

Chapter 0

Immersion in Digital Games: a Review of Gaming Experience Research

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Abstract—Immersion is a widely valued experience when playing digital games however it is only one component of the gaming experience. In this chapter, we review our specific approach to immersion in relation to other concepts that are used to describe gaming experiences. These include: concepts that are not specific to games such as flow and attention; generic conceptualizations of the gaming experience of which immersion may form part, such as incorporation; and specific concepts around immersion, engagement and involvement such as presence and other formulations of immersion. To illustrate the sorts of studies being done in this area, we describe one experiment in detail which aims to position immersion in relation to presence. The chapter makes three contributions: a clear formulation of immersion as one aspect of gaming experience; an overview of the state-of-the-art of gaming experience research; and a demonstration of the possibility to achieve an empirically founded understanding of these rich, subjective experiences.

Index Terms—immersion, digital games, gaming experience

I. INTRODUCTION

The sheer diversity of style, formats and aesthetics of digital games is paralleled only by the range of experiences that they offer to their players. In fact, it could be argued that

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diversity in games is driven by the desire to offer new and compelling experiences to players. Games have moved from simple activities like shooting as many aliens as possible (*Space Invaders*) or keeping an abstract tennis ball in play (*Pong*) to vast complex worlds (*World of Warcraft*) offering sophisticated back stories (*Heavy Rain*), monumentally beautiful landscapes (*The Shadow of the Colossus*), dream-like explorations of time (*Braid*), almost unlimited building resources (*Minecraft*) and shooting as many aliens as possible (*Duke Nukem 3D*) (though admittedly in much more interesting and complicated ways).

Undoubtedly, players experience games in a subjective way from the anticipation before purchase [1] to the drive to pick up a game and play again [2]. However, throughout the enormous individual experiences had by many millions of players across a wide range of games, certain types of experience are consistently reported: fun, immersion, challenge and so on. In this chapter, we focus on the idea of immersion in games as it has consistently proved itself to be an important component of the experience players seek from games [3] and has been a sustained focus of our research into games over the past ten years.

Here we review the work on gaming experience with the aim of positioning immersion in relation to the various other, generic experiences that games offer. With such a wide variety of other approaches to gaming experience, there is a risk that immersion is just a re-packaging of other, potentially more important, concepts. The aim in this chapter is therefore to make clear distinctions between immersion and the other experiences that games offer. The chapter therefore functions as review of the general gaming experience literature but with a focus on better formulating the notion of immersion. To do this, we discuss the findings of several studies in this area, some of which have not previously appeared in the literature. Before going any further though, it is worth making clear what we mean by immersion based on our research to date.

II. INTRODUCING IMMERSION

Immersion, as we use the term here, is intended to mean the engagement or involvement a person feels as a result of playing a digital game. A more colloquial expression would be to say that a person feels as if they are “in the game” and as such

immersion has parallels with the idea of being immersed in water [4]. This term is widely used by players and reviewers alike though very much in a casual, colloquial sense but clearly as a positive component of any gaming experience. This led Brown and Cairns [3] to further study what players meant by this term. They conducted a qualitative, grounded theory study with gamers in order to investigate their experiences of immersion. It was found that players were able to distinguish different levels of immersion in games and these corresponded to their sense of engagement and involvement in the game. The basic level of immersion is engagement where players simply invest time and effort to play the game. The next level is engrossment where players are dedicating a lot of attention and also emotional involvement into the game. The third and highest level is total immersion which they identified with presence. As will be discussed below though, this was a confusing use of terminology as presence, as more widely understood, does not correspond to immersion. Total immersion was seen as the idea of complete involvement with the game where nothing else matters and the player feels “in the game.”

All three levels of immersion were considered as good features of a game and more interestingly it was recognized that total immersion was generally a transient feeling. Most immersive gaming experiences were of the engaging or engrossing variety with total immersion reserved for the most intense periods and even restricted to a short period within a longer playing session. Brown and Cairns also identified barriers that prevented movement between the levels of immersion such as having the time to commit to playing or the energy to make the emotional investment.

What should also be noted was that being “in the game” was not a statement about spatial or social location. It was about the cognitive state of the player and could happen in games like *Bubble Bobble* where there is no meaningful spatial or social location for the player to inhabit. This is important when thinking about immersion in terms of presence and, as will be seen, why the term presence for total immersion was incorrect.

Being a cognitive state of involvement, immersion need not necessarily be reserved for digital games. Hong [5] showed that something akin to immersion in digital games could be experienced whilst watching films or reading a book. Moreover, the level of immersion experienced correlates with the personality trait of absorption [6]. That is, the

more a person had the trait of being able to become lost in their own thoughts, the more immersed they were in the media experience. Of course, the fundamental difference between immersion in digital games and immersion in reading and films is that the player of games has agency within the mediated world that generates what players experience whereas books and films unfold a scripted narrative for players to consume ([2], chap 7).

It is also worth mentioning in the context of generic gaming experiences the notion of cognitive absorption [7]. Cognitive absorption (CA) builds on the personality trait of absorption [6] but is oriented towards people's experiences of technology and their tendency to become involved in their use of technology. At first glance, this may seem to be very similar to immersion but in fact CA is intended to be a personality trait whereas immersion is the state players achieve whilst engaging with technology, specifically digital games. In that sense, cognitive absorption or indeed the original trait of absorption may influence people's individual experiences but does not directly relate to any particular experience that players have.

