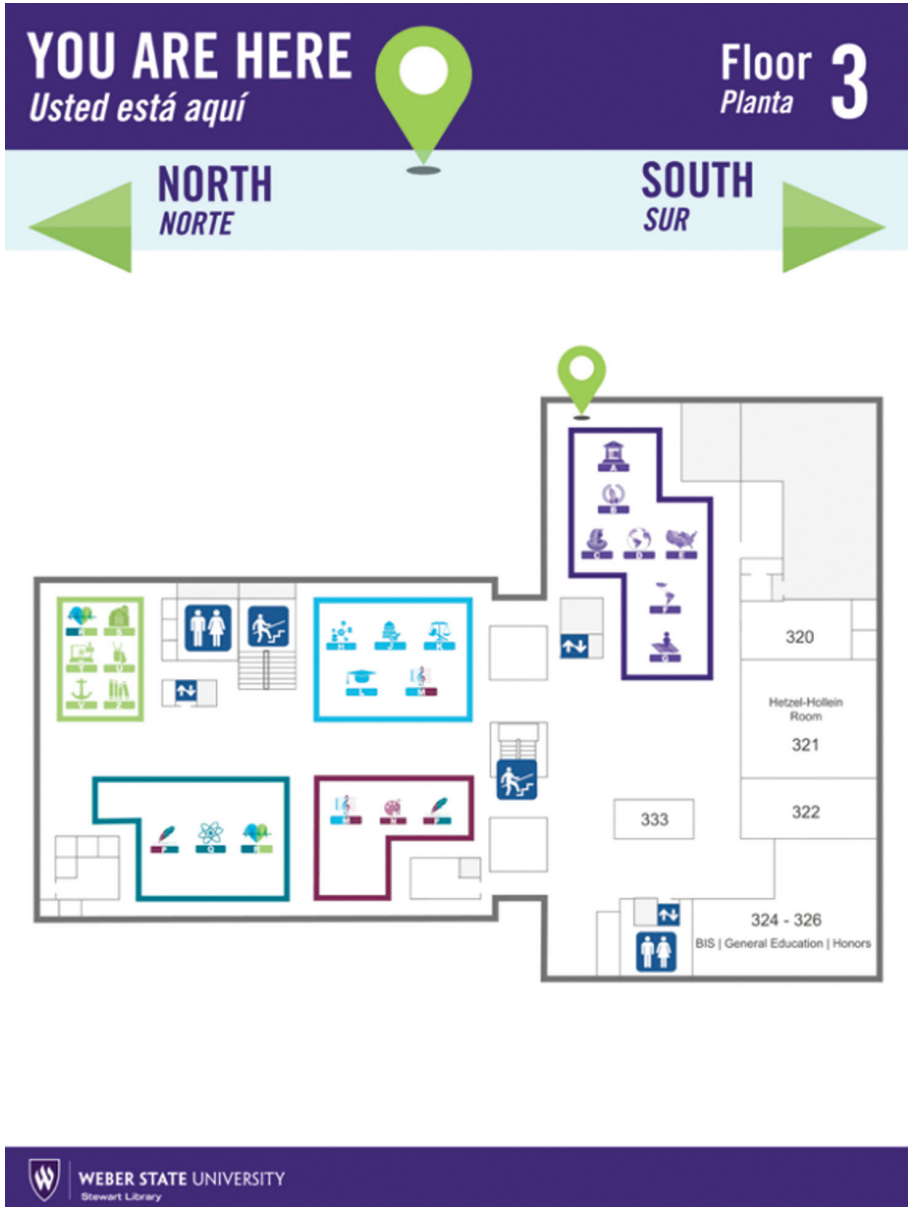
Fig. 25: Endcap and call number signs in situ. Colour-coded Endcap Signs with symbols and English and Spanish verbal descriptors are placed on all stacks to show subjects and collections throughout the library. These are paired with call number signs to further support wayfinding. Future iterations of the signage will list sub-headings in both languages as well.



