

CASE STUDY

Conveying Web Page Layout to Blind Users via Spatial Audio



Challenge

Blind users use screen reading software (i.e., screen readers) to access web pages. Screen readers deliver web content and some HTML markup information to users via synthesized speech. Due to the linear nature of speech, most layout information is lost in this process. Consequently, blind users have reported problems when performing activities or tasks that concern spatial concepts, for example, when talking about web page design with sighted people.

Research

I conducted a formative research study to explore the potential of using spatial audio feedback to help screen reader users perceive web page spatial information. As the principle researcher, I performed all activities in the research, including:

- Developed a web-based spatial audio screen reader prototype
- Implemented web-based data collection instruments
- Designed a mixed-method study
- Planned the research protocol and obtained necessary ethical approval
- Sought funding for the study
- Worked with local blind communities to recruit participants with visual impairments
- Moderated all 20 user study sessions
- Collected both qualitative and quantitative data
- Analyzed data using qualitative open-coding methods and statistical methods
- Wrote paper reporting the study findings

Approach

Each one-on-one study session included three main parts. In the first part, participants were instructed to make sense of spatial terms using the research prototype. In the second part, participants were asked to illustrate their mental models of a web page using puzzles on a whiteboard. The third part was a semi-structured interview where participants provided their feedback on the prototype and the general design concept.

The study utilized surveys, semi-structured interviews, and log data. Participants completed a customized questionnaire measuring their attitudes towards the prototype and the standardized System Usability Scale questionnaire. The semi-structured interview discussed three topics: usability, feedback, and potential applications. Finally, a script recorded each participant's keystrokes, i.e., the interaction with the prototype.

Findings

- Spatial audio feedback enables screen reader users to make sense of common spatial terms.
- Just basic spatial audio feedback is sufficient for screen reader users to reconstruct the layout of simple web pages used in the study.
- Participants found stationary spatial audio feedback more useful than moving audio feedback that depicts navigation direction.
- Interpreting spatial audio feedback is not an easy task! The process imposes high cognitive workload.
- Inexperienced screen reader users had more difficulties comprehending spatial audio feedback; some highly experienced screen reader users also expressed negative views due to their strong adherence to existing interaction routines.
- Spatial audio feedback is most useful when communicating with sighted people as spatial terms were often unavoidable.

Design implications

- Spatial audio feedback features should be optional to allow adoption based on a user's individual skill level.
- Task-oriented feature sets can be designed to help users utilize spatial audio feedback in the most appropriate use cases.
- Sound designs should encode only simple, easy to interpret information.