Building on Hong's work [5], Jennett et al [7] looked to operationalise the measurement of immersion in games by the use of a questionnaire. The questionnaire devised adapted that used by Hong to be more appropriate to digital games and incorporated some of the concepts that had arisen in Brown and Cairns' work. This was validated in a large scale study. The resulting Immersive Experience Questionnaire (IEQ) consists of 31 Likert scale questions that together address a wide range of experiential outcomes that tap into the latent, subjective experiences that could be called immersion. Validation of the questionnaire, including a large scale survey and experiment, provided good support for the construct validity of the IEQ. The factor analysis of the IEQ conducted as part of the validation also suggested that immersion could be considered as having five constituent factors. These can be divided into two groups: the person factors of emotional involvement, cognitive involvement and real world dissociation; the game factors of challenge and control (though it should be noted the game factors are really players' perceptions of the games not intrinsic properties of the games).

Overall then, immersion is a cognitive experience that players have that arises from playing digital games. It can be characterised as the degree of involvement that players

have with different aspects of the game leading to a move of the attention, awareness and thoughts of the player from the real world around them to the events happening within the game. In this sense, immersed players are “in the game.” Building on these conceptual foundations, immersion has been shown to be related to wide-variety of factors that relate to games, for instance, addiction [9], the music used in a game [10] and the screen size of the device a game is played on [11]. It has also been used to explicitly inform the redesign of games [12] though with limited success. We will return to this point later in the chapter.

Obviously, immersion is only intended to capture one aspect of the playing experience and very much the state of mind players experience whilst actually playing. The problem with such latent, subjective concepts is that they may be merely facets of other such concepts, for example spatial presence in the game, or just a halo effect arising from a general subjective experience, that is people report high immersion when they have had a good gaming session even though the experience was not especially immersive. In the remainder of the chapter we consider immersion in relation to other descriptions of gaming experience and we group these into three sections: generic positive experiences that are not particular to the experience of playing digital games; broader descriptions of gaming experiences; gaming experiences specifically related to immersion, engagement and involvement.

III. IMMERSION AND EXPERIENCES NOT SPECIFIC TO GAMES

Games are primarily intended as a form of entertainment (though it is becoming recognized that games can be used as a vehicle to achieving more serious goals eg [13], [14]. As such, the experience of digital games can be contrasted with general positive experiences that people can have. Within the field of positive psychology, relatively little work has been done (at least in comparison to fields like cognitive psychology and clinical psychology) to understand these positive experiences. It is only more recently with the work of the likes of Seligman [15] and Wiseman [16] that the positive experiences that people have every day, such as being happy or feeling pleasure [17], are beginning to be empirically understood. In relation to games, two generic experiences

that might be expected to be experienced when playing games are fun and flow. Additionally, immersion as state of involvement or engagement in a game may in fact just be a game-specific formulation of the more general psychological phenomenon of selective attention. We therefore consider each of these three concepts and their relationship to immersion in turn.

Fun per se is a problematic concept. Huizinga [18] identifies it as an important component of play: why would you play if it weren't fun? And this must therefore by extension apply to digital games. But thinking even in the context of digital games, is it reasonable to say that the fun had when playing a casual physics-puzler like *Angry Birds* is the same as that had when playing a survival horror game like *Silent Hill*? Both may legitimately described as fun by their players but the fun had is surely of radically different sorts. Of course, the argument could then be extended to say that the same is true of the types of immersion that can be experienced. We would argue not: the cognitive state achieved through involvement in both types of game leads to a focus on the game with a related dissociation from the real world around the player, that is, immersion. The games offer the opportunity for challenge and involvement, albeit in very different ways, that lead to this sense of immersion.

The problem of fun in games is a specific problem of more general issue of what it means to have fun with any form of technology [19]. It is now widely recognized that even useful and productivity-oriented technologies, such as mobile phones and laptops, should make consideration of the need to have a positive experience like fun. Blythe and Hassenzahl [20] discuss the semantics of fun and note that fun is one of several terms that are loosely used interchangeably but that in fact the usage of fun clearly relates fun to the notion of distraction and transgression (of social situations or boundaries). They contrast this with pleasure which is more about commitment to a process that has meaning and offers achievements. In this sense, pleasure is the better term for the generic experience gamers have because as seen in the development of the notion of immersion, for players to achieve immersion, they need to commit to playing the game and it is only through taking the game seriously through emotional and cognitive involvements that they are able to achieve immersion.

Calleja ([2], p53) rightly points out though that such generic, super-ordinate terms like fun and pleasure have a sense of vagueness about them and an almost holistic approach that defies proper analysis. We agree with his claim that stopping research at this level does not do justice to the richness and depth of gaming experiences that could be had by adopting different terms and working hard to understand them instead.

