DEVELOPING PLAYER MOVEMENT DESIGN PATTERNS IN MULTIPLAYER VIDEO GAMES

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ABSTRACT

Game design patterns are valuable tools in understanding the effect of design decisions on player behaviour. This paper describes the identification and validation of game design patterns based around player movement in first/third person shooter multiplayer games, using a visual identification methodology. These patterns can aid level designers in creating multiplayer levels by eliciting desired actions/movement of the players. The pattern set provides a guide to key behaviours of gamers in this context, how to implement a design feature to evoke a specified behaviour, along with its predicted result. The validity of the approach is demonstrated through a level design case study. The proposed framework can be used alongside other design processes to allow for a more mature and structured approach to level design.

INTRODUCTION

An important focus of level design for multiplayer first/third person shooters is ensuring that the movement of the players around the map is fluid and enjoyable, and is one of the first considerations that is taken into account when designing a new level. Feil and Scattergood (2005) say that "…as a level designer, it's imperative that you consider player movement in all your designs…" (p.64).

Since a multiplayer shooter level is simply a 2D/3D environment, it holds to reason that the best way to experience it is to explore it. So designing with movement in mind will reduce the chance that it will have to be re-designed later because of major "flow" problems. In Jim Brown's presentation entitled "Legacy of Fail" at the Game Developers Conference in 2012, he stated "You never really know for sure how something will turn out until you actually play it. It's that in-game testing that allows for true iteration".

Design patterns in general are very useful in aiding the development of a product. In most cases it doesn't matter what that product is, because it will be one of three types: physical, electronic or a service, it will be directed at a user base and will be required to yield certain results. Björk and Holopainen (2005) say "The focus of architects is on the intended use of the place and the experiences people should have when crossing a bridge or being in a skyscraper" (p.33). This means that designers are always thinking about the end results of a product and the experiences that people will have with it, aiming for it to be as pleasant and memorable as possible. This will also hold true for designers of video games. Design patterns can help to achieve this, by informing an architect or designer as to the predicted results of a design implementation.

RELATED WORK

The concept of design patterns was introduced by Alexander et al, in the book "A Pattern Language: Towns, Buildings, Construction" (Alexander et al, 1977); and described patterns as:

"Each pattern describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice." (ibid) (p.x).

A key piece related to this work is the paper by Milam and Seif El Nasr (2010a) entitled "Design Patterns to Guide Player Movement in 3D Games". Their paper proposes five patterns that "…serve as a contribution to understanding and evaluating level design" (*ibid*). They are intended to aid designers to 'push' and 'pull' players through a single player level. The proposed patterns are

listed as: Collection, Path Target (PT), Pursue AI (PAI), Path Movement and Resistance (PM-R) and player is Vulnerable (PV). The process taken to create and verify these patterns, took the form of visual identification, where the researchers would watch the first 10 minutes of gameplay and note when each pattern occurred. For example in one of the games they tested, Bioshock (2K Games, 2007), they noted when the player collected the wrench, radio, genetic tonic and pistol; which refers to the "Collection" pattern proposed. Having the ability to breakdown a sequence of events in this manner allows designers to better understand them. In terms of the collection pattern example, the designers may decide that they are giving the player too many items on a frequent basis; this would be seen through the visual identification process. The designers could then choose to either reduce the number of collectable items or increase the play time between them.

However, Milam and El Nasr's work only extends to single player shooter games, but can also benefit multiplayer games also. In the case of many multiplayer levels, they are inspired by or even taken directly from the single player campaign; and re-purposed for competitive multiplayer. Some examples of this are "Strike" and "Bog" from Call of Duty 4: Modern Warfare (Infinity Ward, 2007), and "Sword Base" and "Spire" from Halo: Reach (Bungie, 2010). Both singleplayer and multiplayer levels are designed to encourage specific movement from the player, the aims may vary between linear and sandbox formats, but the overall desire is the same. This link suggests that Milam and El Nasr's work on single player games can be modified and added upon, to apply to multiplayer games.

METHOD

The first step in developing a set of design patterns for multiplayer shooter games, was to begin by identifying the extent at which the patterns suggested in single player games were seen in multiplayer games.

