

Applying thematic analysis to define an awareness interpretation for collaborative computer games



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ABSTRACT

Context: Collaborative computer games have evolved from single-player to massively multiplayer awareness-demanding games, usually involving collaboration to achieve team goals. As a consequence of such evolution, these players should be provided with awareness information that enables them to perform collaborative tasks with other team members.

Objective: The objective of this work is the analysis of current awareness interpretations in order to develop an awareness interpretation that collects the awareness needs of such games.

Method: This analysis has been conducted by means of a step-by-step Thematic Analysis of current interpretations that led us to extract the most relevant awareness elements defined in existing interpretations. The developed awareness interpretation was empirically evaluated by means of several surveys aimed at assessing whether the implementation of the interpretation elements in a game would improve the players enjoyment.

Results: The Thematic Synthesis Analysis concluded that none of the current awareness interpretations can deal properly with collaborative computer games, specifically due to collaboration and social & group dynamics. This Thematic Synthesis Analysis led us to coin *Gamespace Awareness*, a new awareness interpretation based on a combination of the previously analyzed awareness interpretations, which is suitable for collaborative computer games. The interpretation was positively evaluated for two games, namely a first person shooter and a real-time strategy game.

Conclusions: Gamespace Awareness combines the potential awareness elements needed for collaborative computer games, making it possible to identify the awareness requirements of these games from the very beginning.

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1. Introduction: collaboration and awareness in computer games

If we take a look at Forbes top 10 best-selling videogames of 2014 [43] we can see a melting pot of games belonging to several platforms and genres. However, all these games have something in common: they feature a collaborative mode, indicating that nowadays players certainly enjoy playing together. This multiplayer trend started back in 1958, when William Higginbotham created the first multiplayer computer game, *Tennis for two*, which simulated a tennis match on an oscilloscope (see Fig. 1). Nevertheless, the two-player mode was necessary due to the non-computing capabilities of the oscilloscope. The trend for two op-

posing players continued until 1978, when John Ray and Howard Delman designed the very first cooperative arcade game, *Fire Truck* [5], whose two players had to drive a truck as fast as possible, the gas and brakes being controlled by the player sitting at the front, while the other player controlled the rear wheel tiller (see Fig. 2). Since then, those computer games which used to be played by a single player or at best up to four players, have evolved beyond all recognition. Nowadays, together with such classic 2D games, which are having a revival thanks to the increasing popularity of smartphones, 3D collaborative multiplayer games have also become really popular. This style of gaming has evolved dramatically, especially since the inception of *massively multiplayer* games. The increasingly popular *Massively Multiplayer Online Role-Playing Games* (MMORPGs) are simultaneously played by millions of people, *World of Warcraft* [12] being the best-known example, with 8 million paying subscribers. Nevertheless, such players do not all play together, but are organized into different realms with a capacity for 8000 players per server. However, different MMORPGs such

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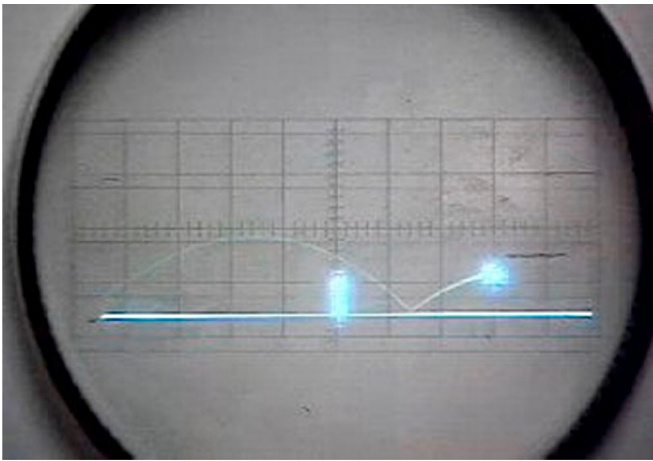


Fig. 1. Tennis for two (1958).



Fig. 2. Fire truck (1978).

as Ultima Online [36] have a higher capacity for 15,000 simultaneous players. MMORPGs usually organize their enormous number of users into groups, whose members collaborate with each other to achieve common goals that would be impossible to attain individually.

