Make Believe

Investigating Replayability in Deterministic Puzzle Games

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COMP 521: Modern Computer Games

Dedie Kanda

260561891

| Introduction

The main objective of this paper is to propose a means by which one may assess the replayability of a deterministic puzzle game. Two objectively replayable video games will be put through an investigative comparison to pinpoint recurring traits that can be used to generate a flexible metric for puzzle games. A video game demo will then be presented at the end of the paper to showcase how these criteria would manifest themselves in a deterministic context.

| Background

Deterministic, with regards to puzzle games, refers to a game containing a problem to be solved, where the inherent nature of the problem does not change between differing playthroughs or players.

The topic of focus is replayability - a phenomenon intrinsically linked with all of video game design. To understand replayability, two other terms must be defined. These two definitions, as well as the description of replayability, come from Timoty Fratessi's paper, *Replayability in Video Games* (2011). In it, he describes *play* as a random, free activity housed within the imagination of its participants, *replay* as the "mechanical" ability of playing again, and lastly he states *replayability* is "the collective reason for replay" (9 -11).

Several additional concepts are relevant when describing these terms and each will be briefly touched upon. As mentioned earlier, play and replay are actions, but replayability is a reasoning. Lastly, in order to replay, one must have played already. This qualification brings with one of those additional concepts, namely, completion. For the purpose of this paper, 'completion' will be taken to mean the moment when a player has reached the end of the game's narrative arc. Or, when they have completed the "story playthrough" (Fratessi 65), whatever that may be for the specific game. With this in mind, we will slightly redefine replay to instead be, the act of playing again *after the story playthrough has been finished.*

This paper deals primarily with puzzle genre of video games, so the story playthrough in this context will be the progression of the player as they find a solution to each puzzle presented them from the first stage/level of complexity, up until the last. In order to promote a player's desire, or reasoning, to replay a puzzle game, designers resort to using randomness as a means of diversifying each playthrough of the game. And while this is

admittedly a simple way of creating replayability, such a means will be intentionally disregarded throughout this paper as a viable means of generating replayability.

Now, with all relevant terms presented, the purpose of this paper can more readily be outlined. The objective question is twofold. Firstly, is it possible to design a puzzle video game that does not rely on randomness to create a reason to replay it? And secondly, how?

The answer to the first question is yes, and this paper hopes to prove that, by starting from an offhanded comment within Kasper Allan Pederson's *Replayability in Strategic Computer Games* (2012), where he makes mention of several key concepts. Most notably: Emergence Games, Inventible Objects and Geographic Narrative, each of which will be explored more thoroughly later on.

| Methodology

The two games analysed are: *Super Smash Bros. Melee* (2001) (henceforth *Melee*), and *Tetris* (1984). Each game is taken through an investigation towards identifying what their core game mechanics are, what their core identity is, and what about their design could ever promote a reason to replay.

Both *Melee* and *Tetris* contain elements that seemingly stand against the objective of this paper. For *Melee,* its marketed genre, as well as its accepted one, is that of a fighting game. And for *Tetris*, the entire gameplay experience hinges on randomness, namely, which block will fall next for the player to manipulate. But both of these games have also lasted for over ten years, either through game variations, or simply through a competitive community. Existing so long as a played game all but confirms these games are very much – replayable. The only question is why.

1) Emergence Games: How they lay the Groundwork for Replayability

The answer for that is Emergence Games. Proposed by Jesper Juul in his paper, *The Open and the Closed: Games of Emergence and Games of Progression* (2002,), Juul highlights the concept of emergence games as games that have simple rules and offer multiple strategies for the player, and thus, multiple ways to play the game (324). He contrasts these with progressive games – games where the player follows a set path on the

way towards a final goal. It can be seen that both *Melee* and *Tetris* fall under the former category of emergence games.

For *Melee,* as both a fighting game, and a fighting game without the genre's definition of combos, gameplay can be easily broken down to the core – and simple – mechanics of punching, kicking, grabbing, shielding, jumping and running. Absolutely every interaction in the game is a combination of these mechanics. Because of this ability to string an infinite number of sequences together, each playthrough will inherently be distinct, and in so doing, promotes a reason to replay through variation in gameplay experience.

For *Tetris,* the emergence is also apparent. Blocks fall, and as they fall may be manipulated by the player. When a complete horizontal line is produced, that line of blocks disappears, the player gains points, and there is provided more space for the player to work with. Variations of the game have added and taken away from that core loop, but for the most part those have been the mechanics of *Tetris,* from its inception to the present day. Again, an immensely large number of variations can occur between playthroughs. Admittedly, randomness is partly responsible for this variation, but this will be covered later.

2) Addressing Concerns

With key similarities between the games identified, the next step in developing the metric of replayability is to validate why these particular games were investigated at all. As mentioned earlier, *Melee* is a fighting game, and *Tetris* relies on randomness to accomplish its variation. So why then were these two – and precisely these two – chosen?