In contrast to fun and pleasure, flow is a very specific concept arising from positive psychology and is described as the optimal psychological experience that can arise from being engaged in an activity [21]. As such, flow is an extreme experience that can be had when we are performing any activity. While performing an activity, one can only achieve flow when one has fulfilled all nine characteristics of flow namely a balance between challenge and skill, clear goals, immediate feedback, intense concentration, merging action and awareness, loss of self-consciousness, a sense of control, time distortion and experiencing the activity as intrinsically rewarding [22] [23]. It is clear that there is no shortcut for it. Flow helps to integrate the self during performing the activity and it makes the activity more enjoyable. It makes the activity become the only thing that matters and the rest of the world disappears from awareness. This growth of the sense of self is intrinsically rewarding and leads to happiness and enjoyment and the desire to seek out the activities that lead to further flow experiences.

There have been a number of investigations into flow in digital games. Chen [24] states that to provide an enjoyable gaming experience, game design should follow a four-step methodology that would maximize the opportunity for flow. The methodology includes consideration for some of the components of flow, how to keep users' experience within the flow zone and offering adaptive choices to let users enjoy flow in their own way and embed choices within core activities to ensure flow is never interrupted. In addition, Cowley et al [25] add that a flow state experienced when playing a game depends on how the player relates to the game as an activity. They believe there is a common correlation between playing digital games and getting in the flow state based on the characteristics of games that allow gamers to master the game as the challenge develops. Hence within digital games, flow is considered to be an important element for gaming experience.

Having said this, the word immersion is used in flow to capture and label the essence of what happens when one becomes totally absorbed in an activity [26]. It is, however,

different from the concept of immersion in digital games. We argue that flow and immersion in games are distinct from each other based on their own characteristics.

For example, considering type of game like *Minecraft*, there is final goal to achieve yet gamers are still able to be immersed in the game but flow requires a clear goal from the activity. Moreover, if you are playing a game on your mobile device while waiting for the bus at the bus stop, you are quite likely to become immersed in the game but it would take something intense to provide a flow experience in those circumstances. This is because, when people get immersed in a game, they are still aware of needing information from the real world such as when to catch the bus however flow requires one to be unaware of the surroundings and the real world tasks. Thus, immersion is more of a graded experience whereas flow is an all-or-nothing sense of being “in the zone.” This may correspond to the experience of total immersion though it is interesting to note that total immersion is usually reported as fleeting whereas flow can be sustained over a longer period.

Selective Attention (SA) is a well-researched concept in the psychology literature, and refers to when a person attends to one source of information over others [27]. Our senses are constantly being bombarded by information from all our senses. However, it is not possible to process all events in the world around us [28]. Mechanisms of selective attention help us to focus primarily on just that information which is relevant at a particular time and help us to avoid being constantly distracted by everything else in our environment. As a result of selectively attending to a particular task, (reading this chapter for example) a person is less aware of the world around them (such as the colour of the walls) because their mind is engaged with the current task. Given that gamers report being less aware of the real world when they are immersed in a game, perhaps immersion is therefore simply the experience of selectively attending to an activity such as a game.

However, Cox et al [29] demonstrated that immersion is not solely the experience of being busy or occupied by a game. They report a study in which they manipulated the number of actions required to make progress in a game: one condition required more physical actions than the other, indicating a difference in the level of physical effort being placed upon the participants in the two conditions. The two versions of the game were not

different in their level of difficulty however: players in the two conditions did not differ in the amount of time spent playing in either condition, nor in their overall levels of success in the game. The observed levels of immersion were consistent between conditions, demonstrating that physical effort alone does not impact significantly on the level of immersion experienced.

In addition, Jennett [30] demonstrated that the degree of immersion experienced can vary when the attentional resources required by the task are unchanged. In her experiment, two conditions were compared in which the games were identical, apart from an additional feature of the game that either served to dramatically increase or dramatically decrease the participant's score. A key aspect of the design was that the actual performance of the participants did not differ, just their perceptions of their performance, influenced by the rigged feedback they received. The two performance conditions were virtually identical in terms of perceptual features and task difficulty, and therefore one can suggest that the differences in immersion experienced were not a result of differences in the amount of cognitive resources required in the two conditions. This suggests that immersion cannot be accounted for solely by selective attention.

IV. IMMERSION AND MODELS OF GAMING EXPERIENCE

Naturally, the popularity of digital games has led to many attempts to characterize the experience of playing games. Several such attempts are based on theoretical analysis of games or gamers. For instance, Bartle [30] characterised playing experiences according to four types of players based on his extensive experience of *MUDs*. Other people have defined the playing experience based on their own personal experiences such as Adams [32] analysis of immersion or Freeman's [33] and Schell's [34] guidelines for designing gaming experiences. In such cases though, there is always the need to map these accounts of gaming experience back to the actual experiences had by players.

Working, then, from a more data-driven perspective, there have been several attempts to produce widely applicable frameworks that can describe the richness of the gaming experience.

Game reviews of course are intended to both describe the game and also to evaluate the game so that the reader is left with an understanding of what it might be like to play the game and therefore whether they might like to play it. Thus, they must necessarily refer to the elements of the game that lead to good experiences. Calvillo-Gamez et al. [35] therefore used game reviews to build up an understanding of what aspects of a game were important to lead to a good experience. The resulting theory was called Puppetry. This is a metaphor for how a player is able to have agency within a game whilst also being outside of the game as the controller. It is the fusion of the player with the actions available in the game that leads to a state akin to a puppeteer controlling a puppet.

