Value Sensitive Design for Neurodiverse Teams in Higher Education

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ABSTRACT
In a neurodiverse team, such as one comprised of students with autism and neurotypical students, social interaction and cognitive styles differ. We used a Value-Sensitive Design (VSD) approach to explore the role of technology in supporting the diverse values of neurodiverse teams. We conducted interviews with higher education disability services staff, followed by interviews with students with autism. We analyzed the students' values using the Q-Methodology. We found that key values of students with autism are: *freedom from stigma, individual comfort, social comfort, social connection*, and *team cohesion*. Through a VSD technical investigation, we found that current collaboration and affective technologies focus on supporting *social connection* and *team cohesion*. However, these technologies tend to not enable tailoring the user experience for the *individual comfort* that can benefit autistic users.

CCS Concepts
Human-centered computing – Collaborative and social computing; Accessibility – Empirical studies in accessibility

Keywords:
Autism; neurodiversity; value-sensitive design; collaboration

1. INTRODUCTION
According to a study by the U.S. Department of Education [5], 47% of young adults with autism enrolled in a postsecondary institution within 6 years of graduating from high school. Among that group, only 35% of that group earned a degree, as opposed to a 51% completion rate for the general population. In higher education, class-based teams require students to work together in a high-pressure and unpredictable environment. For a team to function, the students need to use collaboration skills including communication, planning, and organization. Some class-based teams will be neurodiverse, such as those comprised of students with autism and neurotypical students. The team dynamics of neurodiverse teams will be constructed by the skills and working styles of all team members. Individuals with autism have diverse social, communication, and cognitive styles that influence their social dynamics and their approach to performing at school or work. In related research [4], adults with autism reported feeling pressure when communicating face-to-face: managing eye contact, interpreting the expressions of others, and responding at the right tempo. Interpersonal and workplace challenges can include "difficulty interpreting nuance in the meaning of coworkers' statements, difficulty interpreting coworkers' emotions, difficulty dealing with office politics, and difficulty handling conflicts" [3]. To explore the role of technology in supporting neurodiverse teams, we used a Value-Sensitive Design (VSD) approach [2]. VSD facilitates a close analysis of the ways that stakeholder values are supported or inhibited by technology. We conducted VSD conceptual, empirical, and technical investigations focusing on our research questions: (1) What are the values of autistic students in relation to class-based teamwork? (2) How does team-focused technology support stakeholder values? We conducted semi-structured interviews with five higher education disability services staff, followed by semi-structured interviews with seven students with autism. This paper reports on our preliminary analysis of our interviews with the higher education staff, as well as the students' Q-Methodology ranking of value statements [4]. We found that, within the context of class-based teams, autistic students value *freedom from stigma, individual comfort, social comfort, social connection,* and *team cohesion*. Through our technical analysis, we found that collaboration and affective technologies support general notions of *social connection* and *team cohesion*. However, there is opportunity for technology to better support needs around *individual comfort*.

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2. METHOD
For our VSD conceptual investigation, we drew from related work and autism-related online blogs and forums to determine the stakeholders who would be directly or indirectly affected by technologies. For the key stakeholders, we identified their core values (e.g. *individual comfort*) related to team work and identified trade-offs between values inherent in different technology concepts. For our first phase of empirical investigation, we conducted interviews with five employees of student disability services. Based on our conceptual analysis and staff interviews, we generated 15 value statements representing the emerging values. For instance, the values of *freedom from stigma* and *social connection* were reflected in statements such as "I want my teammates to know I have autism" and "I do not want to stand out as different than my teammates." The value of *individual comfort* mapped to statements such as "It is helpful for me to talk with someone about how my team is doing." and "I want things to be straight-forward." For our second phase of empirical investigation, we conducted in-person or online semi-structured interviews with seven adults with autism (4 female; 3 male) who were enrolled in college either currently or within the past two years. Interview questions and value statements are available upon request. Per the Q-Methodology, the participants ranked the value statements along a "strongly disagree" to "strongly agree" scale. In the five-column template, the participants were required to place two statements in the "strongly" disagree/agree columns, three in the "mostly" agree/disagree columns, and five in the middle "no opinion/mixed feelings" column. Finally, we conducted a VSD retroactive technology investigation of the team-based technologies we identified during our literature review and empirical investigations. Our team

analyzed how these technologies met or conflicted with the values of our participants.