Melee, though it contains the option of artificially intelligent foes and randomised elements such as items and differing game modes, is still at its core about combat between two, or more, human players. The goal of each player then becomes to best the enemy by knocking the opposing character avatar far enough off-screen a certain number of times.

As mentioned earlier, the core mechanics of the game are all immediately available to both players, creating a symmetry of power and allowing the game's true objective to shine through clearly - 'solving' the opponent. Not *Melee* alone, but every fighting game is simply a puzzle game where the 'problem' is how to overcome the one being faced, and the solution is victory. *Melee's* emergence gameplay allows for every foe to be defeated in an

infinite number of ways using a simple base set of mechanics, so that fundamentally, *Melee* is a presentation of a problem with multiple ways to be solved. This, at its core, is just a puzzle game.

Tetris, on the other hand, is most known for tasking players with navigating a slew of random blocks. Just as *Melee* could be analysed beyond its genre in order to identify key objectives and similarities with puzzle games, so too can *Tetris* look past its reliance on randomness to note its core identity as a puzzle game.

3) Inventible Space

Neither of these proven replayable games – *Melee* or *Tetris* – fully fits the criteria for what this paper is trying to measure. While *Melee*, for the most part is a deterministic game, its genre is still isn't puzzle, per se. And *Tetris*, while actually being a puzzle game, is the farthest thing from deterministic.

Still, both these games have had their mechanics and their identity broken down to the smallest units of emergence gameplay, and problem solving, respectively. And these characteristics are very much crucial in developing a replayable puzzle game. The characteristic of problem solving is a given with regards to the genre, and the characteristic of emergence allows for these problems to be solved in a multitude of ways.

Putting these two together creates the final commonality between *Melee* and *Tetris*, and exposes precisely how deterministic puzzle games can become replayable. The term I've developed to represent this merging is called *inventible space* and comes from an offhand comment made by Pederson, where he remarks that a world able to be constructed by the player could be called 'inventible space' (Pederson 36), after Espen Aarseth's category of game objects.

In Aarseth's paper, *A Narrative Theory of Games*, Aarseth partitions video game objects into six categories – static, non-interactable; static, usable; destructible; changeable; creatable and finally, inventible. This sixth category is the biggest focus in this paper. Inventible, via Aarseth's definition, refers to objects that can be created with a very wide degree of freedom by players (5).

'Inventible Space', then, is the ability for players to actively shape their game world. And in so doing, players can mould the very domain of their gameplay experience into

something personal, something nuanced. In addition, there is a temporal aspect to all of this. Borrowing from Ted Friedman's, *Civilisation and its Discontents: Simulation, Subjectivity and Space* (2005), comes the term 'geographic narrative', that is defined as lending a narrative momentum in games by allowing players to be exposed to, and ultimately conquer, unfamiliar game terrains. In his words, the geography is not the protagonist – rather, the actual protagonist's experiences within the geography of the game go on to serve as a structure for the entire gameplay narrative (142). Using these definitions, inventible space can be seen as the subjective narrative experienced by every player for determined by each of their actions that helps to mould the game world around them in some way.

4) Inventible Space in Context

Finally, the three major building blocks are all in place – Emergence Gameplay, Problem Solving and Inventible Space. What's left is to show – via *Melee* and *Tetris* - how these three blocks interact in context to facilitate replayability.

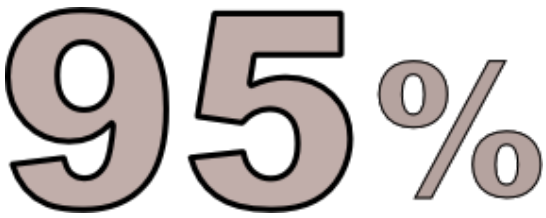

Figure 1: Super Smash Bros. Melee Damage Indicator

Displayed in Figure 1 is the damage indicator used inside of *Super Smash Bros. Melee*.

A brief explanation: *Melee* does not use health bars like other traditional fighting games. Rather, there exists this number at the bottom of the screen, which will increase every time the player's character avatar takes damage. The higher this number gets, the farther characters are knocked back when struck, with the character eventually losing a life when knocked back far enough to exceed the screen dimensions.

95% is a simple enough number. But, if given context, it's soon shown to be so much more. Say this 95% is the current amount of damage that Player_1 has taken. It can be split an infinite number of ways, with below being just a glimpse to how those combinations may occur:

Damage Partitioning			
Attack_Amount	**15%**	**60%**	**20%**
Attack_Name	Fireball	Left Tilt	Forward Throw
Attack_Source	Player_2	Player_2	Player_3
Time	1 min 20 secs	10 secs	44 secs
Location	(200, 35)	(500, 47)	(15, 1000)

Quickly, the number 95% goes from being a single numeral at the bottom of the screen into an entire story – with location of damage occurrence, time of occurrence, the type of attack, the name of the culprit and the amount of damage done at each instance.

