Music Video Games...Beyond Fun and Games

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Abstract
Music-driven video games (e.g. Guitar Hero, Rock Band) have proven popular for recreational game-play, but their value in music education and training has yet to be investigated directly. This project held a supervised gaming study of “gamer” (N=17) and “non-gamer” (N=7) cohorts of Drexel freshman in a nine-week gaming study. Pre- and post-assessments were taken using musical skills tests and surveys of music- and gaming experience. Quantitative data analysis suggests learning advantages in gamers over non-gamers only among certain aural- and visual-processing musical skills tests and surveys of music- and gaming experience. Qualitative surveys indicate demographically balanced experimental allocation, and survey data bolsters evidence of predominantly visual learning from these games.

The Games
Our study is motivated by interest in the basic elements common to these “rhythm games.”
- Gamers “play” songs using microphones or pseudo-instrument controllers (drum-pads, buttoned-guitars, microphones).
- Play follows “time-line”-notated melodies and rhythms scrolling at a constant rate.
- Game scores are based on how accurately such notation was followed (in timing or “pitching”) by player input.
- Game notation and difficulty are based on arbitrary interpretations and/or reductions of vocal and instrumental performances.
- These visual- and motor-skill abstractions are central to questions of the games’ validity and utility for use in conventional music education or music skill training.

References:

Musical Skills Tests
Max.-Likelihood Psychometrics (MLP)[1]: Discrimination tasks for timing, pitch, order and intonation of tone sequences.
Musical Aptitude Profile (MAP)[2]: Melody and rhythm fitting.
R3 Notation Test (R3NT) Our “time line” notation (Fig. 1) represent (like in-game graphics) motifs for performance of Keyboard Melody, Vocal melody, or Dual Key/Voice rhythm.
R3 Aural Skills Assessment (R3ASA): Repetition of heard-only rhythms and melodies by voice and MIDI keyboard.

Performance Analysis by Computer
Timing and pitch of R3-“musical responses” are analyzed by a Dynamic Time Warping algorithm [3], rating pitch- and time- congruence in “melody lines” between the MIDI target/prompt and human effort (MIDI or pitch-tracked voice). This edit-distance (ED) error metric provides a consistent and automatic quantitative metric of qualitative performance accuracy in terms of these pitching and timing properties.

Results and Conclusions
- 1-way ANOVA of MLP show global improvement (test learning-effect) among all auditory tests (Fig. 2).
- 1-way ANOVA of MAP show no significant learning-effects for music-listening tests, per section or as a whole.
- Among R3NT keyboard sight-reading, while non-gamers had lower average error, only the gamers showed significant learning over time (Fig. 3).
- The R3ASA shows significant gamer learning advantage across the whole test (Fig. 4), with strongest difference in keyboard melody skills (Fig. 5).

Figure 1: R3NT: time-line melody exercise with 3 tones over 5 beats
Figure 2 (below) MLP global time-effects (standardized scores)
Figure 3 (below) R3NT error-scores for key-melody sight-reading
Figure 4 (below) R3ASA standardized ED scores across all aural skills
Figure 5 (below) R3ASA raw ED scores for keyboard skills

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