Eliciting Intuitive Actions for Whole-Body Natural User Interfaces

Aaron May
Simon Fraser University
250-13450 102 Ave
Surrey, BC Canada V3t0E7
amay@sfu.ca

Alissa Antle
Simon Fraser University
250-13450 102 Ave
Surrey, BC Canada V3t0E7
aantle@sfu.ca

DIS 2014 Workshop on Social NUI: Social Perspectives in Natural User Interfaces, June 21, 2014, Vancouver, BC, Canada.

Abstract
Thanks to technological advancements, Whole-Body Natural User Interfaces (WB-NUI) are becoming increasingly common in North American homes and public spaces. However, because WB-NUIs lack obvious affordances, users can be unsure how to control the interface. We are presenting a research design for an upcoming study to be completed in the summer of 2014. By studying users mock controlling a WB-NUI interface during a Think Aloud task, we hope to find common themes in their actions that can be incorporated in future designs of the system.

Author Keywords
Whole body; NUI; Intuitiveness; Interaction;

Introduction
The release of a new wave of whole-body consumer technology such as Microsoft's Kinect has resulted in a wave of interest in body- and gesture-sensing. Although many of these applications are being developed for the home in the form of video games or computer controls, we are also seeing increased deployment of WB-NUIs in public spaces such as festivals and museums. One critical difference between these two situations is that home WB-NUIs emphasize expertise (the user must be able to become very good with the interface over a long period of time) and

flexibility (the interface will likely control many different aspects of the system), whereas public space WB-NUIs emphasize intuitiveness (the user instinctively knows how to control the system). This is because users in a public space situation frequently spend very little time with the system, certainly not enough to gain mastery of dozens of commands. It is like the five second rule in web design- if a museum patron can't figure out how to work the system within a short amount of time, they will quit and move on to a different exhibit.

Another important difference is that NUIs in public spaces have a social component that influences user actions. For example, individuals may feel self-conscious using large, dramatic movements to control a system in a crowded museum or art gallery. A system that recognizes smaller motions utilizing only the hands or arms may be preferred over those that track the body's position in space. Additionally, a system that inspires instant competency is preferable to one that requires more trial-and-error. We expect that this social effect would be more prevalent for adult users than child users, and may even vary depending on cultural background or other social factors.

So, in order to better design WB-NUIs for these public spaces, an increased understanding of what people expect before they use system is necessary. To accomplish this, we propose augmenting the study of intuitiveness of interaction sets based on known mapping strategies [3, 5] with the study of elicited user interactions and their relationship to those mapping strategies.

Related Work

Within a Human-Computer Interaction (HCI) context, several researchers have put forth definitions of "intuitive" with regards to interactions. When users know how to interact with a system based on prior knowledge, their interactions may be considered intuitive. However, this prior knowledge can take multiple forms (metaphoric elaboration of image schemas, isomorphic mapping to a convention the user already understands, etc.) and different forms of prior knowledge may be processed at different levels of conscious attention (metaphors may be processed pre-consciously while learned behaviors may require more attention and rational thought). Antle et al. considered intuitive interaction to be instances when users unconsciously or automatically perform appropriate input actions [1]. Macaranas et al. interpreted Kahneman's work on intuitive thinking and considered intuitive interaction to quick and automatic user inputs to an unfamiliar system without conscious effort or attention [5]. When intuitive interaction is achieved in HCI, the user's cognitive resources are used on the task or goal, rather than on manipulating the interface [7].

Studies of Natural User Interface (NUI) intuitiveness frequently take a top-down approach. Some have focused on comparing NUIs to more traditional interaction methods such as controllers [2, 3]. Their findings indicated that although NUIs do not have time or accuracy costs, users are not always aware of how the system works (it lacks intuitiveness). Other studies compared the intuitiveness of multiple interaction mapping strategies (Metaphoric, Conventional, and Isomorphic) and found that the Metaphoric and Conventional mappings were most intuitive for users [6]. Still others showed how the affordances of

Tangible User Interfaces (TUI) could be misinterpreted, leading to user frustration and decreased focus on learning [4]. While these studies have provided critical knowledge about Natural User Interfaces, their top-down approaches hamper the extent of the findings. Without providing users a role in the development of the interaction methods under investigation, the studies lack critical insight. Users may be failing to fully comprehend the available mapping strategies because none of the strategies behave the way the user expects.

