



Review

Video game personalisation techniques: A comprehensive survey[☆]Stephen Karpinskyj, Fabio Zambetta^{*}, Lawrence Cavedon

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ABSTRACT

Personalisation is the automatic customisation of content and services based on a prediction of what the user wants. Common examples of personalisation can be found in websites that automatically recommend news items or products based on the similar behaviour of other users. In the video game domain, personalisation involves constructing a system capable of tailoring video game rules and content to suit some aspect of the player, e.g., a player's gameplay preferences, playing style, or skill level. The result of personalisation is a video game that can adapt to suit individual players while they play in order to more effectively entertain, learn, or communicate. In this paper, we survey the most relevant trends and directions of research in personalisation for computer games, a true multi-disciplinary problem requiring contributions from areas as diverse as artificial and computational intelligence, game studies, psychology, game design, and human–computer interaction.

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1. Introduction and overview

Personalisation is the customisation of content and services based on a *prediction* of what the user wants. Common examples of personalisation can be found in websites that recommend news items or products based on the past behaviour of the user or the similar behaviour of other users. We are primarily interested in *automated* personalisation, in which such customisation is

performed automatically by/within an application, and this review focuses on reviewing work on this capability within video games.

In the video game domain, personalisation involves constructing a system capable of tailoring video game rules and content to suit some aspect of the player (e.g., a player's gameplay preferences, playing style, skill level, etc). The result of personalisation is a video game that can *adapt* to suit individual players *while* they play in order to more effectively entertain, learn, or communicate.

A system that dynamically modifies or generates video game content and rules could theoretically also do so by basing its decisions on some kind of input *other* than the player, e.g., as done by “context-based” games. For example, a system that adapts the attitudes of non-playable characters in a role-playing game can do so

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Table 1

Examples of how video game personalisation has been applied, categorised by both the type of player data used (i.e., input), and the gameplay being personalised (i.e., output).

Preferences	Role-playing game maps [5] Difficulty, weapon control, and objectives [6] Platforming levels [7]
Personality Experience	No current games applications Camera position [8,9] Plot/story points [10] Platforming levels [11,12] Action game levels [13]
Performance	Platforming levels [14] Enemy type and count [15] Platforming levels and dungeon structure [16] Battle missions [17,18]
In-game behaviour	Quest structure [19,20] Weapon behaviour [21]

in a randomised fashion, or in a way that is dependent on the time of day. In spite of this, much work describing an adaptive video game system still places exclusive focus on a single input source: the player [1–3]. This exclusive focus is hardly surprising given the core purpose of a video game: to entertain, communicate with, and educate a population of human players that each have a varying assortment of tastes and attitudes.

However, while the potential of video game personalisation is significant and can enhance a video game's effectiveness and in some way account for variety within a population of players, achieving personalisation to any meaningful degree is a challenge. Even a more widely accepted application such as “dynamic difficulty adjustment” [4], defined as the adaptation of a video game's difficulty to match the player's skill level, is still far from becoming a staple feature of modern video games. Again, this is hardly surprising when you consider the profundity of what video game personalisation is really setting out to achieve: the construction of models that describe human characteristics and, in many cases, the reliable interpretation of in-game player behaviour.

In this paper, we survey work relating to video game personalisation in sections that correspond to five ways that players are often said to differ from each other:

1. By preferences (i.e., gameplay that players find appealing).
2. By personality (i.e., distinctive character of players).
3. By experience (i.e., how players emotionally and cognitively respond while playing).
4. By performance (i.e., the degree and rate of player achievement/progression).
5. By in-game behaviour (i.e., the actions a player made within the game).

Each section introduces each player differentiation category before describing examples of their application to video game personalisation. Table 1 contains all references for each category's applications for quick reference. Our discussion of other work in this paper aims to identify key research avenues that require further exploration.

Other surveys related to the topic of video game personalisation include [22,23] which both survey the broad field of player modelling with a focus on a better understanding of how players behave in games.

2. Player preferences

In this section we review and compare work that focuses on differentiating players by how much they do or do not like particular

types of video games (e.g., puzzle games, racing games), or elements of video game design (e.g., “competition”, “discovery”, and “strategy”). This is often described as a *player's preferences*. Though this section focuses on preferences and how they have been applied to personalisation, we also briefly discuss work on player motivation and list types of gameplay that others have identified. We introduce motivations and gameplay types in this section because they can also provide insight into different preferences that a player might have. In fact, we draw upon work in all three categories (i.e., preferences, motivations, and gameplay types) to form a comprehensive list of preferences.

2.1. Our view of player preference

We start our discussion of preferences by first establishing how our view of preferences differs from other work. This is important because the term “player preference” has been used ambiguously in the literature on this topic.

Firstly, we view a player's preferences as being equivalent to a player's “taste” in video games that is potentially *independent* of commonly held video game genres such as the real-time strategy (RTS) or role-playing game (RPG). For example, a player can have a preference for gameplay concepts such as “strategic planning” or “player cooperation” that can be fulfilled in different measures and forms by multiple genres. For example, strategic planning is often found in RTS's where the future production and location of buildings and units require planning, and in RPG's where the future development and specialisation of the player's character requires forethought. Similarly, player cooperation is often found in both multi-player RTS's and multi-player RPG's. This view is in contrast to another that instead equates a player's preferences to being an abstraction of a person's “play style” *within* a particular video game genre. For example, a player can have a preference for gameplay activities such as “exploring/adventuring” or “collecting” within the role-playing game genre [24,5].

Secondly, we view a player's preferences as having a similar structure to psychological models of personality that are “trait-based” such as the Five-Factor Model [25] rather than “type-based” such as the Myers–Briggs Type Indicator [26]. Our use of these terms throughout refers to their respective structures and separate that from the psychological reasoning behind them.

2.2. Type-based and trait-based preferences

An early example of a type-based player preference model is Bartle's taxonomy [24] that views online role-playing game players as either “achievers”, “explorers”, “socialisers”, or “killers”. This has since been extended to eight types rather than four [27]. Other examples have since followed a similar approach, but none present a model that can be confidently applied to video game personalisation for various reasons. For example, [28] does not include details of the instrument used in *Wizards of the Coast's* market research, [29] is based only on informal observations of player behaviour, and while [30] is based on empirical evidence it is self-admittedly “very sketchy and incomplete”. All of these examples are not only what we consider to be the *play style* view of preferences but are also *type-based* without exception. [31] is an example that deviates from this trend and describes a set of preferences where each item corresponds to a common video game genre or subgenre from the set of nine categories described at length in [32]. This is an example of yet another player preference perspective, one defined by viewing each preference as being equivalent to a game genre. [33] details at length the arguments for both type-based and trait-based models, but states that, for the same reasons that psychological models have moved from being type-based to trait-based, future studies should focus on investigating a trait-based

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