Visual Identification

Visual Identification (or Visual Analysis) in this context is where the behaviour of players is recorded. The procedure comprises of an expert researcher watching a gameplay video, and making notes of emergent behaviour patterns. The note would include the name (or abbreviated name) of the action, along with the time in which it occurred. An example of this is shown in table 1.

Table 1: Examples of the first five notes in two gameplay videos.

Halo 4	Team Fortress 2
0:21: PM-R	00:12: PPv
0:27: PTm, PM-R	00:15: PPv, PV
0:32: Co, PV	00:22: O, PTm
0:35: PT, PM-R	00:26: PV
0:44: PPv, PV	00:30: PPv, PV

This technique is based on those proposed by Milam and El Nasr (2010a and 2010b). In these papers the researchers imported gameplay video into the software 'Nvivo8'. It was then used to annotate all instances of their proposed patterns throughout chosen videos. Where the techniques differ is in the representation of the data. As shown above, the time index is displayed alongside the pattern(s). This allows a researcher to go to the exact point where the player was performing the action, and see what the player was doing and where in the level the player was doing it. For example at 0:27 in the Halo 4 gameplay video, the player is heading towards the hill in the middle of the map (PTm). He jumps over a gap and runs up the hill (PM-R). Once there at 0:32, he collects the 'Spartan Laser' weapon (Co) and almost immediately starts getting shot (PV), in which he retreats to safety.

Initial Pattern Set

In order to comprise an initial set of patterns; preliminary research was conducted. This involved searching for patterns that have a distinct effect on a player's movement. The patterns from the Milam and El Nasr (2010a) paper were the first. At this point the only changes were switching Pursue AI to Pursue Player (due to this work revolving around multiplayer and not singleplayer), and adding the 'Camping' pattern.

Visual identification of six gameplay videos was then conducted. The videos were selected from the most recent games in popular multiplayer series; each covering a specific play style. For example arena style gameplay (fast movement and jumping) and tactical style gameplay (slow movement and low health). During the analysis of these gameplay videos, gaps in the pattern set began occurring; where some of the actions performed by the players couldn't be accurately categorised by any of the six current patterns. This admitted additional patterns, along with modifications of existing ones. The derived patterns included: Reloading, Objective Action, Killstreak and Controlling Air Support. These patterns were added because they have distinct effects on the movement of players. For example if a player engages an enemy and

wins the fight, they will very likely reload their weapon. Since the player will be vulnerable whilst reloading, they may slow down or completely stop and take cover.

Modified patterns included Pursue Player – visual and team (PPv and PPt), Path Target – movement and visual (PTm and PTv). These patterns were modified because they can cover two distinct behaviours each, and required extensions to illustrate which the player is performing. For example Path Target covers a player either looking at or moving towards architecture in the level. The player could be moving towards a section of the level or could be standing still and aiming at it, if they believe it is where enemy players are. Since movement is completely different in these two circumstances, the patterns should reflect this.

Results of Analysis

The finalised set of game design patterns for multiplayer shooter games was presented in a 'score card' style based on the style used by Björk and Holopainen (2005). Each score card listed the pattern's name, description, usage, consequences of use and its relations. They were written in a manner that separates each one and doesn't require the reader to understand one pattern to understand another.

The following is the full list of the finalised patterns, however to remain concise only the description is presented.

Path Movement and Resistance (PM-R)
A path movement goal that encourages players to move in a certain way, any obstruction to this movement goal is resistance that the player must overcome.

Path Target – visual (PTv)
Areas or objects in the map that stand out for players and that can be used to draw their attention through the use of a view finder e.g. a gun sight.

Path Target – movement (PTm)
Areas or objects in the map that stand out for players and that can be used to guide their movement.

Collection (Co)
Refers to the act of players exploring the map in search of collectables, such as health, armour, weapons, ammunition and objective items.

Reloading (R)
Refers to players altering their current movement path to allow them to safely reload their weapon.

Objective Action (O)
Requirements of a player to perform certain actions or be in a certain location in order to achieve an objective.

Player is Vulnerable (PV)
Anytime that the player is susceptible to injury, caused by enemy players or from environmental hazards.

Camping (Ca)
Strategically advantageous areas of the level that a player chooses to remain for a prolonged period of time.

Pursue Player (PP)
Player engagement through either direct combat or through chasing behaviour.

