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EMBODIED MUSICAL GESTURES AS A GAME CONTROLLER

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ABSTRACT

Background

Motivation plays a key role not only in our engagement with a task (Staw, 1976) but also in choosing to which tasks we devote our energies in the first place (Harlow, 1950; Harlow and McClearn, 1954; White, 1959; Maslow 1954, 1970). Digital games in particular are known for their "sticky" attributes and ability to repeatedly motivate users to work at task over an extended time period (Dickey 2007, Prensky 2001). However, music education traditionally emphasizes dedication over motivation, and so games are often seen as a distraction from true learning. Gower and McDowell's recent article (2012) on the use of digital musical games as teaching tools within a traditional school environment recognizes this, and also examines some cultural reasons why technology may be under-utilised within music education. For example, if teachers tend on average to lack knowledge of technology, they will tend to be cautious or even suspicious about the use of digital learning tools. This will contribute to poor results for businesses in the sector and likely also mean that the best developers will work in other areas— keeping the level of available product low and reinforcing the teachers' disengagement with technology.

Even in the relatively hip and boundary-dissolving mobile app market, one sees a strict divide among "game" apps such as Rock Band, "creativity" apps such as SoundPrism, and "music education" apps such as ABRSM's Aural Trainer. Apps in one of these market segments almost seem to go out of their way to avoid even the appearance of infringement into the territory of another: Rock Band lets you imitate existing rock classics, helping your game avatar's star rise through successful emulation of a pre-existing work; SoundPrism is designed to allow nondirectional playing with a collection of pleasant-sounding diatonic pitch groups, and, to quote one of this author's students on an encounter with the ABRSM app, "The main missing ingredient… is FUN. They're all like, 'Your rhythm could be better. You didn't sing the notes required. You are a failure'".

Additionally, the task of "music education" very often seems to revolve around learning the names of things in written music first (quarter note, minor-seventh chord, diminuendo, rest, 5/8 time, chord progression, structure, matrices) often before ever having performed or even consciously heard these things in music. Contrast that with native language-learning, in which seemingly-passive listening, non-goal-directed exploration, and increasingly-sophisticated recombination of assimilated linguistic chunks allows a sort of robust bootstrapping to occur, which eventually can lead to active, conscious language acquisition using not only the parts of speech, but the names for them and their relations as well.

Aims

I set out, therefore, to make an app that bridges these divisions, and subsequently to use it as a research tool to study how people interact with such a game, ultimately aiming to determine (a) whether the embodied nature of the musical interaction has an effect on the motivation people felt toward playing the game, (b) whether any musical skills drawn upon in playing the game are actually enhanced by exposure to the game, (c) whether ludic motivation enhanced learning in this context, and (d) whether the goal-directed yet non-work-centred values of the game have appeal.

Main Contribution

The goal of the current research is sixfold: (1) Develop a game-based experimental framework of a type and quality such that it will be taken up repeatedly and voluntarily by participants not connected with or even directly approached by the author; (2) Construct the game in such a way as to elicit spontaneous formulation and performance of embodied musical gestures which are of measurable relative utility as moves within the rules of the game; (3) Collect data through commercial release of the game; (4) Calibrate this data in comparison with a smaller set of data collected under controlled conditions in which the game is paired with a control task; (5) Evaluate whether subjects' motivation differed as a result of exposure to the game relative to the control task; and (6) Determine whether it is likely that musicality, as defined within the experiment, is impacted upon by the engagement afforded by the game. Toward this end I developed a game, *SingSmash* (singsmash.com, @singsmash) on Apple's iOS platform in which feature extraction from realtime analysis of a live audio input stream serves as the sole control mechanism.

The game mechanic follows the classic mode of Breakout/Arkanoid, with roots going back to Baer (1967) and purposely designed to facilitate easy understanding of the game objectives: Bounce the ball off the sides and top of the screen, attempting to hit blocks placed on the main area of the screen. When the ball hits a block, it changes type or disappears, giving the player points. The other goal is to keep the ball from hitting the bottom edge of the screen (in which case the ball is lost, or, if all three balls for that level have been exhausted, the level is lost). Where the game differs from these archetypal instantiations is that, rather than the player moving a paddle along the bottom of the screen to reflect the ball upward, here the player controls a row of fixed paddles or gates, each of which corresponds to a pitch class. The app uses an octave-agnostic pitch-class identification routine to determine which note is being produced by the player at a given time, determining which (if any) of the gates are closed at that moment. In earlier levels there are fewer pitches, necessitating wider gates. The pitches also begin in simple relationships to each other (Do-Re-Mi, Do-Mi-Sol). As the levels progress, the pitches grow in number, and the gates become narrower as the number of pitches increase. While the initial ten levels could be described as 'diatonic', 'Western', or 'pop-y', with linear pitch relationships present even on higher levels, the game will support additional "level packs" which might be themed according to one's musicoacademic preferences: Balinese scales, microtones, famous Second Viennese School sets— or, perhaps more likely from a marketing perspective: Rock 'n' roll, Middle Eastern, Cinema.

In order to enable the game's use as a research tool, several gameplay metrics are collected, written to a local XML file, and uploaded asynchronously to a remote server for analysis. Each device is given a unique identifier which persists across multiple installations, and each separate user on the device is encouraged to play under their own alias, to separate out effects of multiple players

using one device sequentially. Each level played is tracked in the XML document, with a move-by-move description of all pitches sung between one ball-paddle contact and the next (including a representation of the harmonics detected in those pitches), the blocks hit during that time, and the final score gained. All of these metrics are timestamped. Future refinement of the software will enable ray tracing, which involves the projection of the ball's future path to determine which paddle it will eventually hit, thereby enabling assessment of the user's ability to predict, remember, and produce the required note (and only the required note) efficiently.

A control task is created by removing the gameplay element, requiring the subject to sing pitches associated with the "paddles" shown on the screen during the game, in pseudorandom order and triggered by a visual stimulus, but without the blocks, ball, or scoring. A control and an experimental group will play the game in a laboratory setting in order to allow meaningful comparison of changes in their performance on the tasks. This ground will serve as a baseline for the interpretation of patterns in the larger, publically-gathered data set.

Implications

Michiel Kamp (2009), in his survey of ludic music in video games, calls for just this sort of music-in-the-rules which he finds almost completely lacking in commercially-available games. Gower and McDowell (2012) find evidence of beneficial effects for game-based music education, and perhaps the lack of association with console gaming on the one hand and rock culture on the other may help to overcome some of the resistance they describe in teachers and parents reluctant to invest time in gaming when students might be "productively" engaged in non-game study. The huge success of imitative games such as *Rock Band* (Harmonix, 2007) suggests that a subset of this audience may be interested in a productional/embodied game as well. Similarly, the cultural phenomenon of casual musicking without formal instruction may point to a group unserved by the current music-educational approach, and who might benefit from a goal-based yet open-ended framework for practicing and enhancing pitch-related skills.

Keywords

Digital games, mobile devices, signal processing.

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