Rhythm Games and Learning

Matthew Gaydos, University of Wisconsin – Madison, Gaydos@wisc.edu

Abstract: This paper extends studies of music cognition to the genre of video games known as "rhythm games" – a popular, understudied video game genre. In this study, eight Guitar Hero II songs were analyzed and six participants were asked to perform a listening and tapping task. Results suggest that players do not exhibit knowledge of underlying metrical structure.

Introduction

Contemporary research on video games and education argues that the social, authentic and engaging activities that games encourage provide players with learning environments that outstrip traditional schooling (e.g. Gee, 2004). While this perspective has produced compelling evidence in support of the theory that games encourage exemplary educational activities, difficult questions have begun to arise from pragmatic issues of implementation and from structural issues of formal educational settings (Van Eck, 2006), not to mention the inherent (and non-trivial) issue of figuring out how one goes about designing an educational game that engages a player and promotes learning specific content (Gaydos & Squire, in press). Specifically, new methods still need to be explored to investigate and interpret the complex player behaviors and measurable changes that result from play.

The purpose of this investigation was to specifically investigate the nature of meter learning in the popular music game Guitar Hero 2. It re-appropriates methods used in the study of music cognition to the genre of rhythm video games – a genre of video games that has only in the past ten years or so, achieved market prominence and widespread popularity.

This paper presents preliminary results of a study that examined the rhythm game Guitar Hero for the way that it conveys meter, and explored whether Guitar Hero players were leveraging musical resources similar to those of trained musicians. Discussion of the potential for the design of rhythmic interactive environments and performance-based assessment is provided.

Guitar Hero, Meter, and Music Cognition

Recently, rhythm/music games have exploded in popularity. For example, the Guitar Hero franchise, for example, has become the third franchise ever to break the billion-dollar mark (Carless, 2009). Despite this success, rhythm games have received relatively little attention from researchers. In a recent study by Miller (2009), a survey and interviews suggests that Guitar Hero is like lip-syncing, in that it is a hybrid of traditional music and performance. Miller describes the satisfaction that results from Guitar Hero as arising from the players re-assembling of the recorded music that the game designers took apart. Miller argues that, rather than evaluating Guitar Hero as a bastardized form of music performance, a tension often found within game communities, the game should be considered for its own merits and for the experiences it provides players. Nevertheless, investigating the nature (musical or not) of Guitar Hero play is interesting from the perspective of music cognition, where a robust corpus of research has been developed to explain musical mechanisms such as timing, tone, and rhythm.

According to Lerdahl and Jackendoff's *Generative theory of tonal music* (Lerdahl & Jackendoff, 1996) meter is comprised of beats, or zero-duration points in time, and is structured hierarchically, with lower equivalence classes comprising higher equivalence classes. The beat is said to be *strong* where coordination is high amongst these classes and *weak* where coordination is low amongst these classes. Meter is thus defined as the hierarchically organized structure of beats. Within Guitar Hero, players are forced to synchronize their actions in time with musical, structured stimuli.

Over the course of game play, players may be learning the structure, or meter, of the stimuli, and that this learning might result in behavioral differences between expert guitar hero players and guitar hero novices.

Methods

This study is comprised of two components, an analysis of Guitar Hero II (GHII) songs and an experiment on players. One song from each of the eight song sets within the game Guitar Hero II was randomly selected and, similar to Palmer & Krumhansl (1990), the frequency of notes with respect to their location in the "measure" were recorded for the first twenty measures of each song on all four difficulties (easy, medium, hard, and expert), starting with the first measure that contained notes.

