MobileHCI 2014 Extended Abstracts Mobile Experience Lab: Body Editing

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MobileHCI 2014, September 23-26, 2014, Toronto, ON, Canada.
ACM 978-1-4503-3004-6/14/09.

http://dx.doi.org/10.1145/2628363.2633574

Abstract
Body Editing is an interactive installation that combines depth sensing (Kinect 3D camera), biometric sensors, musical performance and abstract drawing software to create a mobile wireless interface that sonically and graphically represents the user's motion in space. The wireless nature of this gesture-controlled interface is an explicit attempt to create embodied experiences that encourages users to be more aware of their body through movement and audio/visual feedback and less focused on technological augmentation.

Author Keywords
Data Sonification; Embodiment; Movement; Gesture; Wireless; Musical; Interface;

ACM Classification Keywords
B.4.1 [Data Communications Devices]: B.4.2 [Input/Output Devices; C.5.3 Microcomputers]: D.2.2 [Design Tools and Techniques]:

Introduction
Body Editing is an interface that enables a user to make music and abstract graphical images through movement. The interface uses the Kinect 3D camera, which tracks a user's position in space to send movement data to a computer that runs both the audio and drawing software. The wireless nature of this platform makes it a very accessible interface that doesn't require the use of traditional musical MIDI interfaces (i.e. music controller keyboards), game type controllers or mouse/pointer

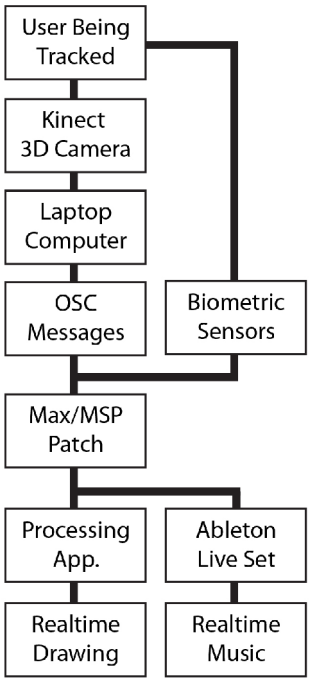

Figure 2. Body Editing process.

Figure 3. Baycrest demo setup, with the Kinect camera and projector visible to the right. An LED screen would save on space.

interfaces. The lack of tethering to tangible interfaces allows the user to become more embodied in their interaction with the music making and drawing software. The wireless biometric sensors, include a simple to use pulse (heart rate) sensor and an accelerometer that can track finer movements of the user.

Previous Installations of Body Editing

Body editing has been installed in various locations and institutions during recent years, including OCAD University, York University, Baycrest Elderly Care Research Centre, Hospital and Residence, and most recently, the GRAND Conference 2014 conference where Body Editing was accepted as a GRAND Experience. The proposed Body Editing experience at MobileHCI will offer the platform as an experience that provides audio visual art experience in response to both the user in the performance space and the crowd surrounding or approaching the performance space

The next sections describe the technical processes of the installation and then explain my technical requirements to create an experience at MobileHCI.

Figure 1. Example of user in wheelchair at Baycrest using Body Editing interface. Max/MSP tracking points (left of screen), Kinect 3D image (on right of screen).

Kinect Data

The Microsoft Kinect 3D camera is a depth camera that can detect a user's skeleton (a set of 16 points found around a person's body, i.e. right hand, left elbow, head, right knee, etc.). It tracks a single user at a time and uses the hand and head data to send OSC (Open Sound Control) data, in the form of spatial coordinates relative to the camera (X, Y, and Z axis) to Max/MSP (a visual coding environment). Within Max/MSP, the OSC data is translated into musical note data that is used to compose music in Ableton Live (music production software) and coordinates to create abstract line and colour drawings in a Processing application as “feedback” to the user.

