A systemic domain model for ambient pervasive persuasive games

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Abstract

By the development of the system domain model it is hoped that a greater conceptual and theoretical clarity may be brought to understanding the complex and multifaceted nature of pervasive and ambient computer games. This paper presents a conceptual model, the system domain model, to illustrate domain areas that exist in a console, pervasive or ambient game. It is implicit that the regions that the systemic domain model describes are contextually dependent.

By developing this model it is possible to more fully understand the gaming application area for game technologies and in particular the pervasive and ambient games. Further implications of this model are discussed with specific instances of games that are designed to promote behavioural change, in particular with regards to health.

Categories and Subject Descriptors

K.8.0 [**Personal computing**]: Games.

H.5.1 [**Information interfaces and presentation**]: Multimedia Information Systems **-** *artificial, augmented, and virtual realities.*

H.5.2 [**Information interfaces and presentation**]: User Interfaces (D.2.2, H.1.2, I.3.6) - *input devices and strategies (e.g., mouse, touchscreen), interaction styles (e.g., commands, menus, forms, direct manipulation).*

C.2.4 [**Computer-communication networks**]: Distributed systems – *distributed applications*.

General Terms

Design, Experimentation, Human Factors

Keywords

games, persuasive, pervasive, ambient, ambient intelligence, ubiquitous computing, console

Introduction

Common perspectives on pervasive games include the technological and cultural. The technological perspective addresses pervasive games in terms of the technology which enables the game to be played, whereas the cultural perspective focuses on the game itself and the way it integrates into the everyday world (Nieuwdorp, 2007). In this paper we focus on the cultural facets of pervasive games. In particular, we propose that a pervasive game can be conceptually modelled by three domains: data generation, participation and receiving feedback.

The study of pervasive games as differentiated from traditional games seems to have focused on mobility of devices and spatial aspects, temporal expansion and social aspect of new gameplay. We see pervasive games as a subset of traditional games. We posit that if we can define the essence of a traditional game then this will include its subsets. This does not mean that they do not have unique gameplay aspects, but that these are aspects and not fundamental determinants.

This paper first describes these three domain areas and then uses an instance of the model to describe the process of playing a pervasive game, in particular an ambient games, a class of pervasive games that are designed to work with ambient intelligent environments that may be used to promote gameplay behaviours.

Engagement domain

Many games may be considered primarily as autotelic entertainments, having a purpose in itself. If we consider that a game is an open system we might expect that games may affect the world outside its narrow confines (Salen & Zimmerman, 2004). For example playing the word completion game Hangman many times might result in improvements in spelling and perhaps even the admiration of peers. In many games the abstract winning conditions either do not have benefits in the real world or only have limited benefits.

When playing games the player participates and accepts the rule systems and victory conditions of games. While participating the players may engage with the internal logic of the game, aligning their goals with those of the game (whether the goals are to complete words or defeat alien invaders). Salen and Zimmerman talk about entering into the 'magic circle' in Rules of Play (ibid.) when playing games.

This acceptance of the game world, game goals and the limitations of a game may be part of the process of engagement.

McMahan reports Carr's definition of 'deep play' as: "a player accessing/accumulating layers of meaning that have strategic value... like "deep play" in a Dungeons and Dragons context would mean knowing all the monsters and the different schools of magic, for example, whereas 'shallow' play would mean more 'up and running hack and slash' style of play". McMahan further goes on to say that 'deep play' is a measure of a player's level of engagement (McMahan, 2003).

However there are other ways of engaging with a game. The Oxford English Dictionary defines engagement as: 'To entangle, involve, or mix oneself up' and 'To attract and hold fast (attention, interest);' (Oxford English Dictionary Online: Second Edition, 1989). So being engaged with a game would mean becoming involved with it, to be attracted to it and focus attention on it. Therefore one might be engaged with a game while playing it, and still be engaged after stopping play. After stopping play it is still possible to be thinking about the game; reflecting on play, narrative, milieu and so on.

So engagement comprises:

- an acceptance of the game system (rules, goals and so on)
- entanglement with gameplay and ideas of gameplay
- focus on the game (sometimes entering a flow state)

Note that these criteria do not require the player to observe the game. Clearly this is normally part of engaging with a game, but it is possible to engage with a game without observing it; for example by thinking about it.

