Cognitive and Pedagogical Benefits of Multimodal Tabletop Displays

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This workshop position paper describes our prior and ongoing work, which explores how multimodal tabletop displays can support cognitive processes and pedagogical goals. Our work ranges from applications involving adolescents learning social skills to enabling communication between deaf and hearing individuals. Currently we are examining how capturing and representing conversation on a multimodal tabletop display could aid in language learning, enhance memory, and promote reflection.

Introduction

Interactive tabletop displays are a promising medium for enabling cooperative computing scenarios. The horizontal form factor of a multitouch tabletop surface allows multiple people to simultaneously interact with the same representation. Multimodal tabletop displays combine multiple modalities of input such as touch, speech, and keyboard entry. The benefits of multimodal tabletop displays for educational applications seem endless; however, few studies have specifically examined the cognitive and pedagogical benefits of multimodal tabletop displays. In this paper I summarize our prior and ongoing research involving tabletop displays as well as describe future directions for this work.

Tabletop Research

La Mesa de Clasificación (LMC) [3] is a project that examined the educational benefits of using a digital table to facilitate foreign language learning. The application allowed four language learners to sit at the tabletop display and cooperatively categorize facts about various Spanish speaking countries. The goal was to facilitate discussion in the foreign language. While this project focused on how tabletop interface design affected participation and cooperation, the research did not address actual learning outcomes from using the tabletop compared to traditional in class exercises. This is an area for improvement, but the broader idea of using an interactive tabletop display for language learning is a promising area for future work.

The SIDES project [2] examined how a cooperative tabletop computer game could encourage adolescents with Asperger's Syndrome (AS) to practice effective group work skills. Adolescents with AS have difficulty reading facial expressions as well as understanding and applying accepted social protocols. Individuals with AS are more comfortable with rote instructions and do best with a consistent, predictable routine. The social challenges these individuals face make learning effective group work skills an especially daunting task. SIDES leverages adolescents' interest in computer games to encourage and motivate a cooperative problem solving task. Research on SIDES found that middle school students with AS were motivated by the cooperative computer game and worked together to solve the problem. Findings also indicate that having the computer enforce rules such as turn-taking and game piece ownership, rather than have a therapist or adult "police" game play, was important as the computer is more predictable and consistent than a human.

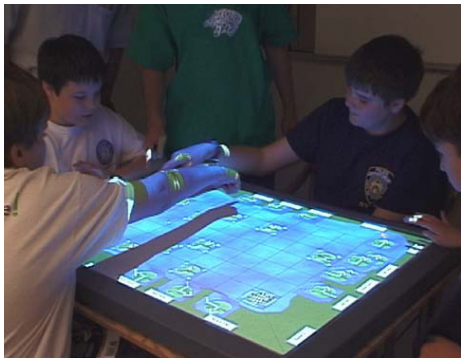

Figure 1: four adolescents playing SIDES.

Figure 2: doctor and patient using SSI.

Our work on Shared Speech Interface (SSI) [1] examined how a multimodal tabletop display supports communication between a deaf patient and a hearing, non-signing medical doctor. Typically an American Sign Language interpreter enables communication between a deaf patient and their doctor; however, many medical

conversations involve sensitive information and the presence of the interpreter may inhibit the deaf individual's desire to speak candidly with the doctor. Furthermore, when an interpreter is present, the deaf patient must focus their attention on the interpreter and cannot attend to the doctor's facial expressions, gestures, and body language. SSI allows the doctor to speak into a headset microphone and the deaf patient to type on a keyboard. As both people speak, their speech appears on the tabletop in the form of speech bubbles. SSI transforms ephemeral dialogue into a tangible and persistent form that can be rearranged and referenced later. By removing the temporal nature of speech and the need for a human interpreter, the doctor and patient can better attend to each other while communicating and discuss sensitive information without another person present.

Future Directions

One question that guides our current research is how multimodal tabletop displays could support group activity and learning by representing real time dialogue between people. Our work with the deaf community begins to address some of the benefits of viewing a shared representation of conversation, but there is much to learn about how other populations could benefit from viewing a real time shared transcript of conversation.

Language Learning. Providing learners with a shared representation of language in both a literal textual form and an auditory form (i.e., could tap on a speech bubble and hear the phrase repeated) is cognitively and pedagogically valuable. For example, a native speaker and a foreign language learner could work together around the tabletop. Together they could access literal text translations as well as the original auditory form. Another population that stands to benefit from this approach includes individuals with Aphasia or people who are recovering from a stroke. This population often has a major loss of language, and a shared representation of conversation could potentially help the impaired individual communicate with others and regain language.

Enhancing Memory. This approach also stands to benefit hearing, non-impaired individuals as a memory aid and enhancement to traditional face-to-face communication. This is especially relevant for supporting co-located problem solving or reasoning tasks, where reviewing previous dialogue could be instrumental in reaching a solution and solving the problem. Elderly users could also benefit from seeing a shared representation of conversation, as many older individuals suffer from slight hearing or memory loss. A shared transcript of conversation could provide enough support to help this group function as they previously did.

Promoting Reflection. Viewing a shared representation of conversation from a cooperative task could also aid in reflection after the task and overall learning. This is especially interesting for cognitively intensive problem solving tasks involving multiple people over multiple sessions of work. We are currently designing studies to assess how valuable a real time transcript of conversation would be for reflection and whether this information would inform future decisions.

Conclusion

Our work on multimodal tabletop displays provides a starting point for thinking about the broader educational impact of these devices. Multimodal tabletop displays are a rich medium for facilitating cooperative learning scenarios, and this paper identifies several areas that need further exploration. I look forward to discussing the tradeoffs of using shared interfaces, particularly tabletop displays, for educational purposes with other workshop attendees.

Acknowledgements

Research is supported by a NSF Graduate Research Fellowship, NSF Grant 0729013, and a Chancellor's Interdisciplinary Grant. We also thank MERL for donating a DiamondTouch table to our laboratory.

References

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