Data Sonification

The X, Y and Z-axis received from the Kinect data is translated using three main criteria. The X-axis (left to right hand motion of the user) controls the note to be played, similar to the playing of a traditional piano's keyboard, where left is low notes and right is high. The Y-axis adjusts the rhythm of the note to be played; a raised hand may play a quick 16th or 32nd note, while a low hand, or one on the floor may produce a slow whole or half note. The Z-axis controls the volume or velocity of the note; when the user is near the the camera, the volume is louder and when farther away, the volume is lower. During recent demonstrations, only the left hand, right hand and head of the user is being tracked. Each of these points send the X, Y and Z coordinates to Max/MSP.

The minimum and maximum value of each parameter (effecting the sensitivity of a users movements) can be set manually, preferable for a user who has a large amount of mobility within the space visible to the Kinect camera. The min./max. values can be set automatically by detecting the users range of movement; for example, a user in a wheelchair that has limited reach from a solitary position, the min./max. values will be set so that this space can represent the entire range of notes

available. This user-generated bounds system was an important feature during the Baycrest demonstration, where many of the elderly participants had very limited movement capabilities. The manually adjustable bounds and automatic user generated bounds system will be available during the MobileHCI experience.

Data Visualization

The visualization component of the Body Editing interface is created using Processing, an open-source coding environment that allows for quick and creative coding of interactive applications.

The OSC data received from Max/MSP is translated into X and Y-axis coordinates that are used to control a marker on a 2D plane. This marker (which can be made visible or invisible) acts as a magnet to several nodes that are also present on the screen. The marker represents a user's hand position, as if the participant was using their hand like a mouse on the surface of the image. As the user moves their hand in space, the nodes will move towards this point on the screen. Each of the nodes creates lines as they move. Eventually these lines build up to create a visual composition. This graphical rendering can easily be saved and printed, allowing the user to have a take away from the experience.

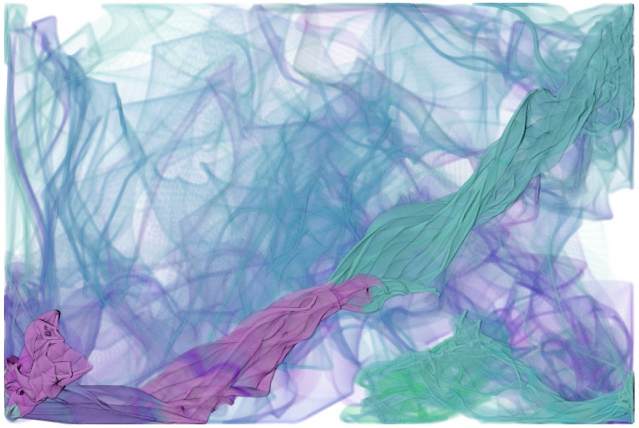

Figure 5. Example of imagery created by Body Editing interface and the Processing application.

Biometric Sensors

The pulse sensor uses a light sensor that is light pressed with the tip of the user's finger to get their pulse or heart BPM (Beats Per Minute). The BPM of the user's heart is used to set the BPM of the music. This becomes the relative measure of note lengths i.e. 8th note, 16th note, etc, making the users body more present in the interaction. The accelerometer (a sensor that detects motion) provides another way to interact with the music. This sensor can be held near the chest, in order to detect the motion of breathing – the rising and lowering of the chest. These sensors send their data to Max/MSP which is translated into MIDI (Musical Instrument Digital Interface) data to control Ableton. This data controls the BPM of the music and parameters like reverb, echo and delay of the music generated by the user's movements.

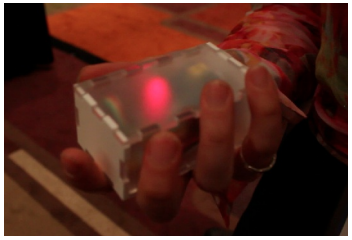

Figure 8. The accelerometer unit is displayed here. Held comfortably or placed in the pocket, fine motion can be sensed with this unit.