Pursue Player – visual (PPv)
Player engagement through visual acquisition of enemy players.

Pursue Player – team (PPt)
Friendly player engagement through flocking behaviour.

Killstreak (K)
The 'killstreak/pointstreak' action where a player reaches a certain amount of kills or points, and is rewarded with something that is beneficial to them.

Controlling Air Support (CAS)
Instances where the player takes control of something other than their character, such as a drone, a chopper or an AC-130.

Emergence of Patterns in Different Titles

This section presents data recorded from gameplay videos of the following commercial games: Halo 4, Call of Duty: Ghosts, Battlefield 4, Team Fortress 2, Gears of War: Judgment and Unreal Tournament 3. As shown in figure 1, the proposed patterns can be used to determine what kind of architecture each level in these videos has, by simply looking at the chart. For example PM-R stands for Path Movement and Resistance, which is where the player is moving towards a goal but has to avoid physical obstacles such as walls, rocks, buildings, trees etc. The paths that the players took in the Call of Duty: Ghosts and Gears of War: Judgment videos; had more obstacles than that of Unreal Tournament 3. This shows that the level in UT3 was more open than the others.

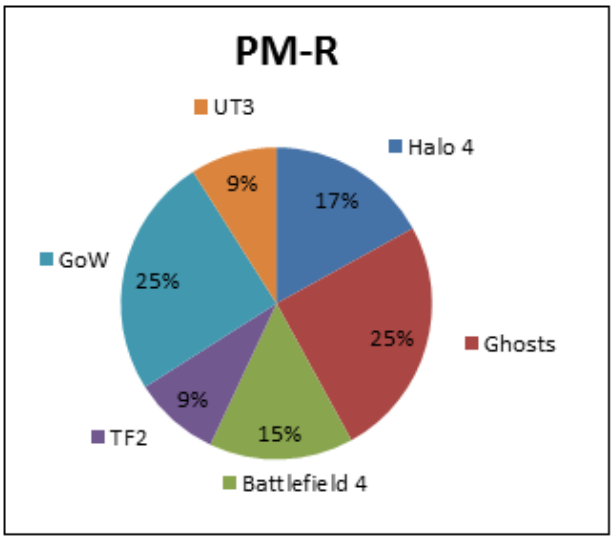

Figure 1: Data collected for the Path Movement and Resistance pattern in round one of Visual Identification.

Similarly for the Collection pattern (which involves collecting any kind of pickup in a level), some levels/games have more frequently collected pickups. As shown in figure 2, the player in Gears of War: Judgment collected the most pickups, where the player in Battlefield 4 collected none.

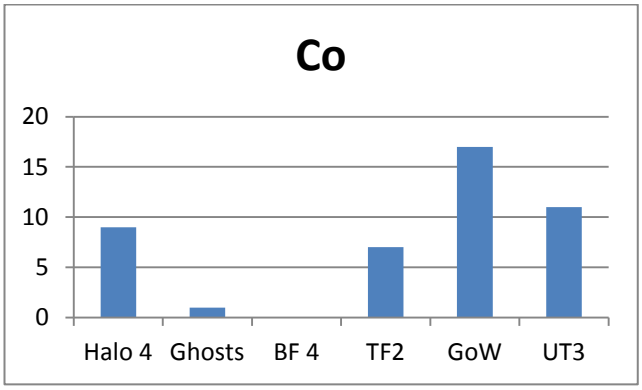

Figure 2: Data collected for the Collection pattern in round one of Visual Identification.

As mentioned previously the games selected can be categorised as either arena or tactical style shooters. The data presented in figure 3 supports this. Three of the six games have a higher frequency of the Pursue Player pattern, which means that the players were more likely to be moving whilst engaging the enemy. These three games are the 'arena' style games mentioned. UT3 is slightly lower than Halo 4 and GoW due to its larger map. The other three are the tactical style games due to the more static player engagement and reduced chasing behaviour. This is also illustrated in figure 3 through a lower PP frequency for these games.