Because the account of puppetry is data-driven, it is possible to breakdown puppetry into the components that lead to a good gaming experience. These form a hierarchy called the Core Elements of the Gaming Experience (CEGE) of which the top level is Puppetry itself made up of Control, Ownership and Facilitators interacting with the Digital Game which is made up of Game-play and Environment. This account has good credibility being grounded in the experiences relevant to game players however it was recognized early on that these were at best hygienic factors leading to good gameplay [36] That is, absence of these factors would mean that players could not have a good experience but their presence was not a guarantee of a good experience. In this sense, CEGE is the necessary step that allows achievement of the first level of immersion or engagement. The higher levels of immersion though must be achieved through other aspects of the experience not covered by CEGE.

Other attempts have therefore been made to identify what aspects of a gaming experience constitute a good experience. IJsselsteijn et al. [37] recognized the need for better measures of the gaming experience and identified both flow and immersion as important concepts that should be better explored in relation to specifying the general gaming experience. Poels et al. [38] then used a focus group methodology to talk to players about their experiences and build up a comprehensive set of categories that capture the major components of the gaming experience that occur both whilst playing and subsequent to playing. These are: enjoyment, flow, imaginative immersion, sensory immersion, suspense, competence, negative affect, control and social presence. There is an obvious overlap in terminology between these ideas and our formulation of immersion

used here but it should be clear that there is not necessarily a direct mapping from the components of immersion into this generic model. For instance, control is a factor of immersion but only maps partially on to control and competence in Poels et al's categorization. Similarly, sensory and imaginative immersion is related more to presence and narrative (see further discussion below on alternative formulations of immersion).

Of course, this categorization also captures aspects of the gaming experience entirely outside of immersive experiences such as frustration (negative affect) and connecting with others (social presence). Whilst it would be extremely useful to position immersion more precisely in relation to these concepts and the same team did develop a Gaming Experience Questionnaire (GEQ), a validated form of this questionnaire has never been published and has not been made generally available by the authors. Nonetheless, some research groups have had access to it and it has been used to evaluate gaming experiences in a range of contexts including as part of the wider user experience important for educational games [39] and the influence of 3d on gaming experience [40]

The only component of the GEQ that has received wider, public validation is the Social Presence in Gaming component of the GEQ and we discuss this below as a specific aspect of gaming experience rather than a wider general framework here.

Similar to the development of the GEQ, Qin et al. [41] developed a questionnaire to investigate players' immersion in the narrative of computer games. This obviously has much in common with our ideas of immersion but the emphasis on narrative is a very particular direction to take in understanding the gaming experience. There is already much controversy of whether or not digital games can truly be said to have a narrative. A strongly narrative approach to games would say that all games have narratives even if that is a reconstruction of events that occurred in the games [42] and that games can only have real impact if they have emotional narratives [33]. However, against that is the fact that some games, like *Tetris*, simply defy any attempt at what would be commonly accepted as a narrative. However, the way out seems to be to regard games as something that offers the potential for narratives or something that is not antithetical to narrative but is not narrative [44]. In many ways, Qin et al do not try to resolve what exactly constitutes a narrative in a digital game and in this sense are open to the narrative being a

broad term to represent the possible experience players might have. This may be seen in later work [43] where the game used is a fighting game with very little of what might be recognized as story let alone a narrative for that story.

In the immersion in narrative formulation, gaming experience has seven components. Three correspond to our understanding of immersion, control, challenge and skills, and concentration, and four are more to do with engagement with the narrative of the game, curiosity, comprehension, empathy and familiarity. However, all components are based around narrative and this emphasis together with the ill-defined nature of narrative in this formulation makes it hard to draw more general comparisons when games clearly lack a traditional narrative or story.

The fact that immersion is only one facet of gaming experience means that it is conceivable that it is better understood in relation to these other facets or as only a subset of a larger, richer concept. Calleja [2] argues that this is indeed the case and drawing on extensive qualitative studies, proposes the notion of incorporation. With incorporation, a player is able to assimilate (incorporate) the game environment into their consciousness and simultaneously be incorporated into the environment as an avatar. Immersion then arises as a component of incorporation but together with a sense of transportation (presence) into the game environment. In this sense, incorporation might seem like a specific form of gaming experience but it is in fact built on a player involvement model with 6 components: kinesthetic, spatial, narrative, shared, affective (emotional) and ludic involvements. Attention is a limited resource shared across this model from which the sense of immersion emerges by focusing on one or more of these types of involvement. What is clear though is that immersion cannot be made up of all of these types of involvement at once and that immersion changes across the types of involvement in the course of playing a game.

As such, the notion of incorporation covers a wide range of playing experiences and there is a natural mapping with the work of Poels et al [38]: ludic involvement is competence; shared involvement is social presence; kinesthetic and spatial involvement correspond to sensory immersion; affective involvement to enjoyment, negative affect and suspense; and narrative involvement corresponds to imaginative involvement. Thus,

the player involvement model might be better viewed as a generic model of gaming experience though Calleja does make it clear that the model was defined based on studies specifically of Massively Multiplayer Online (MMO) games and as such there may be elements of the model that may not apply to all games.

Because of this, the subsumption of immersion into incorporation is somewhat problematic. Immersion undoubtedly occurs in games that lack the rich virtual environments of MMOs, games such as those used in Jennett et al.'s studies and abstract games like *Tetris*. Arguably, in these cases immersion then arises from only those components of the player involvement model that apply to those games. However, from our studies, there is a further challenge.