5.3. User Testing, Needs Assessment Feedback, and Signage Efficacy

The results from the User Testing are, on the surface, inconclusive about the efficacy of the signage. Overall, performance improved with signage for browsing and diminished when finding an item on the shelf, but the partial

Fig. 26: Dead end bump point sign. Bump Point Signs are placed outside each elevator and at additional bump points, such as peripheral spaces and dead ends, directing users to content available on each floor.



system (Round 2) times skew these results, being both much faster than both the Round 1 and Round 3 times for browsing, and much slower for finding an item on the shelf. This pattern of results remained consistent when controlling for library experience, such as a library class or one-shot session or frequency of library use, or removing outliers changes the pattern of results. Controlling for age or minority status also made virtually no change in the results, which is not surprising with so few participants, especially in Round 2.

When comparing Round 1 and Round 3, a few things stand out. Participants in Round 1, who took an average of 7:12 minutes to discover the area to browse, and 1:26 minutes to locate a book on the shelf, all had experience with a credit-bearing library class, and half also had other library sessions. Among Round 3 participants, only two of seven reported taking a library class and another two a library session; these participants took an average of 3:02 minutes to discover the area to browse, and 3:22 minutes to locate a book. In addition, only three out of four participants in Round 1 (75%) were successful in the browsing task, but all seven in Round 3 were successful (100%). Removing the unsuccessful participant's time from the Round 1 calculation only slightly changes the average search time to browse, increasing it from 7:12 to 7:21. This is noteworthy because library experience apparently did not help users with browsing when there was *not* signage, but lack of library experience also apparently did not *hinder* users when browsing or locating a book on the shelf when there *was* signage.

In short, based on user testing results alone, access to the complete signage system may increase success rates for browsing, as well as times. The complete signage system may also have helped inexperienced users in Round 3 to locate a book on the shelf once they became familiar with the system during the browsing task, even if it didn't improve their time. Regardless of their level of experience, all Round 3 participants were able to complete their tasks in five minutes or less, with the exception of one who nevertheless persisted and succeeded. In short, experienced users located books easily, and others succeeded without undue difficulty in spite of inexperience.

The Needs Assessment feedback reinforces this: after the system was in place for several years, students rate signage components as being helpful far more often than not, demonstrating that the design choices and commitment to UDL are supporting students in the library. Open-ended comments indicate that the system helps students navigate the library to find books, areas to

browse, study areas, and classrooms. In addition to the extremely grateful comment noted above, other comments called the signs “very easy to read, understand and locate,” “very helpful” and “very informative.” One student said, “Easy to follow and I like the colors [sic],” and another said specifically that “they help you navigate the library.”

In response to the Endcap Signs, students had similarly positive comments. One stated, “I like being able to more easily narrow down my search and the signs help with that,” and another echoed them: “These give me some good examples of the books in a certain area so when I’m searching for something on a certain topic they give me a good idea of where to search.” One called out specific features, saying, “the words and pictures are especially helpful.” Overall, the comments demonstrate that the signage system is helpful to many students, but particularly to some who lack experience, face other barriers, or are hesitant to approach staff. Poblocki (2007, p. 18) says, “Soliciting input in the design process for the most high-profile signs can foster good will with the student body and a stronger sense of connection to the campus,” and one of the final comments shows the truth in this: “You guys do a pretty good job.”

6. Limitations and Conclusions

Considering the promising User Testing results and positive Needs Assessment feedback regarding the signage, the research team and, indeed, the library consider the visual signage system successful in its goal to support student wayfinding and access to information. The research team also sees the development of the symbols for the visual signage as a success. The considered use of data through each stage of the development and design undoubtedly contributed to the positive feedback and high rating of helpfulness of the signage components, including the symbols, and the ultimate success of the project.

It must be noted that a significant limitation of this study was the very low participation in the User Testing, largely as a result of the COVID-19 pandemic, with only four participants in Round 1 and three in Round 2. Additional impacts of COVID-19 on User Testing Rounds 1 and 2 included excessive temporary signage about safety protocols, service interruptions, and new services, as well as the need to conduct user testing outside library operating hours to avoid having too many people in the space. Low participation and

complicating factors prohibit significant comparison of search times between rounds, particularly the anomalous Round 2. These difficulties notwithstanding, and considering positive feedback and success in other areas, the Stewart Library plans to update the system to address changes in the library collections.

In addition to these updates, user and personnel comments have inspired us to make all signs dual-language, rather than offering multiple signs in different languages. Observed patterns of use have also inspired potential modifications to the system, including putting Elevator Signs and Elevator Maps in frames to protect them from users who lean against walls, wet umbrellas or other spills, and other hazards in a small, heavily trafficked space. Minor inconsistencies between signs will also be addressed and, over time, the system will be monitored for damage and necessary updates.

