

INTRODUCTION

Problem:

Most endless single player games generate challenges based on a progression of difficulty inherent to the challenges themselves and tuned through playtesting.

Goal:

Improve individual play *experience* and maintain player *engagement* by adapting the game to each player, following a *development-friendly* approach.

Approach:

Player-centric designer-driven procedural progression model taking both the player's *skill* as well as the *familiarity* with each type of challenge into account.

Experiment:

Individual player *adaptation* over time in the endless mode of the mobile game *Smash Time* (250K+ downloads on iOS, Android and Windows Phone).

SMASH TIME

Smash Time has fast gameplay mechanics that combine elements from classic games like “Whac-A-Mole” and “Space Invaders”, mixed with puzzle mechanics.

Waves of enemies enter the screen from the top and both sides and try to attack both the hero that is at the bottom of the screen, as well as the animals that are trying to escape. The player goal is to clear all the enemies by tapping on them with a finger.

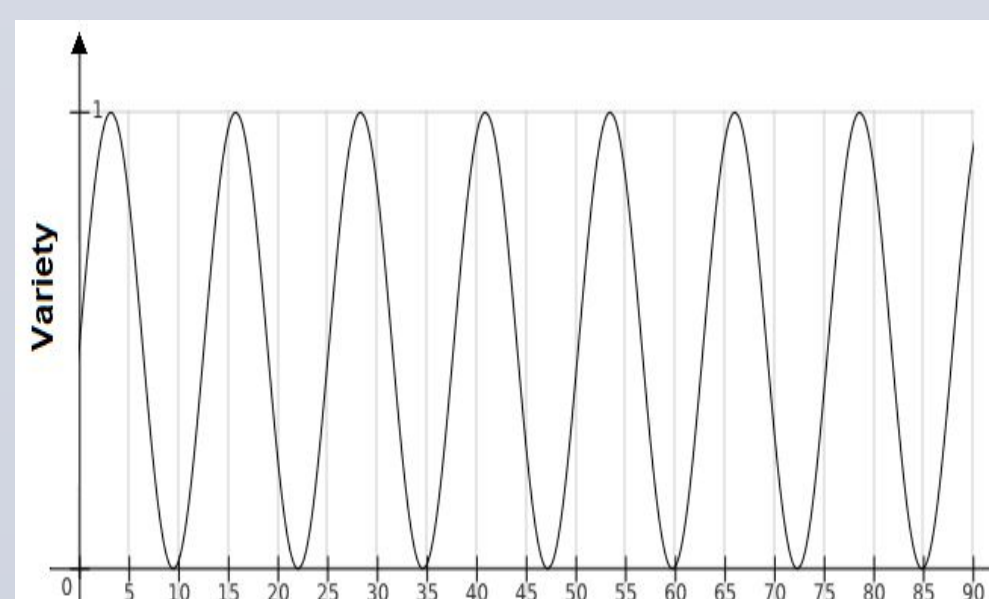
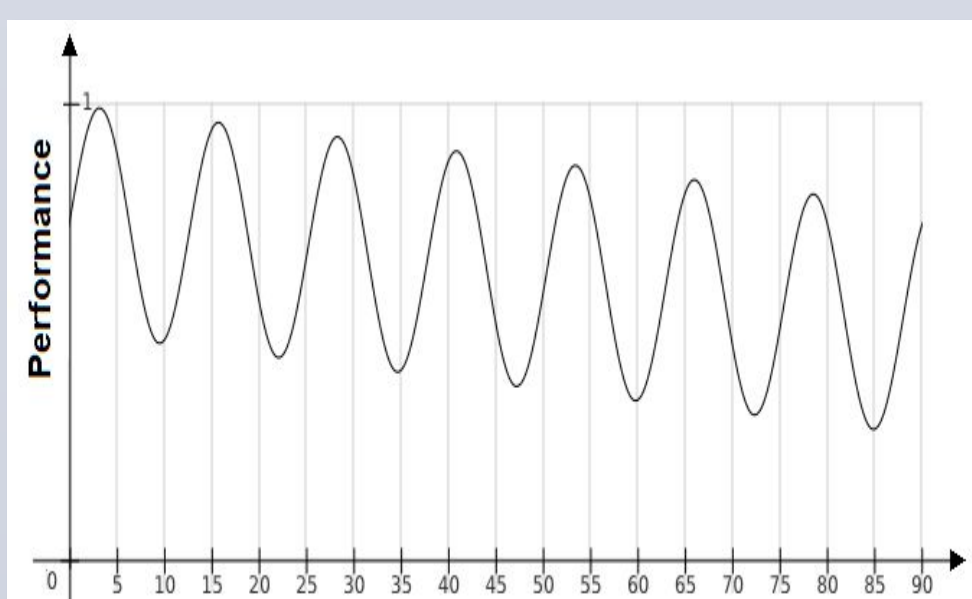
The duration of a game session is limited by a timer. Clearing incoming waves in the suggested sequence extends the timer.



DESIGNER'S PROGRESSION MODEL

A) Tag the components of gameplay that will be tracked by the system, both in terms of the performance of the player as well as the variety of the presented content. Each challenge is typically associated with *multiple* tags.

B) Define the normalized **desired performance curve** and **desired variety curve** for a play session.



PROCEDURAL CHALLENGE GENERATION

Each time a new challenge is created by the game, it is selected from a **pool of random potential candidates** uniformly covering the challenge space, based on the **distance to the desired performance** (based on the player performance with similarly tagged content) and the **distance to the desired rarity of the content** (based on similarly tagged content presented to the player over time).

The **distance** is computed based on the **weighted average of the expected performance and experienced variety** of all tags associated with the challenge.

After the interaction with a challenge is over, all the tags associated with the challenge are updated, using the information from the **N most recent interactions** ($N=10$ in this experiment): the **expected performance** is the average of the performance in the N last interactions and the **experienced rarity** is based on the appearance of such content in the last M ($=N$ in our case) interactions.

USER STUDY

Sample:

32 participants, 87.5% gamers, 65.5% with experience in games of the same genre, 46.9% with previous experience with the original *Smash Time* game.

Procedure:

Participants were randomly split into 2 groups of 16: one group played the game with our player progression model; the other played the original game.

Data collection:

Game data automatically tracked; subjective experience measured with GEQ (Game Experience Questionnaire), complemented by an unstructured *interview*.

Results:

A) Collected Game Data: Mann-Whitney U tests revealed statistical significance on: playtime ($U = 39, p < 0.001$), number of games started ($U = 28, p < 0.001$) and, number of times a game ended by timeout ($U = 29, p < 0.001$). The Mean Ranks suggest the game with our progression model had better results than the original game on these dimensions.

B) Game Experience Questionnaire: Two items of the questionnaire were found statistically significantly different: “I found it tiresome” ($U = 70.5, p < 0.05$) and “I found it impressive” ($U = 74, p < 0.05$). These results suggest the participants felt our version of the game was more impressive but also more tiring in comparison with the original.

CONCLUSIONS

We created a **player progression model** based on designer-specified desired player **performance** and **variety curves**, and applied the approach to a commercial game, *Smash Time*. The approach aims at reducing the time spent on fine-tuning the player experience during game development.

An exploratory study with 32 participants suggests the approach was able to increase both the duration of each game session and the number of times a game was replayed. By quickly bringing the players to and keeping the players in the flow channel, the approach makes the game more impressive but also more tiring to the players.

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