Generating data domain

Games are driven by decisions of players that lead to inputs from players, these actions of players result in changes within game worlds. The decision and input are two separate events, though they may often occur close together. Normally in games the input is coincident with the generation of data. For example pressing a fire button is an input that has results in a game (a weapon fires). The act of pressing the fire button may be broken down into four distinct components: first the decision to press the button, second the physical act of pressing the button, third the mechanical motion of the button that closes contacts to complete an electrical circuit and fourthly the electric signal from the button that carries the input to the computer/console.

The pressing of the button is the act that generates game data. The mechanical closing of contacts and the resultant signal that travels to the computer/console is the process of inputting the generated data.

Sometimes generated data is input in real time and has immediate effects to events in the game world. For example in a first person shooter the generation and input of data from the player has immediate effects in the game world. Note that when viewing these actions we are breaking time into very small segments, just a fraction of a second each. If we changed the level of granularity (that is, the size of time segments we are viewing) so that we were using a coarser granularity with larger segments of time then these actions and events might appear simultaneous.

In some games data is generated and input but then has an effect at a later time. For example in turn based strategy games, Civilization 2 for example, the player generates and inputs moves and after the input they complete their turn (by clicking an 'end turn' button) and the consequences are then calculated and displayed.

There are also games in which there is a long time between generating the data for play and the consequences of that data input. For example in play by mail games the data for moves in the game is posted to a game master who calculates the results of the moves and then posts the results back to the player (a more recent version of play by mail are play by email games).

Note that in all the game types mentioned above the data is generated once play has started and lies on a timeline comprising decision, data generation, input and in-game consequences.

Ambient games expand the possibility of starting to generate data before a game session (even before the player is aware of the existence of the game), since the games can be driven by everyday behaviours: distance walked, galvanic skin response or locations visited for example. In this case the ‘decision’ phase where the player plans their next move is missing or may occur later when the player decides how to use the data they have generated.

It is possible to simulate an ambient game with current technology and therefore collect data before play in a traditional game. However, it is a feature of ambient games that this real life data from gameplay can be made more accessible as it can mapped onto every day activities. In this way all of the data generation in ambient environment may be thought of as a resource that can be used in a future game. It may also be used in current games to instantly triggering actions.

Receiving feedback domain

For purposes of clarity, we will discuss receiving feedback in the limited context of observation although feedback is not defined or limited to it.

Observing is defined as: ‘The action of watching, noticing, or subjecting to scientific observation.’ (Oxford English Dictionary Online: Draft Revision, 2004).

In the context of the systemic domain model there are different things that may be watched. A gameplayer may watch what is happening in a game they are playing as they make moves. This may be divided into a number of separate steps:

a) They notice themselves making a decision.

b) They are aware of their movements (or other physiological phenomena) that generate data.

c) They notice the immediate mechanical/electronic consequences of their movements (the data that has been generated may also be recorded in this step).

d) They watch the consequences of the input of their data.

Note that in ambient games players may observe a) and b) before they start playing the game or even before they are aware of the game.

In addition to observing the game people may observe things connected with the game while not playing. They may observe events that are occurring in a game world that are driven by other players. They may also observe other players both while playing themselves or while not playing. In the case of ambient games they may further observe people who are generating data but who have not started playing, and also observe the data being generated.

Note that it is possible to receive feedback from a game or observe a game while not being engaged in the games, that is not accepting the game system (rules, goals and so on), not being entangled with gameplay and not focusing on the game.

Systemic domain model for computer games

The three domains as described previously are combined to create a systemic domain model for computer games. This can be used to describe a class or genre of games and could also be used to describe individual games. Each of the intersecting areas represents a different game related activity which players may pass between over time; before, during and after play. Note that these movements need not be between touching areas, but can jump between distant areas. The areas themselves are contextually dependent, in that they can apply to many different games and the perspectives adopted by different people.