This is exactly what an Inventible Space is – the narrative of the game space that shapes a player's future decisions based on previous ones, and it's created *entirely by the player*. This is the absolute most crucial aspect – this fact that everything about that graph came about because of the *player's* decision to take, or failure to avoid, each source of damage. As a result of these choices, the current state of the player has changed, and incidentally, so has the player's set of available choices in the future.

In *Tetris,* the nature of the inventible space is different, but the contents are much the same.

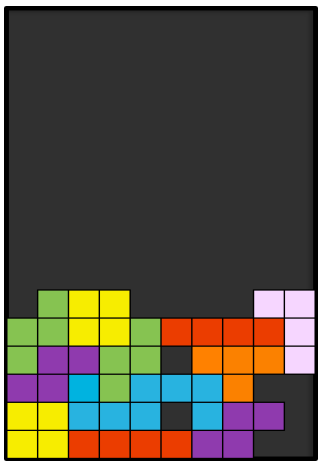

Figure 2: Replica of in-game Tetris screenshot

The past choices of the player are more readily apparent in this game, with every block serving as a reminder of decisions that were made, and because of those decisions the game's space has changed accordingly, thus exposing and/or limiting future choices the player can make. This picture is very much like the 95% in *Melee,* where an entire story sits just beneath the surface of initial impressions, and it was created entirely by the player's volition.

| Results

Both *Tetris* and *Melee,* in being long-lived video games, presented themselves as objectively replayable games to be investigated – with each of them presenting enough reason to be played again and again by multiple people well over ten years after initiall release.

The next step in research was to either find, or to create, a deterministic puzzle game with all the promise of what investigate games had to offer. Fortunately, both options were met. The game that was found, entitled *Infinifactory*, was a deterministic puzzle game, with simple game mechanics, multiple solutions and an inventible space. The created demo, entitled *The Turquoise Adventures of Mimi and Momo*, was likewise deterministic, possessing emergence gameplay mechanics and multiple ways of reaching the solution to a single problem, all while having an inventible space for players to operate within.

A brief analysis of both games will showcase why each possesses the three necessary criteria for replayability in puzzle games.

Infinifactory

- *Emergence Gameplay:* The core mechanics of the game revolve around placing various types of blocks within a 3D space in order to create an assembly line capable of producing complex artefacts. There are no limitations to the number of blocks, the types of blocks or where to place the blocks.

- *Problem Solving:* Because of the simple mechanics mentioned above, solutions can be reached through an array of ways. Even a simple chain of conveyor belt blocks has the ability to be arranged as a straight line, or a meandering one, where either choice still accomplishes the same goal.
- *Inventible Space:* Every block placed in this game acts similarly to tetrominoes in *Tetris*, in how each one marks a time and place where a player choice modified the game world, and in so doing indicates the exact moment a previous choice came to affect the present state of things, and modify the set of future decisions the player can make.

The Turquoise Adventures of Mimi and Momo

- *Emergence Gameplay:* Within the demo, players are tasked with sliding squares from the peripherals of the screen into the middle. Changing values within a square changes how that particular square will interact with its neighbours, allowing for a variety of ways to move from place to place in an attempt to reach the centre of the screen.
- *Problem Solving:* This choice in how to displace each square directly entails that every square has multiple ways of moving from place to place, and ultimately – the middle. Simply moving up can be done in five different ways, and every other direction has a number of options as well.
- *Inventible Space:* In a similar vein to *Tetris* and *Infinifactory*, the developed demo - *The Turquoise Adventures of Mimi and Momo* - allows players to keep track of each of their effects on the game's world via the squares that have been displaced. Moreover, the positioning of squares directly transmutes the set of subsequent choices that the player can make.

1) Observations

Both *Infinifactory* and *The Turquoise Adventures of Mimi and Momo*, fit each of the criterion presented for what makes a puzzle game replayable. Given time and resources,

the next step of this research would be to survey perceived replayability of both games by presenting both to a wide number of players and assess just how heavily each metric element is weighed when determining how others create reasons to replay a game after its completion.

|Conclusion

The metric proposed for measuring puzzle video games is aimed at assessing puzzle games in three separate fields.

- The first metric would be whether or not the gameplay experience allows players to discover, from a small set of simple game mechanics, continuously branching, differing ways of playing.
- Second, whether the problems presented in the game have multiple ways of being solved.
- Third, whether the game world can be moulded by player's actions, and whether these modifications can in turn alter the set of future possibilities for the player choose from.

Future research with this topic lends itself towards investigating how marketable of a feature game replayability is in driving sales and, more importantly, how such a design feature might affect other elements within a video game for better or for worse.

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