In the experimental portion of the study, three expert GHII players (age 21 – 37, all male) and three non-GHII players (age 25 – 33, 1 male) who did not regularly play music were recruited from the local university community. GHII expertise was verified at the end of each study session by asking participants to play a song on progressively harder difficulties. All GHII experts could complete at least two songs on the hardest difficulty level. No non-GHII players could complete a song on either the hard or expert level. Participants performed a listening task in which they provided goodness of fit ratings on a 7-point likert scale for the timing of tones within a 4/4 meter. Participants also performed a tapping task in which they synchronized taps in time with a metronome, which sounded at inter-stimuli-intervals (ISIs) of 250, 500, 750, and 1000 ms. They continued tapping once the metronome was removed. Results for the tapping task were analyzed in light of the Wing Kristofferson model (1973), which posits that for ISIs greater than 250 ms, time-keeper variance can be thought of as originating from a stochastic wait process in which an internal time keeper and motor control processes account for tap variances.

Results

The GHII song analysis suggests that increasingly metrical as difficulty increased from easy to expert. Results from the listening task were unclear. A 4 (ISI Times) x 2 (Synchronization/Continuation) x 2 (Level) ANOVA was conducted on the inter-response intervals and a significant 3-way interaction effect ($F = 3.32$, $p = .019$) was found for Player Level*Times*Synchronization/Continuation, results that align with previous findings in the literature. A significant effect for player level was found at the shortest inter-stimulus interval ($F = 10.087$, $p < .01$).

Discussion and Conclusion

Though rhythm games may appeal specifically to the already musically inclined as Miller's (2009) survey suggests, it is interesting to note that, even in spite of GHII's distinctly non-traditional musical form, this study does not support the theory that players are improving their sensitivity to meter, rather suggests expertise entails improved performance at the fastest levels of perception and action. It is important to consider that the primary purpose of the game is entertainment and the primary goal of the company is revenue; the game is not designed for music education. In some ways, these results are unsurprising considering the difficulty in associating language learning with merely exposure frequency. The results suggest that frequent structured actions may not be sufficient for adopting specific mental representations.

The line demarcating where perception stops and cognition begins is not easily determined and theories that highlight the active nature of "seeing" (e.g. Noe, 2005) suggest a connection between perception, action and thought. Reconsidering the role of perception may be important for theories that emphasize the meaningful experiences that games can provide for education (e.g. Squire, 2005) as experiences that change how we see the world may lay the groundwork for future learning (diSessa, 2000).

References

Carless, S. (2009). Kotick: Guitar Hero Now $2 Billion Franchise. *Gamasutra*. Retreived 10/09 from <http://www.gamasutra.com/php-bin/news_index.php?story=23537>

diSessa, A. (2000). *Changing Minds.* The MIT Press: Boston.

Gaydos M.J. & Squire, K (in press). Citizen Science: Designing a game for the 21st century. *In Interdisciplinary Models and Tools for Serious Games: Emerging Concepts and Future Directions*, Richard Van Eck, Editor. Hershey, PA: IGI Global.

Gee, J.P., (2004). *Situated Language and Learning.* Routledge: UK

Honing, H., & Ladinig, O. (2007). Exposure influences expressive timing judgments in music. *JEP:HPP.*

Lerdahl, F., & Jackendoff, R. (1983). *A Generative Theory of Tonal Music*. The MIT Press: Boston.

Miller, Kiri. (2009). Schizophonic Performance: Guitar Hero, Rock Band, and Virtual Virtuosity. *Journal of the Society for American Music.* 3(4):395-429.

Noe, A. (2005). *Perception in Action*. The MIT Press: Boston.

Palmer, C. & Krumhansl C. (1990). Mental Representations for Musical Meter. *JEP:HPP* 16(4) 728-741.

Squire, K.D., (2006). From content to context: Video games as designed experiences. Education Researcher. 35(8): 19-29.

Van Eck, R. (2006). Digital game based learning. *Educause.* 41(2). 16-30.

Wing A., & Kristofferson, A., (1973). The timing if interresponse intervals. *Perception & Psychophysics.* 13(3), 455-460.

Yee, Wm., Holleran, S. & Jones, M. (1994). Sensitivity to event timing in regular and irregular sequences: Influences of musical skill. *Perception & Psychophysics*, 56 , 461 - 471.