3. FINDINGS

3.1 Values of Neurodiverse Teams

The stakeholders for technology designed to support neurodiverse teams include members of a class: student(s) with autism, neurotypical teammates, other classmates, the teaching assistant, and the professor. There are also stakeholders who are not directly involved in a class setting: peers and family of individuals with autism, and university employees who work in student disability services, information technology, and administration. An even broader set of stakeholders are the policy makers and funders of the university, including public and private funders. Our investigation focused on the perspectives of students with autism.

Students with autism value *freedom from stigma*, with four interview participants strongly agreeing (and three having mixed opinions) that there is a stigma associated with autism. Some participants cited perceived stigma as a reason for sometimes not disclosing their diagnosis to teammates or professors. Five participants expressed that although they feel there is a stigma associated with autism, this is stigma perceived by others, not self-stigma, so they prefer to be open about their autism. These students tended to be upfront about their preferred communication and work styles. Autistic students value *individual comfort*, which we define as being able to interact and work in ways that feel physically, emotionally, and intellectually natural to oneself. Autistic students value *team cohesion*, which is the degree to which members of a team contribute to a task at hand and foster productivity by setting and attaining meeting goals [6]. Team cohesion can benefit from enhanced interpersonal *social connection* (i.e.; connecting on a personal level in addition to a professional level). However, all our participants favored straightforward, predictable team interactions. The majority of our participants preferred spending meeting time on project tasks, rather than discussing topics unrelated to the project. All the participants expressed underlying concerns about privacy and trust inherent in *social connection, individual comfort,* and *social comfort*. *Social comfort*, which we defined as following social norms and supporting each other's needs, can be difficult for all stakeholders depending on the team dynamics and the level of open, supportive communication.

3.2 Values of Technologies Supporting Teams

Adults with autism actively use Computer Mediated Communication (CMC), such as online communities, to foster relationships, although there are disadvantages [1]. Burke et al. speculate the social affordances of CMC can work well for these adults due to technology affordances of highly-structured environments without extraneous stimuli, asynchronous communication, visual anonymity, and privacy. Exploring technology-based social awareness, Williams et al. designed a smart scarf, SWARM [7], that used lights to convey the wearer's physiological state. Although designed for a range of users with disabilities, the scarf was inspired by weighted vests, which are used by some in the autism community for physical and sensory comfort. Our technical analysis found that primary technologies designed for teams can be placed in two categories: (1) tools that support collaborative work both for content sharing (Google Drive and Microsoft SharePoint) as well as project coordination and communication (Slack and email); and (2) affective computing prototypes designed for teamwork settings (SmartHeliosity [6] and SWARM). The content sharing and electronic communication tools allowed for asynchronous communication and fewer non-verbal social cues to interpret, therefore, generally supporting *social connection, freedom from stigma*, and *social comfort*. However, students with autism may feel constrained by the tools since they do not offer customizations or features to address issues around *individual comfort*. For instance, some individuals with autism are highly visual thinkers, while others may rely on text. Existing tools tend to require teams to use one mode, without the flexibility of different views for different users. The affective technologies are designed to communicate the emotional state of an individual or a team to promote *team cohesion* and *social connection*. However, students with autism may want more explicit support from affective technology, such as discrete naming of emotional states rather than communicating via ambiguous colors. They may prefer more personal and private expressions of emotions depending on their *individual comfort* needs, which can change over time.

4. CONCLUSION AND FUTURE WORK

Our VSD approach allowed us to begin developing a holistic understanding of the dynamics of neurodiverse teams. We identified primary value tensions within a team regarding *team cohesion* and the need for *freedom from stigma, individual comfort,* and *social comfort.* Another key tension was between *social connection* and *team cohesion.* In future work, we will complete our analysis of the interviews with higher education staff and autistic students. We will create a design framework to brainstorm technology-based tools to facilitate teamwork. Although technology cannot eliminate value tensions, we hope to identify opportunities for technology to mediate tensions leveraging strategies already used by stakeholders—such as fostering collaborative reflection and decision making by enabling communication with trusted peers and staff.

5. REFERENCES

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