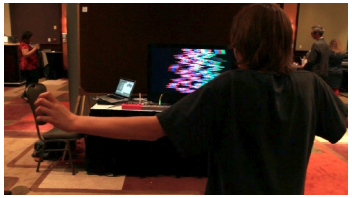

Figure 9. A user creating music using the Body Editing interface at the GRAND 2014 conference.

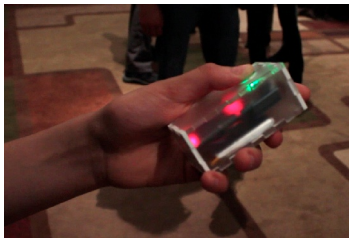

Figure 10. The user pictured in figure 9 is shown here using the pulse sensor with their thumb rather than index finger, like figure 7.

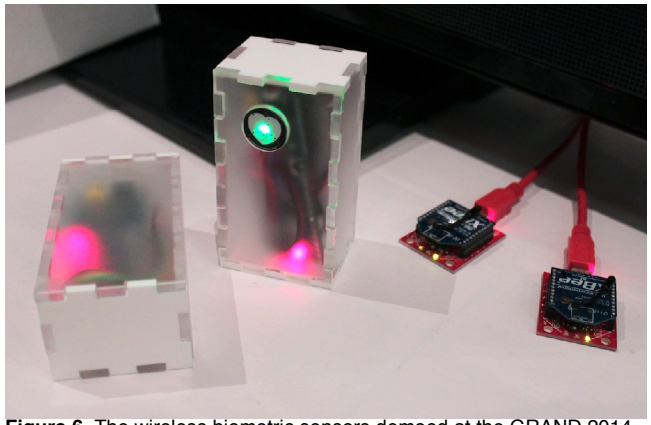

Figure 6. The wireless biometric sensors demoed at the GRAND 2014 Conference.

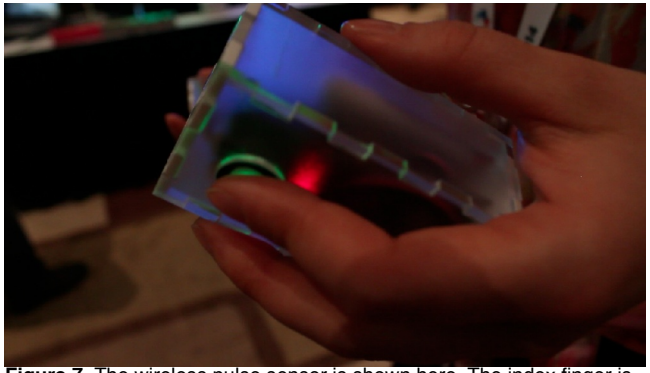

Figure 7. The wireless pulse sensor is shown here. The index finger is used to sense the heart's BPM (Beats Per Minute), which controls the tempo (BPM) of the music.

Results of Demonstrations

The demonstrations of Body Editing interface at OCAD U, Baycrest and the GRAND Conference 2014 revealed several trends in user response.

The ability for the interface to adapt to the users range of motion seems to be an important way to get the user engaged quickly. Since the interface will be responsive immediately, it ensures the user that it is functioning and detecting their motions.

The abstract renderings generated with the Processing application seems to distract the viewer form considering the technology and mechanics of the interface and encourages them to focus more on the effects of their body motion and their potential movement in space. These qualities may lead the user to have a more embodied experience.

Technical Needs and Specifications

Body Editing has many of the needed components already. This includes: Kinect camera, computer, sensors and etc.

For the MobileHCI experience, Body Editing will require only a television of approximately 32” LCD Screen or larger and a PA system to produce high quality stereo sound in the venue. If MobileHCI has the resources to provide a human scale rear projection setup this would be preferable. If a colour printer system was available, the user drawings could be printed out for people to take away from the experience. The experience generally requires a 10' by 10' area to allow the user to move freely within the space unobstructed.