UNDERSTANDING TACTILE PERCEPTION FOR DESIGN OF EFFECTIVE TACTILE GRAPHICS

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ABSTRACT

Many students with blindness become interested in STEM in their school years, but unlike their sighted peers, blind and visually impaired (BVI) students often find themselves at a disadvantage because the ubiquitous use of diagrams, charts and graphical information in education is not available to them in accessible formats. In addition to conversion of text into braille or audio, accessible adaptations of visual representations are essential to support the learning of most STEM subjects. To promote participation and interest of blind students in STEM, thus paving a way for prospective future academic and career opportunities, the urgent need for accessible educational resources should be met.

The primary method for making visual graphical information more accessible to BVI individuals is to translate visual graphics into tactile graphics (TGs), sometimes called “raised line” graphics. Tactile perception is key to comprehension of tactile graphics. Making effective tactile graphics requires an in-depth understanding of how BVI students perceive and learn with TGs. This is the subject of present research.

The present work investigates and evaluates the discriminability, memorability and semantic capacity of TG shapes composed of design primitives, whether as individual shapes or in table-top layouts. It evaluates the role of these primitives in tactile perception of graphical and positional/spatial information and its retention. The research also attempts to evaluate the pedagogical use of the empirical insights through validation trials and games. Further, this work evaluates the use of variable height in tactile graphics and how it can be used to make graphics more effective and intuitive.

The above-mentioned questions have been addressed by studying different tactile graphic design strategies and elements. A set of experiments which use a two-step exploration approach has been adopted: (1) tactile graphical stimuli designed using novel strategies were presented to participants followed by a recall test using verbal questions or a test challenging subjects to learn then recreate sequences or layouts of tactile tiles; (2) information is presented in association with these tactile stimuli to test how well they facilitate the retention of information presented verbally in association with the tactual experience.

The results of this work can help in improving guidelines for various types of information media, primarily in tactile graphics which are frequently part of tactile books and accessible interfaces. They can facilitate the development of effective tactile material. Additionally, the insights can help shape and evolve the pedagogies for students with blindness, to make learning more effective and engaging.