Collaborative Sciences Center for ROAD SAFETY

Coffee and Conversation Speaker Series

Proceedings from "Designing for All: A Human Factors Perspective"
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The third installment of the Collaborative Sciences Center for Road Safety "Coffee and Conversation" series focuses on the theme *Building Resilience into a Transportation System for All*.

To kick off the series, Highway Safety Research Center (HSRC) Senior Human Factors Engineer Michael Clamann delivered a talk entitled "Designing for All: A Human Factors Perspective." The art of designing for people with disabilities is often approached as a "special topic." However, many design features that support special populations can also make the world more usable for everyone. In this session, Michael Clamann discussed approaches to Universal Designs that work for everyone, independent of age, physical ability and mental aptitude.

"How do you design systems that are more user-friendly?" Clamann asked. "When we think about users, we need to think about all users at various abilities."

In defining disability, Clamann critiqued the American Disabilities Act Amendment (2008) definition: "A physical or mental impairment that substantially limits one or more major life activity."

He emphasizes the need to think of impairment as something that is part of everyone's experience within the built environment. For that reason, Clamann favors the definition by well-known design consultant, writer in the field of design, author and public speaker Ralph Caplan: "The inability to accommodate a bad design."

According to the 2010 U.S. Census, more than 19% of the population is disabled according to ADA standards. However, Clamann cites another statistic: By age 65, people have a 35.4% chance of having a disability. At age 80, that possibility increases to 71%.

"Everyone in this room is at some point going to have a disability," asserts Clamann. "So, when designing for the disabled, we are designing for ourselves."

In terms of design, one can see the road intersection as a starting place. Displaying an image of a busy street intersection, Clamann asks: How does someone with visual impairment navigate this space? How does someone with hearing impairment use the space? How does a wheelchair user move through this space?

Additionally, when discussing the concept of impairment, all of us are impaired at one point or another, said Clamann. If construction workers are drilling the street, for example, users of the road will be temporarily hearing impaired. This makes users of the road unable to hear sirens or oncoming traffic. If while walking, a parent must attend to a child who is yelling, the parent may have to pick the child up and proceed. The parent's pace is slowed, and hearing is impaired because of the screaming child. How will this person navigate the road safely? There are myriad examples that fall outside the normative definition of disability.

"The truth is we are not operating under normal circumstances," said Clamann. "When you design for disability there are induced benefits to all of society."

A look at the case of curb cuts demonstrates this, says Clamann. The sloped curb was designed in 1945 to provide wheelchair access to veterans of World War II. These products of civil engineering are useful for baby carriages and shopping carts to cross intersections.

In another case study, Clamann points to the design of elevators. Engineers attempted to solve a problem: preventing wheelchair users from getting caught in doors. After attempting to lengthen the time it took for elevator doors to close, it became apparent that what was truly needed was some notification. Currently, there is some visual and audible cue that the elevator is making its way to your floor. People waiting for the elevator could line up when notified. This benefits everyone.

Approaches to design come in three ways:

- **Change the person:** This could be through surgery, education, or skill development.
- **Provide bridging tools:** Design devices to adapt individual parts of the world to match skills.
- **Change the way the world is designed:** Universal and accessible designs that work for all. This is the ideal.

Universal design, says Clamann, is the practice of designing products and environments to be usable by all people to the greatest extent without adapted or specialized design. It involves establishing needs and a set of criteria to measure design performance. Four suggestions on examining these human factors include:

Perceiving

- Controls, feedback, and displayed information. Is it easy to know what you are observing?
- Multiple sensory modalities: Is there more than one way to obtain the information. Are instructions both announced and printed?

Understanding

- After you perceive it, do you know what it's there for?
- Is the design intuitive to the user to make use of functions?
- Can the user interpret displayed info and output? Are the interactions between user and design compatible?

Operating

- Safely carry out all the functions within the time allowed. An example of this is whether there is actually enough time for all users of the intersection to cross.
- Is height accessible to all, including children and wheelchair users?
- Consider efficiency productivity requirements. Are the colors contrasted enough to quickly make decisions?
- Can buttons have tactile signals. For example, the button on a crosswalk signal. You can feel which way the arrow is pointing. The button is located at a height accessible to children and wheelchair users.

Compatibility and assistive technology

Is there a back-up to design where technology is integrated into the user experience? An example of this is headphone jacks installed in ATMs, so that the visually impaired have access. Are there multiple access points depending on how information can be consumed?

“You may have heard that if you design something for the 50th percentile you are reaching the most people,” said Clamann. “That's not really useful. No one is really at the 50th percentile. Design does not work that way. We should aim to design for the most people.”

Some other guidelines include:

- Maximize the number of people who can hear an auditory signal
- Use sounds in middle to low frequencies (500-3000Hz)
- Use 2 middle to low frequencies
- Have a brief alert indicating a message is coming
- Communicate important information through redundant channels (audio, visual, tactile)
- Consider physical placement and line of sight.
- Consider reach envelopes: If something is high, can everyone reach it?
- Make controls easy to find and identify
- Put labels on controls
- Follow movement stereotypes
- Make visual information clear and readable
- Large letters, mix upper and lower case (We don't read capital letters as quickly as lowercase)
- Color should not carry information (consider shapes instead)
- Use filters and surface treatments to minimize glare (for all ages!)
- Don't abbreviate

Portland implemented many of these guidelines. Clamann displayed one way the city does this. Bike and walking lanes are contrasting colors so that as one changed mode, one would be able to discern the transition.

Yet another example at the conceptual level is the U.S. Department of Transportation's (USDOT) "The Complete Trip." Using the narrative of a trip to and from the doctor for a person with visual impairment, the agency outlines funding across six categories to improve accessibility. When considering universal design, the narrative asks: "Can a person with a variety of abilities get from their home to where they want to get and back again?"

Clamann admits there is no easy solution, however, he says a willingness to evolve solutions is crucial.

"You want to the best design possible. You have to do it knowing that you might not have nailed.it. At least be open to changing it."

Further Reading:

- Principles of Universal Design (poster): https://projects.ncsu.edu/design/cud/pubs_p/docs/poster.pdf
- Universal design and accessible transit: http://es.easterseals.com/site/EcommerceDownload/Universal_Design_FactSheet-5821.pdf?dnl=90752-5821-761N6ivu74JPUrFe
- Accessible Transportation Technologies Research Initiative (ATTRI): https://www.its.dot.gov/research_areas/attri/index.htm
- National Association of City Transportation officials (NACTO) Universal Design elements: https://nacto.org/publication/transit-street-design-guide/stationsstops/stop-design-factors/universal-design-elements/