If immersion arises from incorporation then the experience of immersion is determined only from the components of the player involvement model. However, we have conducted a study where players played only one game, *Wii Mario Kart*, but the level of lighting in the room where the player was sitting was varied. We found that the brighter the lighting, the lower the immersion as we had anticipated. This idea came from the fact that many players take control of their environment before playing by arranging themselves and their room to be ready for playing, for example by setting a suitable lighting level, getting their seat comfortable and getting snacks and drinks to hand. This concern for getting ready to play is a precursor to the first level of immersion and allows immersion to occur [3].

The cognitive account of immersion that we propose is able to accommodate this. The increased lighting partly takes control of the player's surroundings away from what the player would want and hence presents a barrier to immersion. Additionally the lighting makes the world around the player more visible thus impairing the ability to become immersed. The incorporation model though is not able to account for this change of immersion. There is no change to the game nor is there any change to any of the components of involvement. Immersion therefore cannot simply be a function of the player involvement model. We would contest that immersion is in fact the "attention" that Calleja describes as moving around the player involvement model. This "attention" is able to become increasingly focused on the game, through the various types of

involvement and this is experienced as an increase in the sense of immersion. However, there are aspects of the external context of the playing session, not captured by the involvement model, that are able to influence the immersive “attention.”

It is also worth mentioning in the context of game specific experiences the notion of GameFlow. The GameFlow model was developed by Sweetser and Wyeth [45] with the aim to better integrate flow as part of the gaming experience. However, the model was more focused to review games instead of the experience. GameFlow is the features of a game that are proposed to lead to flow experience in digital games. With flow as the structural foundation, the components in GameFlow were mapped to flow components to ensure the model fit into flow. Therefore, GameFlow and flow both relate to optimal experiences.

The core components in GameFlow are concentration, challenge, skills, control, clear goal, feedback, immersion and social interaction . Immersion in GameFlow refers to two of the characteristics of immersion in digital games namely emotional involvement and real world dissociation. While the other three immersion characteristics such as challenge, control and cognitive involvement overlap with other GameFlow components. Having said that, there are further components that stand apart entirely from immersion and hence differentiate GameFlow from immersion. Despite these overlaps and differences though, it is important to emphasise that GameFlow refers to properties of the game whereas immersion is the experience had by players in specific instances of playing the game.

More recently, to make GameFlow more useful in the design and evaluation of games, GameFlow has been validated and augmented as a set of detailed heuristics based on an analysis of game reviews [46]. However, in doing so they acknowledge that what they refer to as immersion is perhaps on a different level from the other elements of GameFlow. This suggests an interesting line of inquiry where a link is made from the analysis of the game under GameFlow to the experiential outcome of the game with particular concern for the role of immersion.

Further models of gaming experience are also emerging though naturally because of their recency there has been limited opportunity for in-depth validation. Generally these are about understanding the gaming experience in relation to specific types of game, for instance, serious games [47] or to make a link to the more general concept of User Experience [48] These, in particular, are building on the models discussed in this section and the next such as the GEQ and the CEGE models and notions of immersion and presence. Whilst the aim is to bring together and add to these concepts for the particular contexts, they are not attempting to re-formulate the key aspects of the gaming experience concepts.

Overall then, there is a degree of consensus between all these formulations of gaming experience. They all acknowledge the need to consider immersion but there are also other factors such as social engagement, enjoyment and motivations to play that are important in the gaming experience as well. Care needs to be taken when using any of these terms though between the different models. In particular, they all have different definitions of what is meant by immersion and without a substantial amount of further work it is not clear to what extent these differences are important.

V. IMMERSION, PRESENCE AND INVOLVEMENT

As has already been seen, the importance of immersion in the digital gaming experience has meant that it is commonly referred to within the general descriptions of gaming experience. However, there are other attempts to specifically define immersion as an isolatable concept. These come from two perspectives that can be characterised as the experiential perspective and the technological perspective. The experiential perspective, like our understanding of immersion, tries to characterize the attributes of immersion as an experience felt by gamers. The technological perspective is driven by the experience of virtual environments where the notion of presence is considered to be very important. This is the sense of being located in a virtual environment. We consider each of these in turn in relation to immersion.

From the experiential perspective, Ermi and Mayra [48] most notably proposed three types of immersive experience: sensory, challenge-based and imaginative. Sensory

immersion corresponds well to immersion in the sense that is usually used in the context of presence that is, games as virtual environments may offer high quality, realistic audiovisual presentations. Challenge-based immersion is due to the challenges offered by a game and the skills a player needs to do well. Imaginative immersion is more like the emotional involvement a player has in a game. Ermi and Mayra, contrasting their work with that of Brown and Cairns, claim that their conceptualisation of immersive experiences reflects the different modes of involvement players can have. There is however significant overlap between the notion of imaginative immersion and emotional involvement factor and of challenge-based immersion and the immersion factors of challenge, cognitive involvement and control, see Fig. 1. Unfortunately, though Ermi and Mayra did develop a questionnaire to allow measurement of their model of immersion, this questionnaire has never been published so it is not possible to compare it directly with the notion of immersion operationalised by the IEQ.