Since a collaborative multiplayer game is a special kind of collaborative system whose users play collaboratively [16], they need real-time information about the other players (e.g. what they are doing, where they are, what capabilities they have). In other words, players must be provided with *awareness* of other users (both allies and enemies) and the game's environment [4]. Dourish and Bellotti defined awareness as the “understanding of the activities of others, which provides a context for your own activity” [34]. Many modern computer games are 3D-immersive, so that you must not only be aware of the other players, but also of the context, i.e. of objects hidden in the environment and their characteristics. Providing players with awareness benefits them in two different ways: first, this information makes them better players and thus increases their enjoyment [51,85], and second, it makes the game easier to play for novel entertainment-oriented players since it will facilitate the players choice within the game [90]. This is because further awareness information of the different elements (allies, foes, items, active skills, etc.), means the players are able to interact with each other and with the different elements more easily. In Gutwin's words, “being able to stay aware of others plays an important role in the fluidity and naturalness of collaboration, and supporting awareness of others is looked on as one way of

reducing the characteristic awkwardness of remote collaboration” [50]. In other words, awareness makes collaborative games more natural. Furthermore, this awareness will also increase some of the different forms of fun defined in [46,55], such as fellowships or social interaction.

Awareness in games can be considered as additional information about the game the players are provided with in order to improve different aspects such as usability, user's enjoyment, the ever more in demand in-game socialization, etc. In other words, if the players are provided with no awareness, they may be able to play the game, but would do so in a clumsy and uncomfortable way due to the lack of information about the game environment (other players, items to interact with, social aspects and so on). Awareness information also increases the players' interest in the game [109], or in other words, makes them feel that they are *involved* in the game and not just playing it [75]. For example, in a real situation it is common to be aware of a player behind us. However, in a computer game we are not aware of his presence unless some awareness mechanism is implemented. With similar needs in mind, several authors (see Section 2) have defined their understanding of awareness by focusing on different domains that range from the design of military vehicles to groupware systems. Some of the most well-known interpretations are Collaboration Awareness, Situation Awareness, Workspace Awareness, Location Awareness, Context Awareness, Social Awareness, Activity Awareness, as well as other interpretations of awareness focused on more specific domains. However, none of these interpretations can be considered enough by itself to cover all the awareness needs in a modern collaborative computer game (as will be shown in Section 3). This constitutes the main motivation for this work: the development of a new awareness interpretation, by compiling elements from different existing ones, that helps game designers and developers to identify awareness needs of new and more successful [94] collaborative games. In this regard, our proposal could be used as a basis that includes the most recurring awareness elements of such interpretations. Nevertheless, it could also be enriched with new awareness elements if needed.

As Wohlin states [113], “despite the increased focus on conducting systematic literature studies in software engineering, there is still too little attention on conducting research synthesis”. Therefore, in order to properly identify the awareness needs of collaborative (or non-collaborative but immersive) computer games, a Thematic Synthesis [14,25,105] has been conducted in this work. Thematic Synthesis is a synthesis method of qualitative evidence that guides researchers in the process of analyzing literature and identifying important and recurrent themes that are summarized later on. As the main result of the Thematic Synthesis we present *Gamespace Awareness* (GA), a new awareness interpretation focused on representing the real-time awareness information required by players of modern computer games. To present our proposal, we rely on one of the analyzed awareness interpretations, namely *Workspace Awareness* [50] which offers a way of representing the knowledge behind GA in a clear manner which can be easily used by game designers. GA was developed by analyzing and extending Workspace Awareness with different elements obtained from the other interpretations analyzed which are related to several awareness requirements such as the social features of collaborative computer games. Similarly to previous awareness interpretations, GA will provide game developers with a scaffold on which they can specify and build the awareness capabilities needed for modern games. Moreover, we conclude our work by integrating GA into a game development process that guides game developers while they identify awareness needs from the very beginning of the game development, i.e. the requirements engineering step [28]. Finally, GA is empirically evaluated by using two surveys related to well-known collaborative games, obtaining

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