Tetris and Flow: The Effects of Challenge on Enjoyment

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Background

- Flow: the ability to work at the peak of ability for an extended period of time, feeling "in the zone"
- Czikszentmihalyi, 1990: Enjoyment levels are dependent on subjective levels of challenge associated with activities
- Brzustowski, 1992: The only winning strategy in Tetris is infinite play, with ever-increasing challenge incremented by level
- O'Keefe and LinnenbrinkGarcia, 2014: participants reported activities as more enjoyable when they completed the most problems in their group; exit surveys reported them being in a flow state
- The gap in the literature exists in directly connecting flow to continuously increasing challenge

Hypotheses

- A removal of a flow state should result in a decrease in player enjoyment, where this drop in enjoyment is dependent on a player's reported skill level
- Players with lower skill levels should enjoy less challenging versions of Tetris than those with higher skill level

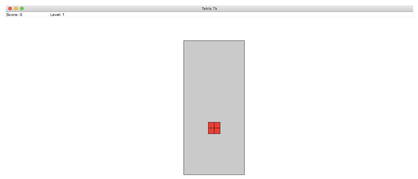
Design

- Participants consisted of 10 Carnegie Mellon University students with normal vision and hand-eye coordination.
- Dependent variable: Task Enjoyment
- Independent variables: Game Condition, Participant Skill
- Game Condition refers to specific game modifications, explained in detail in the Methods section
- Skill level computed using data collected in an initial practice round: ratio of score-to-time.

Methods

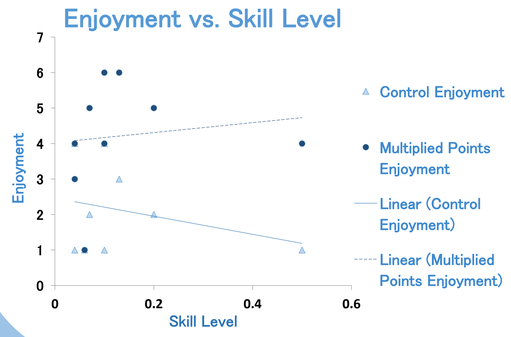
- Open-source python code was adapted to fit the study, altering number of rounds, game speed, and point accumulation rate. Additionally, two wholly new modules were written: one to present a battery of questions to the participant after each round, and another to export data to an excel spreadsheet.
- Participants played through five rounds of Tetris, counterbalanced to prevent possible confounding factors. After each round participants were asked to rate just their enjoyment of the prior round on a Likert scale, as well as being asked to rate themselves on a battery of statements in terms of engagement.
- Tetris Variations:
  - Control: 100 pts per line clear, 5 min. play, no increased drop speed
  - Points: 500 pts per line clear, otherwise same as control
  - Time: 2 min. play, otherwise same as control
  - Challenge: drop speed increased 200 ms per level, otherwise same as control

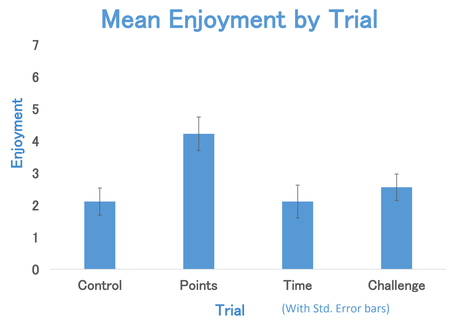
Tetris stimuli:



Results

-ANOVA revealed significant effect ($p < .005$, $F(3, 24) = 7.361$) of game condition on enjoyment; in particular, a spike in enjoyment for the higher points condition, as illustrated in the bottom-right graph "Mean Enjoyment by Trial"
-ANCOVA using skill as covariate revealed a decrease in significance of effect of game condition on enjoyment, though the effect remained marginally significant ($p < 1$). This effect is illustrated in the bottom-left chart, "Enjoyment vs. Skill Level"





Limitations

- Enjoyment survey intended for use with more in-depth games- some question omitted due to redundancy and disconnect from Tetris experience
- A small *n* study, but F value suggests that more participants would strengthen significance of findings
- Five rounds of Tetris became exhausting and boring to some subjects

Discussion

Continuing Research:

- Investigation into different activities that may invoke a flow state
- Creation of an Enjoyment Survey more finely tuned to Flow research

Conclusions:

- Significant main effect of game condition on enjoyment, supports higher points lead to higher enjoyment
- Marginally significant beyond skill measure
- High F-value suggests that with more subjects, effect significance would increase—possibly providing support for initial hypothesis concerning challenge

References

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