Creating a complete signage system takes time, attention to detail, and dedication. However, designing such a system in-house can ensure accuracy and commitment to the project, and can make maintenance easier, especially if signs can be printed in-house and staff has working knowledge of Adobe Illustrator, Photoshop, or similar programs.

Anywhere academic libraries with open stacks struggle to help students understand and use classification systems, visual signage that illuminates subject areas through symbols, verbal descriptors, and the principles of UDL can help them empower users, support resource discovery and retrieval, and enable research and learning. Combining individual visual signs into an intentional signage system likewise improves the user experience, fostering connections between subject areas and call numbers. Visual signage systems can also facilitate direction-giving for library staff and improve ease of direction-following for users. By adjusting elements to suit the requirements of local classification schema, the benefits of incorporating these readily adaptable symbols into a visual signage system, designed with intentionality for usability and accessibility, can be extrapolated to a broad range of academic library and user needs.

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Note

¹ *Symbols for Visual Signage and Academic Library Wayfinding*, <https://dataverse.harvard.edu/dataverse/library-symbols>.

Appendix A: Participant demographics: survey and focus groups, and user testing.

Demographics	Survey (n = 487)	Focus group (n = 30)	User testing			Total (n = 531)
			Baseline (n = 4)	Partial (n = 3)	Complete (n = 7)	
Gender						
Female	62.2%	55.2%	50%	100%	42.9%	61.6%
Male	36.8%	44.8%	50%	0	42.9%	36.7%
Transgender	0.2%	0	0	0	0	0.18%
Other	0.2%	0	0	0	0	0.18%
None/nonbinary	0.2%	0	0	0	14.3%	0.38%
Age						
18–21	9.0%	13.3%	25%	66.7%	42.9%	10.2%
22–25	14.8%	10%	25%	33.3%	28.6%	14.9%
26–30	9.2%	10%	-	0	28.6%	9.4%
31–40	22.0%	10%	25%	0	0	20.9%
41–50	22.2%	13.3%	-	0	0	21.1%
Over 50	22.0%	30%	25%	0	0	22.0%
Challenges						
Trouble reading or understanding what you read	9.2%	6.7%	0	33.3%	0	9.0%
Blindness	0.6%	0	0	0	0	0.57%
Partial blindness (not corrected by glasses, etc.)	0.8%	3.3%	0	0	0	0.94%
Colour-blindness	0	0	0	0	0	0
Partial colour-blindness (red-green colour-blind, etc.)	1.4%	6.7%	0	0	0	1.7%
Primary language						
English	94.9%	83.3%	100%	100%	100%	94.4%
Not English	4.5%	16.7%	0	0	0	5.1%
Role						
Student	38.2%	36.7%	100%	100%	100%	39.7%
Faculty (tenure-track)	20.8%	16.7%	0	0	0	20.0%
Faculty (adjunct)	0.2%	3.3%	0	0	0	0.38%
Academic support staff	10.3%	6.7%	0	0	0	9.8%
Administrative staff	19.1%	26.7%	0	0	0	19.0%
Other staff	11.5%	10%	0	0	0	11.1%
Frequency of library use						
Daily/almost daily	1.2%	10%	0	0	0	1.7%
1–3×/week	5.1%	16.7%	25%	0	0	5.8%
1–3×/month	13.8%	16.7%	25%	66.7%	42.9%	14.7%
1–3×/semester	36.8%	36.7%	25%	33.3%	14.3%	36.4%
Never/almost never	42.9%	20%	25%	0	42.9%	41.2%
Department						
WSU Administration	12.3%	20.0%	0	0	0	12.4%
College of Arts & Humanities	11.3%	20.0%	100%	66.7%	14.3%	12.8%
College of Engineering, Applied Sciences, & Technology	5.5%	3.3%	0	0	0	5.3%
College of Social & Behavioural Sciences	6.4%	3.3%	0	0	0	6.0%

Appendix A: Continued

Demographics	Survey (n = 487)	Focus group (n = 30)	User testing				Total (n = 531)
College of Education depts.	5.5%	0	0	0	0		5.1%
College of Science	6.4%	3.3%	0	33.3%	71.4%		7.2%
College of Health Professions	10.5%	3.3%	0	0	0		9.8%
School of Business & Economics	6.0%	0	0	0	14.3%		5.7%

Appendix B: Student participant status and experience.

