Whole Body Interaction 2010

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Abstract
In this workshop we explore the notation of whole body interaction. We bring together different disciplines to create a new research direction for study of this emerging form of interaction

Keywords
Physicality, whole body interaction, multi-modal, motion capture

ACM Classification Keywords
Human Factors; Artificial, augmented, and virtual realities; Interaction Styles.

General Terms
Human Factors.

Introduction
As Bill Buxton [1] pointed out some years ago, archaeologists digging up 21st century computers would be puzzled by how humans made use of this limited technology. 21st Century humans would seem to be equipped with two hands, no legs, one eye, limited hearing and no sense of touch or smell. His argument was for more multi-limbed and multi-modal interaction to make the best use of human abilities. Moving forward we have the technology today to make this happen, albeit in a limited way. However there is scope for further exploitation of human physical potential in

interaction and this potential comes from developments in diverse fields.

Firstly we have developments in motion capture technology. High-end motion capture equipment was the preserve of research labs and animation companies but we are beginning to see the development of markerless motion capture that can be used in day-light in real-world settings, like Microsoft's project natal [2].

Secondly, artists are exploiting new sensor technologies to explore new ways of human-computer interaction that could have lessons for everyday interaction [3][4].

Thirdly, there have been more projects in bio-cybernetics [5] which attempt to capture patterns of physiological behaviour and derive connections between the user's physiological state and their context of interaction.

And, fourthly, we are becoming more sophisticated in our thinking of interaction frameworks for richer interaction styles [6][7].

In addition, movement scientists are developing better understandings of the range and limitations of human movement. However, until now, that knowledge has not been applied to movement intended for digital interaction and control.

Perspective

We are using the term *Whole Body Interaction* to return to a user-centred approach. So we are avoiding terms, such as, mobile interaction or ubiquitous interaction that focus on where the technology is as opposed to where the person is and what they are physically doing in a particular space. We also wish to go beyond just physical considerations to considerations of the *integration* of physiological and cognitive states and factors as they integrate with physical movement and position. For this to happen we need movement scientists, cognitive scientists, interaction developers and potential end users to collaborate to develop a common framework of understanding.

Our workshop is about posing questions about the capabilities for whole body interaction over the next 5 to 10 years, and seeing how the developing threads, above, come together to support rich whole body interaction.

The technical challenges related to capturing whole body behavior have been a primary focus of WBI research. However, this is only one part of a multifaceted and complex system. Once the signal is captured we must have appropriate methods for processing and interpreting the signal, and finally producing a response or appropriate action in a digital environment. The human brain is a brilliant mechanism for capturing, filtering, processing, and responding to the environment, all at incredibly fast rates. The success of future applications depends, in part, on making progress understanding or satisfactorily replicating each of these components. Beyond the technical requirement of physically capturing the signal, we must know what signal(s) to capture for a specific application. For example, the signals for detecting road rage while driving may be quite different than signals for diagnosing and treating a patient with chronic pain. One reason identifying the relevant signals is important is because of the high cost of processing large amounts of data. Further, with appropriate signals known, efficient algorithms can be developed for processing the data and looking for or assigning meaning to the patterns in the data. In whole body interaction this is no small challenge. Typically, we focus on a single signal. However, the body is a complex system with a high number of dimensions that can be capture from a motion perspective. For example, with motion capture technology we can capture multiple joints, such as the hip, knee, ankle, elbow, etc., and we can capture these in three-dimensional space. At the present time, very little is understood about the interaction between these joints. However, recent research suggests that while changes in ones internal state (due to emotion, for example) can produce mechanical changes at the individual joint level, looking at one joint does not provide sufficient information for successfully predicting the cause of the change. The current hypothesis is that the success of such predictions depends on how multiple joints (i.e. signals) interact.

Applications

The potential exists to begin developing and exploring real world WBI applications. Applications range from military, clinical / therapeutic, to entertainment. The common theme to all of these applications is understanding what the cues are that communicate expressive meaning, how are they measured, and how are they interpreted.

Clinical / Rehabilitation -- Imagine a virtual application that could help children with autism or adults with Asperger's syndrome learn to read and possibly even teach them to produce nonverbal social cues. This type of system could provide training in a controlled setting to guide the person as they develop knowledge about nonverbal communication. These skills could improve their everyday functioning and overall quality of life.

Since the introduction of the Wii in 2006, development of applications that use the whole body for interaction has exploded. A promising direction for this technology is to use whole body interaction for physical rehabilitation. Thus, patients could supplement physical therapy at home with interactive exercises that could both provide immediate feedback to the patient and track specific clinical measures for the therapist.

Entertainment – An ongoing challenge in the entertainment and gaming community is generating realistic human movement. Two methods are currently used to help guide the generation of the animated movements: Effort-Shape qualities and motion capture. Past use of Effort-Shape qualities has been limited because an interpretation between the qualities and the characteristics associated with specific expressions have not been available. The outcome of our research begins providing practical information about the Effort-Shape qualities that animators can start applying to games and films. A remaining question is how these qualities translate to the actual movements (i.e., the kinematics).

Military – Virtual training systems are currently under development for military applications. These systems require realistic movement from the virtual human. Additionally, these systems need to both detect and generate expressive behaviors that allow natural interaction between the virtual and real humans.

Law enforcement -- If we understand how multiple modalities combine during expressive behavior, improved methods for detecting lies behavior may be developed. Thus, subtle inconsistencies between modalities may prove to be an important indicator of deceptive behavior.

The common thread that ties all of these applications together is that subtle movement qualities can be measured and can have important social meaning. Although small changes in behavior may not always be mechanically significant, those same changes may be socially significant. That is, small changes in behavior can result from changes in an individual's internal state. Whole body movement and multimodal interactions can provide measurable cues that correspond to the internal state.

Citations

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