Arsenault [50] proposes modifying the SCI model to better reflect how immersion arises in games. His two amendments are to remove the notion of challenge and replace it with the idea of Systemic immersion where the player replaces the real world rules with those of the game world. This form of immersion need not be challenging but for challenge immersion to happen systemic immersion must first occur. Secondly, he suggests replacing imaginative immersion with Fictional immersion to better reflect what people become immersed in when they use their imagination. Both of these changes though are at the level of terminology. There has been no subsequent empirical work to either support or reject the distinctions that Arsenault makes.

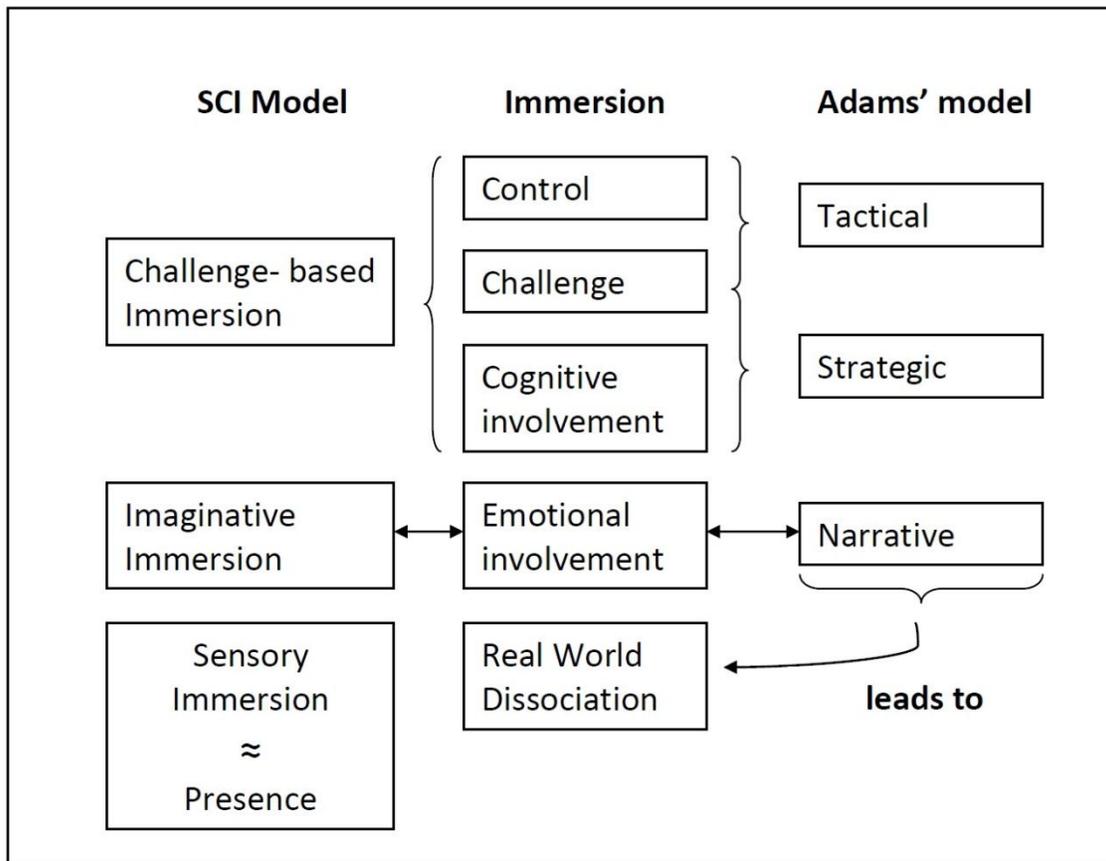


Figure 1: The relationship between the factors of immersion and Ermi and Mayra's and Adams' models of immersion.

Adams [32] by contrast proposes a completely different analysis of immersion but again with three types: tactical, strategic and narrative. Tactical immersion is the moment by moment immersion in the act of playing the game and corresponds in part to the challenge factor and wholly to the control factor of the IEQ. Strategic immersion is related to the large-scale gameplay where players think carefully and effortfully over the game. This again relates to the challenge factor but also the cognitive involvement of the players. Finally, narrative immersion corresponds to the imaginative or fictional immersion of the previous two models and as such relates to the emotional involvement of the players. However, this formulation neglects the possibility of real-world dissociation and in fact, closer reading of Adams' description suggests that it is only when these three types of immersion work in harmony does a truly immersive experience emerge. In which case, immersion as we understand it is not any one of these types but in

fact arises as a result of the types coming together and one indication of that is the sense of real world dissociation that players experience, see Fig.1.

From the technological perspective, another concept closely related to immersion is the sense of presence. Slater et al. [51] define presence as the sense of “being in a virtual environment.” As such, it specifically relates to technologies that offer a virtual environment in which a person can represent themselves. In games, this would most typically be a first-person shooter, like *Call of Duty: Black Ops*, where the player has the perspective of a person in a virtual world that looks like a real place and is able to navigate through the world to explore it, find enemies and kill them.

Lombard and Ditton [52] provide six different forms of presence. Of these, three are related to social factors in the virtual environment being: the social richness of the interaction; the sense of being a social actor within the environment; and the sense that the environment/others in the environment are also social actors. These three factors together constitute a sense of social presence. The other three factors can be dubbed spatial presence and are: a sense of realism of the virtual environment; a sense of transportation usually characterised by the sense of “being there”; and psychological and sensory immersion. It is this last which corresponds to our notion of immersion and, including sensory immersion, would correspond well with Ermi and Mayra’s SCI model.