Methodology

Adults from the greater Vancouver area will be solicited to participate in the study. Basic demographic data will be collected, including sex, age, and occupation. We will also collect data on experience with WB-NUIs. Applicants with a small amount of experience with WB-NUIs will be excluded from the study. We will be looking for individuals with either zero experience (should not have preconceived notions of how to control) or significant experience (should be able to select the most effective interactions from past experiences) with WB-NUI-driven applications.

Our research instrument is a modified version of the Springboard system from Macaranas, et al [5]. In this iteration, the whole-body control has been replaced with manual control by the researcher. This change ensures that the user's movements as they work through the task won't trigger accidental changes in the system while still allowing the researcher to mimic the function of rotating images.

The participants will be introduced to the Think Aloud task through a brief prompt explaining that there is a carousel of images describing a value gradient. The participant will be shown that the images move from one to the other, side-to-side, and that the goal of the interface is to stop the images at intended levels of balance. The participant will then be asked to demonstrate what actions they would take with their body to accomplish the image movement and to talk about those actions as they perform them. The Think Aloud task will last for up to 30 minutes. In order to avoid influencing the user's ideas, the researcher will not suggest actions that could be taken. If the participant performs actions without explaining them, the researcher will ask what the participant is doing, why, and if they are mimicking a past experience. After the participant settles on a set of actions they are comfortable with, a different content set is loaded into the system and they move on to the Confirmatory task.

The two-fold purpose of the Confirmatory Task is to verify that the researcher understands the participant's intention and that the participant was satisfied with their responses when applied to a different content set. During the Confirmatory Task, the participant will asked to perform the action they identified would have an effect on the images as the researcher manually manipulates them to match the action. If conflicts arise at this time, the researcher can ask for clarification from the participant.

Data will be analyzed by having researchers code the video/audio content for common actions. The coders will also be looking for movements or verbalizations that match schemas such as metaphoric or isomorphic mappings. The coders will also be looking for shifts in actions or mappings throughout sessions, to see if

users change their approach in a consistent manner from start to finish.

Anticipated Outcomes

We are expecting to discover some common actions among the 20 participants. Ideally, some or all of these will apply to mappings, increasing our knowledge in that field. Any data gained should help increase our understanding of how to design public space WB-NUIs with maximum approachability.

References

[1] Antle, A. N., Corness, G., & Droumeva, M. Human-computer Intuition? Exploring the cognitive basis for intuition in embodied interaction. *Int. J. Arts and Technology* 2, 3 (2009), 235–254.

[2] Antle, A.N., Corness, G., and Bevans, A. Springboard: Designing Image Schema Based Embodied Interaction for an Abstract Domain. *Whole Body Interaction*, Springer (2011), 7-18.

[3] Antle, A.N., Corness, G., and Bevans, A. Balancing justice: comparing whole body and controller-based interaction for an abstract domain. *Interactive Journal of Arts and Technology, Special Issue on Whole Body Interaction*. (2011).

[4] Hornecker, E. Beyond affordance: tangibles' hybrid nature. In *Proc. of the Sixth International Conference on Tangible, Embedded and Embodied Interaction*. ACM (2012).

[5] Macaranas, A., Antle, A. N., & Riecke, B. E. Bridging the Gap: Attribute and Spatial Metaphors for Tangible Interface Design. In *Proc. TEI 2012,* ACM Press (2012), 161–168.

[6] Macaranas, A. The Effects of Intuitive Interaction Mappings on the Usability of Body-based Interfaces (Masters thesis, Communication, Art & Technology: School of Interactive Arts and Technology). (2013)

[7] O'Brien, M. A., Rogers, W. A., & Fisk, A. D. Developing a Framework for Intuitive Human-Computer Interaction. In *52nd Annual Meeting of the Human Factors and Ergonomics Society,* New York (2008), 1645 – 1649.