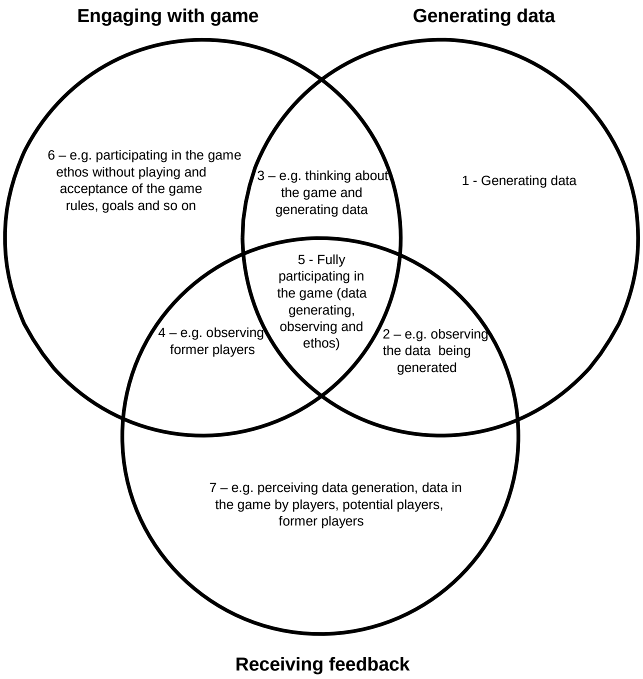

Figure 1: Systemic domain model

Systemic domain model for console (non-pervasive) games

Before considering pervasive games, we will first show a model for more traditional 'console' video games. These are games in which the player moves tokens or characters in a virtual (2D or 3D) environment in real time. The shaded area in the systemic domain model for console games figure represents the space inhabited by the player while they are playing the game. They are fully engaged (with the rules, goals and gameplay mechanisms), they are generating data (making moves, interacting with characters) and are receiving feedback by observing what they are doing.

If we examine a traditional computer game during play at low granularity, we can see that they fit neatly in to the central over lapping area shaded.

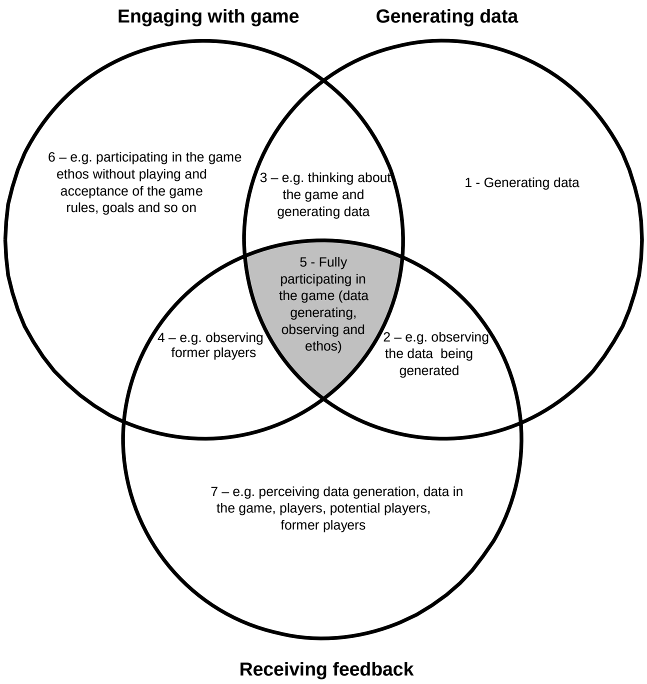

Figure 2: Console games during play

Before playing, the players may have been in area 6 if they had previously played the game and were engaged in its ethos, rules and so on. They might also have been watching someone else play, shown as area 4. If they had not previously played they might start in area 7, watching other players. They may not start in 1, generating data with out some knowledge of the game; they also may not be playing without watching the consequences of their play (area 3).

However at higher-level granularity of a game where we can expand time to look closely at the gameplay, it is possible to expand the traditional games from this central area and consider all areas including independent data generation is part of the system domain model. It is practically less likely that data generation without engagement and receiving feedback will be used in traditional games. It is also less likely that gameplay mechanisms of area 3 and 6 would be extensively used as the association of data generation and extended gameplay, respectively are problematic although they could conceivably exist.

Note that the numbering of the areas does not refer to the order in which the player passes through them but is just to identify them.

