Fostering shared intentionality for diverse learners through cross-sensory interaction design

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Summary

As the theme of this year's conference suggests, cognitive diversity among learners and educators is increasingly acknowledged. However, in our societies that increasingly require advanced education, training, and technical skills, the pressure to standardize learning objectives, delivery techniques and delivery tools, especially online, is high. In these situations, learners and educators of diverse cognitive phenotypes and abilities experience learning environments that are a poor match for their abilities, making effective delivery of educational content challenging. However, with such vast human variation, many learners and educators are experiencing benefits as well as challenges in online settings, accelerated by the COVID-19 pandemic. For example, working remotely provides neurodiverse individuals with greater control over their environments, in terms of noise, light, potential distractions and comfortable seating. (Das et al., 2021). In contrast, structured routines (e.g., commuting to class) vital for executive function are often lost (St. Amour, 2020). Neurodiverse learners may benefit from this new paradigm if their accessibility challenges can be met.

Evidence-based strategies that account for the now extensive (due to COVID-19's social distancing) lived experiences of those affected by these mismatches are still emerging. By moving forward with design that is informed by these accounts, researchers and developers position themselves to make observations while responding to real-world needs. In this way, our proposed workshop will aim to better understand lived experiences and challenges of workshop participants in their roles as learners or educators through co-design, a methodology in which participants actively engage in the design process.

Successful deployments of inclusive learning are thought to benefit all students (Alqurani and Gut, 2012). However, the needs of educators are rarely considered, nor do they often feel properly equipped with the knowledge, competencies, tools, or policies to foster these outcomes independently (Longfellow, 2021; Ware et al, 2021).

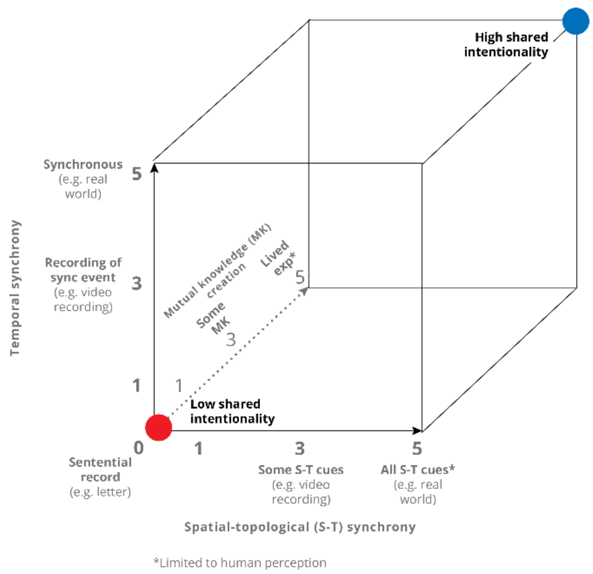

Figure 1: Model depicting conditions that foster high and low shared intentionality.

Cross-sensory interaction design entails two or more sensory modalities to redress these mismatches experienced by cognitively diverse as well as blind and partially sighted learners (Ghodke et al., 2019; Han, 2020; Murgaski, 2020) by fostering *shared intentionality*, the capacity to participate in collaborative activities with shared goals and intentions (Tomasello et al., 2005). Our workshop will utilize a conceptual model (from Lee, Sukhai & Coppin, 2022) that applies this research on shared intentionality to digitally mediated interactions by recruiting Larkin and Simon's (1987) model for distinguishing diagrams versus sentences (the types of external representations graphical user interfaces are composed of). The conceptual model is composed of three dimensions. The first, by adapting Larkin and Simon (1987), is *spatial-topological synchrony* (Fig., 1, x-axis), which is the degree to which Information and Communication Technologies (ICTs) (e.g., Zoom) convey perceptual cues such as gesture, body location and visual-spatial representations. *Temporal synchrony* is the degree to which interactions are asynchronous or synchronous. *Mutual knowledge creation is* the degree to which new knowledge is jointly constructed from diverse perspectives (Lee et al., 2022). 0,0,0 (Fig. 1, red dot) denotes a scenario where shared intentionality is low, because cues for the success of shared goals are insufficient as visually represented spatial, topological, and geometric relations in the environment are not accessible, for example, to blind and partially sighted learners (cf. Coppin et al., 2016). 5,5,5 (Fig. 1, blue dot) denotes a scenario where shared intentionality is high because interactions in a physical space using a hand-over-hand technique is accessible to blind and partially sighted participants.

Thus, these models foreshadow the workshop's goal of co-designing and discussing strategies for inclusive learning environments. Specifically, the objectives of the workshop are (1) to allow participants the opportunity to explore new tools and strategies for creating inclusive educational materials through cross-sensory prototyping; (2) to generate insights on relevant challenges for diverse accessibility needs and technical expertise; and (3) to use insights from the prototyping to develop our lab's research objectives and the features and user experience of a prototyping tool[1]. Participants must register in advance, for preparations involving their interests in a problem space that may be addressed through these activities to be discussed.[1] [2]

The workshop is aimed at building cross-sensory prototypes with options for utilizing everyday household materials and two software programs[1] [2]. To begin the workshop, an information session thirty minutes in length will be held to familiarize the participants with co-design methodologies, effective strategies for cross-sensory prototyping, for example, making use of affordances-based theories (Gaver, 1991), and example projects such as the those from Ghodke et al. (2019); Han (2020); and Murgaski (2020).

Following this, a co-design session will be held in two parts. In the first part, low fidelity prototyping will be used to generate promising concepts based on participants' lived experiences, or with the assistance of a multi-disciplinary team of workshop facilitators from our research lab. After thirty minutes, a twenty-minute discussion will occur with the full group to share insights and recommendations for the next steps in prototype building. The second part will be a seventy-minute continuation of prototyping, with additional tools to foster further creativity and higher fidelity outcomes. Participants will be introduced to software[1] [2] with 3D assets and visual and auditory annotating features. Once completed, a second group discussion will further develop insights and recommendations for constructing inclusive learning environments, for thirty minutes.

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[1]Cross-Sensory Mixed Reality Authoring (CSXR) software developed in collaboration with

[2]Adobe Aero (if participants have access)