Student demographics & experiences	Survey (n = 186)	Focus group (n = 11)	User testing			Overall (n = 211)
			Baseline (n = 4)	Partial (n = 3)	Complete (n = 7)	
Student Categories						
1 st generation	39.8%	36.4%	75%	33.3%	42.9%	40.3%
International	2.2%	9.1%	0	0	0	2.4%
Non-traditional	39.8%	36.4%	75%	0	28.6%	39.3%
Student veteran	2.2%	0	25%	0	0	2.4%
Other minority	8.1%	18.2%	0	33.3%	28.6%	9.5%
Degree program						
Certificate/Associate's	9.1%	9.1%	25%	0	28.6%	10.0%
Bachelor's	65.1%	72.7%	75%	66.7%	71.4%	65.9%
Graduate	9.1%	0	0	0	0	8.1%
Attendance						
Part-time student	12.4%	9.1%	0	0	0	1.9%
Full-time student	77.4%	81.8%	75%	100%	85.7%	78.2%
Library Instruction						
One-shot sessions	40.3%	36.4%	50%	66.7%	28.6%	40.3%
For-credit library class	32.8%	45.5%	100%	66.7%	28.6%	35.1%
Passed test-out exam	8.1%	18.2%	25%	0	28.6%	9.5%

Appendix C: Survey results: incorrect matches by campus demographic.

Campus demographic	<i>n</i>	Percentage of participants who incorrectly matched:					Average matches incorrect (%)
		0 or 1 symbol	2 symbols	3 symbols	4 symbols	5 or 6 symbols	
All participants	484	15.5	33.1	28.7	16.9	5.8	45.5
Campus role							
Student	184	10.9	28.8	34.2	19.0	7.1	48.9
Faculty	102	15.7	37.3	26.4	14.7	5.9	44.5
Staff	198	19.7	34.9	24.7	16.2	4.5	42.8
Age							
18–21	44	9.1	22.7	36.4	20.4	11.4	51.7
22–25	72	9.7	22.2	43.1	18.1	6.9	50.9
26–30	45	17.8	35.6	26.7	13.3	6.6	43.9
31–40	106	15.1	37.7	25.5	18.9	2.8	43.8
41–50	108	13.9	42.6	23.2	15.7	4.6	43.0
Over 50	106	22.7	30.2	26.4	16.0	4.7	43.7
Library use							
Daily/almost daily	6	0	0	66.7	33.3	0	58.9
1–3 times/week	24	20.8	25.0	33.4	12.5	8.3	42.4
1–3 times/month	66	15.2	31.8	31.8	19.7	1.5	45.4
1–3 times/semester	178	13.5	39.3	26.4	14.6	6.2	44.6
Never/almost never	208	17.3	30.3	27.9	17.8	6.7	46.1
Other considerations							
Visual challenges/ trouble reading	56	7.1	32.1	28.7	23.2	8.9	50.5
English 1 st language	461	16.3	33.6	28.6	16.3	5.2	44.9
English not 1 st language.	21	0	19.1	28.5	33.3	19.1	59.1

Appendix D: Survey results: incorrect matches by student demographic.

Student demographic	<i>n</i>	Percentage of participants who incorrectly matched:					Average matches incorrect (%)
		0 or 1 symbol	2 symbols	3 symbols	4 symbols	5 or 6 symbols	
All students	184	10.9	28.8	34.2	19.0	7.1	48.9
Degree program							
Associate's	17	11.8	17.6	41.2	23.5	5.9	48.4
Bachelor's	121	13.2	28.1	35.5	16.5	6.7	48.2
Graduate	17	0	58.9	17.6	23.5	0	44.5
Attendance							
Full-time	144	13.2	25.7	34.8	19.4	6.9	48.8
Part-time	23	4.4	52.2	26.0	13.0	4.4	44.4
Library instruction							
One-shot session	75	10.7	30.6	32.0	18.7	8.0	47.8
For-credit class	61	6.6	32.8	36.1	19.6	4.9	48.3
Other considerations							
1 st generation	74	13.5	35.1	25.7	20.3	5.4	45.7
Minority	15	6.7	13.3	40.0	33.3	6.7	54.5
Non-traditional	74	12.2	36.5	28.4	21.6	1.3	45.3