Systemic domain model for pervasive and ambient games

If we consider pervasive games are a subset of games in general, then we would expect many inherited traits. A distinguishing feature of the pervasive games is the ability of a pervasive game to expand the possible data collected and to make it easier to integrate into a game. This ability to generate data expands the possibility to incorporate real life data into games and to generate this data through an ambient environment. Through this conceptual model, it is possible to view data gathering as a key gameplay mechanism to developing pervasive and ambient games to modify behaviour. Further it is possible to create gameplay rules that encourage or promote behaviours associated with gameplay that are linked to real life behaviour and by so doing promote and reinforce those behaviours through gameplay mechanisms. It may be possible to extend the temporal gameplay to reinforce gameplay behaviour whilst not receiving gameplay feedback or in our particular instance not “see the game”. That is the participant may through engagement with the game continue to show behaviours reinforced by the gameplay mechanisms, in the full knowledge that she will return to the game at some later date, with the knowledge that her continuing behaviour is part of the gameplay mechanism. A further extension of this is that if these gameplay behaviours become embedded in into real life behaviours the game may be affectively used to promote real life behaviours outside of the game.

In pervasive games, play does not just occur in front of a computer or console but passes out into the world. In ambient games the player’s actions in the real world can be used to generate events in a virtual game world, the actions being (ideally) monitored by an ambient intelligent environment (Eyles, 2007a). Consequently, while in the process of playing a pervasive or ambient game the activities of a player may be represented in a number of the areas in the systemic domain model.

Players may take many paths through the model, most notably for pervasive games with which they may generate data before they decide to engage with the game. The knowledge alone that this data exists could attract potential participants to review their own personal data. Replay of this data through gameplay or other means when observed by the potential player might also promote gameplay.

The notions of temporal expansion are seen in areas 6, 3 and 1. These areas may also be closely associated with the notion of social expansion. Montola has also defined pervasive games in terms of social, temporal and spatial expansion which supports the definitions above (Montola, 2005).

Persuasion

The opportunity to modify player behaviour is embedded in ambient games in particular. If we consider that they are open systems then we can recognise that everyday tasks carried out by players have an effect in a virtual world and real world. By assigning game value to tasks that are linked to a gameplay mechanism, it is possible to transform player behaviour as was observed when the ambient game Ambient Quest was played at the Women in Games 2007 conference. In the game Ambient Quest the distance walked by the player is rewarded by moves in a 2D virtual game world. Players reported anecdotal evidence of walking further during the conference while playing the game (Eyles, 2007b). This influence of gameplay affecting real life needs to be further studied in a longitudinal trial.

The lure of associating gameplay mechanisms with real life activities that are perceived to have health benefits may be another strong attractor for transforming behaviour. An example of this might include a gameplay regime that promotes a healthier life style. Other currently exploited examples include viewing data or playing against highly esteemed persons e.g. in a training gameplay mechanism. It is clear that computer gameplay mechanisms if adopted have the potential to promote a healthy life style (Eglin & Eglin, 2007). It has also been suggested that the incorporation of these gameplay mechanisms should not form the sole, or main mechanism, but rather that these learning activities should be designed as mechanisms that allow greater efficiencies while in gameplay. The learning activities, or learning outcomes, are embedded in the mechanisms such that they are not essential for completion of goals, but the required behaviour (that is linked to the outcomes) greatly aids the successful completion of those goals (Bartle, 2006).

The gameplay mechanisms might be seen as a means to transform real life behaviour for short periods between gameplay, via temporal expansion. Further it might be seen as a means to be a transforming agent that could develop lasting behaviour beyond the game playing session. In particular, area 6 in which the players may be deemed to be engaged with the ethos of the game (e.g. where potentially healthy behaviour have been promoted in the case of Ambient Quest) requires further examination.

Current research at the Advanced Games Research Group at the University of Portsmouth is seeking to investigate this phenomenon further and in particular is addressing the question of whether these changes in behaviour only occur during the game or whether they continue after play stops. The systemic domain model offers a way of teasing out which specific types of player behaviour need investigating.

Conclusion

The systemic domain model described in this paper offers a conceptual framework for describing, defining aspects of games and differentiating pervasive, ambient and traditional (console) computer games at set granularity. This model also offers a conceptual model to aid the design of gameplay mechanisms to promote gameplay behaviours as a response to gameplay and in particular to ambient gameplay carried out in an ambient intelligent environment.

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