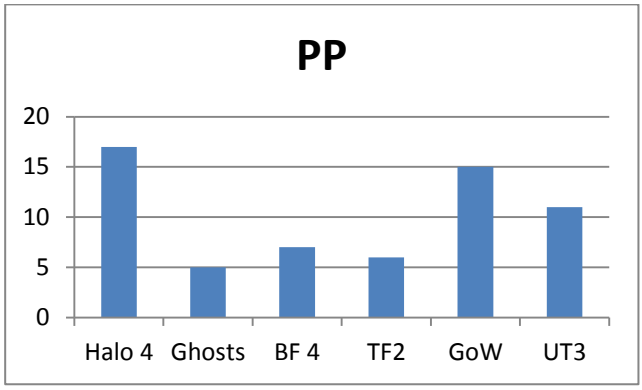

Figure 3: Data collected for the Pursue Player pattern in round one of Visual Identification.

VALIDATION

Although game design patterns are valuable in understanding player behaviour after the fact, they are also potentially useful tools for use in the design process itself. In order to effectively validate the pattern set, it was used in the iterative development of a multiplayer level. This "Testing Level" was then analysed to see if patterns led to the player behaviours predicted. The patterns were used as reference when looking at various levels in published games. For example on the level "Valhalla" featured in Halo 3 (Bungie, 2007), the focal point of the map is a hill centred mid map. This is an excellent application of the Path Target and Pursue Player patterns, as it can be used to guide movement (PTm) as well as used as a vantage point for acquiring targets (PPv). Figure 4 below illustrates the hill in Valhalla, along with the inspired creation in the Testing Level.

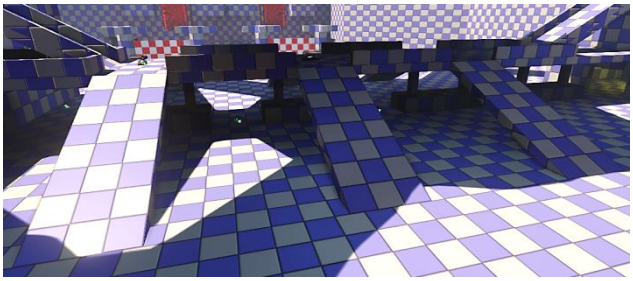

Figure 4: Images of the hill in Valhalla (top) and the bridge in the Testing Level (bottom).

The level was created using the Unreal Development Kit (Epic Games, 2009) due to its ease of use and LAN features. However the application of this framework is not dependant on the game engine nor a specific platform. The design adopted a "bare-bones" style, where the only aesthetic additions are those that influence gameplay; such as crates and team colours. Beyond that the only texturing was done using UDK's default texture. This also provided a virtual environment feel to the design.

User Questioning

To determine whether the patterns are accurately representing player behaviour and intentions, a questionnaire was created. It comprised of 20 questions, each based around an action related to a specific pattern(s). The scoring took the form of a 10 point Likert scale, allowing the users to answer how likely they are to perform the action presented in the question. For example one question comprised of: "*In capture the flag style games do you mainly defend your team's flag?*". This question related to the 'Objective Action' and 'Camping' patterns.

Play Testing (LANs)

To validate the pattern set, a multiplayer level was designed and created using the Unreal Development Kit. In this level several play sessions were held. The play testers consisted of volunteers from the University of Lincoln. They played multiple games of the Capture the Flag game type each session and their gameplay was recorded. At the end of each session they were asked to express their thoughts on the good/bad points of the level along with any suggested improvements. These suggestions were used with reference to the pattern set to make the relevant changes for the following session.

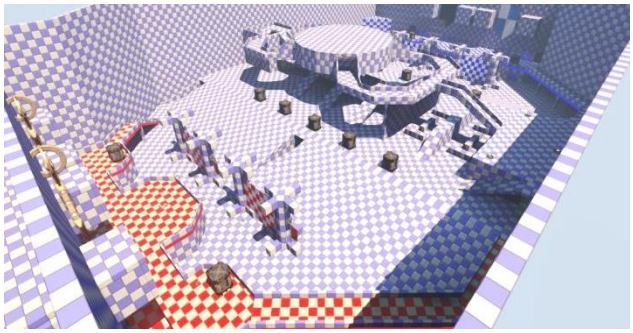

Figure 5: Image of an overhead view of the Testing Level.