Modern games offer the opportunities for all of these types of presence to occur. Many games, for example *Mirror's Edge*, have a first-person perspective on a rich and complex game-world thus offering the opportunity for transportation and perceptual immersion and in some sense, a very high degree of realism. Massively multi-player online games, typified by *World of Warcraft*, require groups of players to work together and provide a good sense of social presence. Also, non-playing characters in such games give the illusion of the game having social actors. Undoubtedly players do experience these different varieties of presence though we are not aware of any systematic studies of this in the literature.

The relationship between presence and immersion is therefore complex. The same term presence is used to explicitly cover the idea of immersion but at the same time has many

more meanings that are definitely intended to be different. We therefore take social and spatial presence in turn and consider them in relation to immersion.

A. Relating social presence and immersion

The majority of digital games available today offer a variety of multi-player settings including co-located and mediated play between opponents. A recent development has been the introduction of online games and online gaming communities which allow gamers to play against, or in collaboration with, other gamers over the Internet. The flagships of these online games are the Massively Multiplayer Online Role-Playing Games, such as *World of Warcraft*, which have proven to have quite complex social dynamics [53][54].

Much of the existing literature suggests that social play provides more fun but less immersion. For example, Gajadhar et al. [55] looked at how social presence, the awareness of being socially connected to others, related to the enjoyment of playing. It was found that high social presence led to a more enjoyable experience. Enjoyment or fun is the obvious experience that should come from playing games, that is, enjoyment is an experiential outcome.

But how does social presence relate to immersion? The immediate argument for the tension between social playing and immersion is straightforward. If immersion is about being in the game, playing socially is a way of making you aware of those around you or, if online, those not intrinsically in and of the game. Thus, the presence of real others in a game can be seen as something of a distraction or interruption to an individual's immersive experience. Alternatively, it may be that interactions increase enjoyment of the game but decrease immersion. Or it may also be that the other players in some sense become part of the game and interaction with them increases the immersion in the game.

In order to explore this relationship, Cairns et al [56] presents three experiments that test the relationship between social setting and immersion. The three experiments aim to manipulate the social setting in which players play be it against a computer, against a person online or against a co-located person. Overall the three experiments show that players are more immersed when playing against another person rather than playing against a computer but that it does not matter whether the other person is online or in the

same room. Observations by the experimenters made it clear that the level of interaction between co-located players was quite low with, at most, occasional comments or laughter. This suggests that whatever interaction was taking place between players was taking place through the game. Thus, it does not matter where the other player was but it does matter that the other player was part of the game world to become immersed in.

B. Relating spatial presence and immersion

According to Wirth et al. [57], spatial presence is composed of two dimensions: the sensation of being physically situated within the spatial environment; and the perceived possibilities to act within the environment. The latter of these dimensions certainly seems to influence the overall sense of presence [58]. The former though is not without problems because what is generally the sensation of being physically situated anywhere? Slater [59] suggests that the sense of presence is a mechanism based on forming and evaluating perceptual hypotheses about what a person is experiencing. In a virtual environment, a person has an experience that suggests a feasible perceptual hypothesis is that they are physically located in that environment. Of course, the real world around them also presents experiences, at least in the form of knowledge, that support the hypothesis that they are present in that world. Presence occurs when the hypothesis on the virtual environment wins out over that on the real world. In some sense then, presence is the sensation of being somewhere else knowing that you are not. When we really are somewhere, there is no sense of presence as there is no conflicting perceptual hypothesis to be resolved.

Consideration of specific games, rapidly suggests that immersive experience and spatial presence are indeed two independent concepts. First take a game like *Tetris*. Here there is little sense of “being there” in this game as there is simply no “there” for a player to be and yet the game is hugely absorbing and can provide a strong immersive experience. Conversely, it is easy to conceive of a game played in a CAVE, for instance collecting flowers in a virtual, floral landscape, where the sense of spatial presence in that landscape is very strong and yet the experience is not at all immersive due to it being a very undemanding game. Thus, in part, distinguishing immersive experience from spatial presence is simply one of definition. Depending on the type of presence being considered immersive experiences are either similar or unrelated to spatial presence.

However, Witmer and Singer [60] argue that a tendency to immersion leads to a greater sense of presence. In their sense, immersion has much in common with ours and many of the questions measuring immersive tendency overlap with questions in the IEQ. It should be noted though that Witmer and Singer consider immersive tendency, that is, the disposition of a person to have immersive experiences whereas Jennett et al. [7] ask about the specific immersive experiences a person had as a result of particular game-playing session. To put this more succinctly, the former is measuring a general trait (much like cognitive absorption) while the latter a specific state. Whilst it is expected that a tendency to immersion should lead to better immersive experiences overall, it may not indicate the immersive experience of any particular game-playing session. Nonetheless, given the link they made between immersive tendency and presence, it is clear that the trait should influence specific experiences and so it makes it reasonable to assume that specific states of immersive experiences should also influence sense of presence.

