Scoop! A Movement-based Math Game Designed to Reduce Math Anxiety

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Abstract
In this paper, we describe Scoop!, a movement-based game designed to reduce math anxiety. The game makes use of research on the effects of 'power poses' to explore whether movement mechanics can shift feelings about math for players. The Interactivity demonstration includes both a 'high power', Kinect-driven version of the game, and a 'low power', track-pad-driven version of the game. CHI attendees can try out both versions to physically experience the effects.

Keywords
Movement-based games; whole body interaction; games for learning; affective computing

ACM Classification Keywords
H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous

General Terms
Design, Human Factors

Introduction and Research Context
In 2012, a growing number of households, pockets, and city streets contain one or more movement-enabled devices. All major game consoles now ship with movement controllers available—the Nintendo Wii, the

Sony Move, and the Xbox Kinect. Many smart phones include accelerometers that allow at least crude motion detection. And cameras, now ubiquitous in our everyday environment, can also be used to detect motion. Yet as designers, we are only beginning to understand how best to use this power [4].

Beyond understanding the ergonomics of movement, and developing taxonomies of gestures that can be used for GUI-legacy tasks, we need to understand the impact of movement on user experience [6]. How does movement itself shift how the user feels, and how might we make use of this?

Our research group is pursuing the link between movement and qualities of experience such as shifts in emotion or sense of connection to others. We have been creating research games to isolate and examine the role movement has in user experience [5, 6, 7, 8].

The Scoop! project emerged from our participation in the NYU Games for Learning Institute (G4LI) [1]. G4LI's initial mission was to systematically and empirically investigate the impact games could have on learning, specifically for middle school students studying Science, Technology, Engineering, and Mathematics. Our group decided to take a close look at movement-based gaming and its potential for learning.

figure 1. High and low power poses from the research that inspired our game [3].

We first did a baseline study comparing impact of varying levels of movement on players [8] then created a research game to isolate and test the impact of movement volume more effectively [7]. In this research we saw clear impact of movement on player emotion. Emotion can play a profound role in learning.

Consider the crippling impact of math anxiety [2]. When we learned of research results demonstrating the impact of expansive physical positions (deemed 'power poses'—see figure 1) on risk-taking behavior and on levels of stress hormones in the body [3], we decided

to create a game that made use of this result to see if we could shift math anxiety for learners.

About the Game

Scoop! is a Kinect-enabled game developed with the Unity 3D game engine. In the 'high power' mode, players use movement of their hands and arms (see figure 2a/b and our video) to expand and contract a number line, to catch fractions as they fall from the sky. The number line looks like a set of ice cream cones, and the fractions are additional scoops of ice cream. We consulted with a member of the power pose research team about what kind of movements to use [pers. comm.], and she told us the key was physical expansiveness. So the Scoop! player has to spread her arms wide and move from side to side to play this mode. In 'low power' mode, the player sits at a low table and uses a track pad. Core mechanics are identical, but the player is in the laptop 'hunch' (see figure 2c). This limbs-close-to-body play position was designed to replicate the 'low power' pose condition. Pretesting has shown promising results. We plan to conduct the formal study in February.

figure 2 a, b, c. In 'high power' mode (a, b), the player uses expansive, full-body movement to control the number line in the game. In 'low power' mode (c), the seated player uses a track pad.

Audience and Relevance

Scoop! should be of interest to CHI practitioners and researchers exploring the benefits of movement for interaction, and how movement may shift user experience in ways that can facilitate end results like learning. We believe the idea of shifting the user's emotional state/attitude through movement has many applications outside the learning context. Being able to try out the 'low' and 'high' power modes, comparing the visceral experience for themselves, should provide valuable food for thought for those interested in exploring the experiential impact of movement.

As movement inputs are becoming increasingly prevalent in the everyday technology ecosystem of consumers, we believe this work has broad relevance to

the CHI community, in terms of exploring the design space and possibilities of movement-based interaction.

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Citations

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