This play testing was used to apply the proposed pattern set to the level design/creation scenario that it could be used for. The gameplay recorded was used in another round of Visual Identification and was used to compare the latest iteration of the level to an earlier one. The following are some examples of the patterns observed in player behaviour, and how level changes can influence how frequently these patterns occur.

With regards to the Testing Level, the frequency of the PM-R pattern increases between iteration 2 and iteration 4. This is due to the addition of an underground section, providing a more closed-in environment and more obstacles i.e. resistance. Figure 6 below displays a summation of the data collected from six different user's gameplay (three from each iteration). The PM-R pattern occurred a total of 54 times in iteration 2, and increased to 67 in iteration 4.

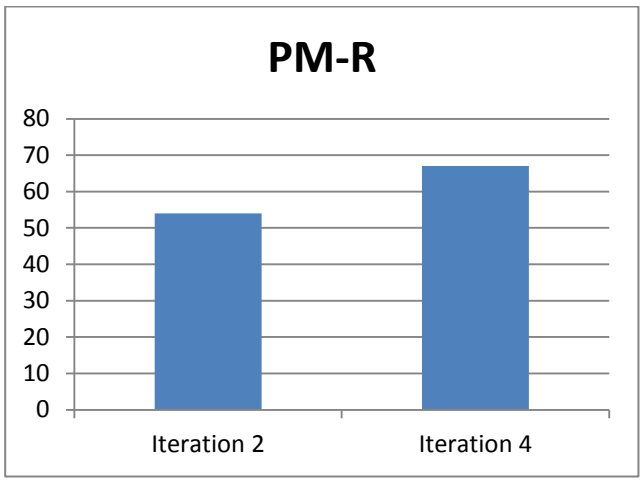

Figure 6: Data collected for the Path Movement and Resistance pattern in round two of Visual Identification.

The frequency of the Collection pattern also increased, rising from 39 to 71 as shown in figure 7 below. This was due to the increase in ammo, health and weapon pickups throughout the level.

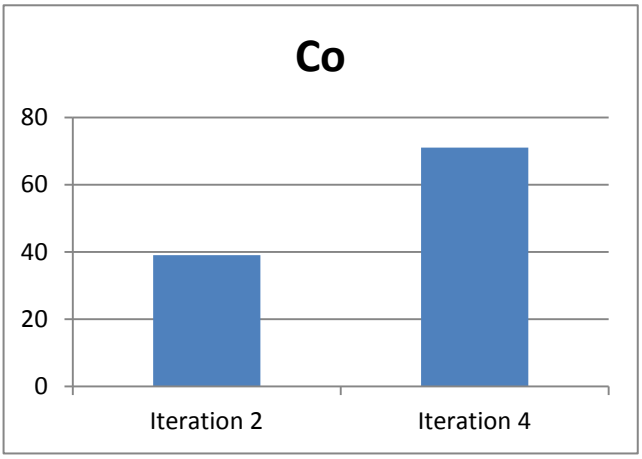

Figure 7: Data collected for the Collection pattern in round two of Visual Identification.

CONCLUSIONS

This paper presented a framework for designing for and analysing player movement and behaviour. It proposed a pattern set specifically directed at multiplayer shooter games. The processes presented aided in validating the framework and in applying it to a real world scenario; where the pattern set was used in the design, creation and testing of a multiplayer level.

It also provides examples of how a level's architecture can encourage certain behaviour from a player, and how it can influence a specific play style. It suggests that the majority of player actions have an effect on a player's movement, be it increased or reduced. Overall it proposes that understanding patterns in player behaviour can allow designers to predict how players will interact with a level; or allow designers to analyse the interactions after the fact.

Future Work

Possible future work could be to use the proposed pattern set to influence the design of multiple multiplayer levels; each with a distinct play style in mind. For example a small enclosed level to promote PM-R, PP and PV, a large open level for PPv, PTv, PTm and Ca, along with a mid-design such as two enclosed bases and an open area between, to promote all patterns. Recorded gameplay of these levels can then be analysed using Visual Identification to determine whether the expected design patterns are present.

Another possibility is to use the pattern set to analyse a multitude of games, other than the six already reviewed. This would further aid in validating the set, by considering how a variety of games of different styles effect its application. This is also how Milam and El Nasr continued their work (2010a), by reviewing a further 21 games on top their initial four (2010b).

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