Overall then, there are good grounds for believing that there is a link between immersive experience and presence. The question is: does an increased immersive experience lead to a better sense of presence? Or conversely, does increasing the sense of presence lead to a more immersive experience? In order to answer this, we conducted an experiment into the relationship between spatial presence and immersion. Whilst this chapter is intended primarily to be a review, the experiment is given here in detail to illustrate how it is possible to better understand immersion through such an experimental approach.

VI. DISSOCIATING SPATIAL PRESENCE AND IMMERSION

In this section we present details of an experiment that has not been published elsewhere. The aim of the experiment was to dissociate spatial presence from immersion to show how the two may vary independently of each other. The hypothesis is that immersion and spatial presence can vary independently of each other. In order to do this, the experiment is two-factor between participants design. The first factor manipulates the level of spatial presence and the second the level of immersion. This gives four conditions and evidence supporting the hypothesis would be the immersion factor

influencing immersion but the presence factor not and also the presence factor influencing the sense of presence but the immersion factor not. In this way the two experiences will be seen to dissociate.

A. *Materials*

A maze game was used as the game where the challenge is simply to find the exit to the maze. This was used as it provides a relatively simply gaming experience and as will be seen fits well with the constraints of the experimental manipulation.

Following an apparently unanimous view of predictors of spatial presence [52][57], one version of the game, the low presence condition, was presented in two-dimensions with a birds-eye view of a robot car in the maze and the other, high presence condition, in three dimensions with a first person perspective as if sitting on top of the robot car, see Fig. 2. The advantage of the maze game here is that the controls were simply the arrow keys with left and right turning the car and the forward and back arrows moving the car forwards and backwards. These controls make sense in both the birds-eye and first-person perspectives.

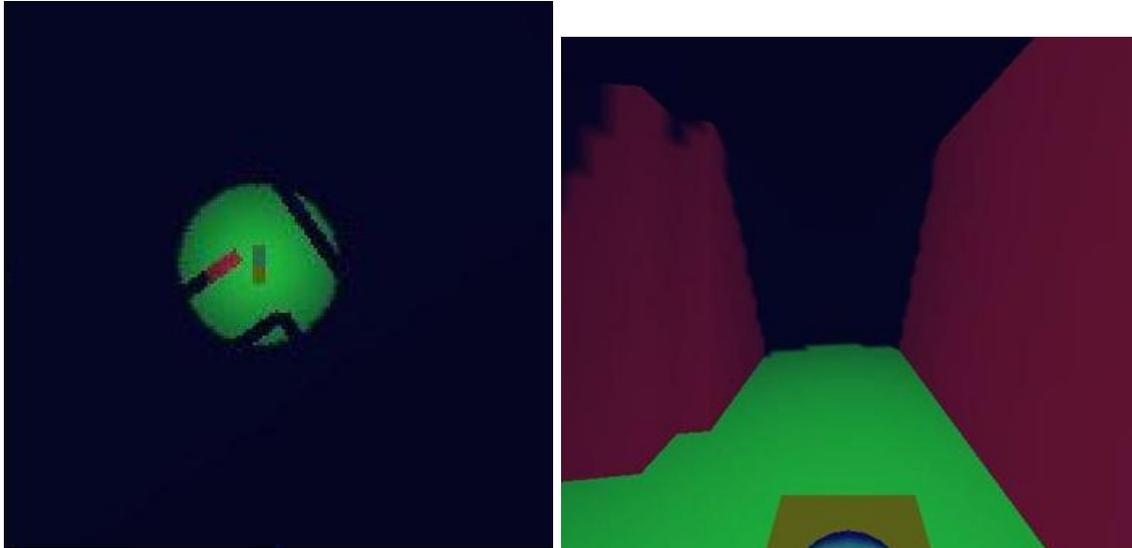


Figure 2: The two versions of the maze game: left is the birds-eye perspective, the right is the first-person perspective.

To manipulate immersive experience was more difficult as factors that might influence immersion, such as the complexity of the game, offering more things to do, might also separately influence presence [57]. One factor commonly used in games is music to add

atmosphere and another is time pressure to require players to focus. Neither of these could reasonably be expected to influence spatial presence nor are they commonly listed as having any influence on presence. Wirth et al. [57], IJsselsteijn et al. [37] and Lombard and Ditton [52] all make consideration of appropriate or diegetic sounds adding to the sense of presence but do not in any way suggest that a more generic, non-diegetic soundtrack would increase presence nor that time pressure of the task in the virtual environment would also influence presence. Thus, for the high level of immersive experience, we added a music track with a voice countdown from 2 minutes, at first at 30s intervals and then also at the final 15s and a final 10s countdown followed by an alarm sound at 2 minutes.

Immersion was measured using the IEQ [7]. The sense of presence was measured using a short presence questionnaire based on that of Slater et al. [51]. They used five questions with responses on a seven-point Likert scale to measure the sense of presence. We have adapted these to four questions suited to the context of this study. The questions have high face validity for spatial presence as they ask specifically about transportation and realism aspects of presence. There are undoubtedly issues around the use of questionnaires to measure presence (eg [61]) but previous, successful application of this approach means that we consider this acceptable for the purposes of this study. Both questionnaires were administered on paper.

B. Participants

Twenty six participants (24 men and 2 women) took part in the study with each participant playing the game in only one of the four possible conditions. They were mostly undergraduate computer scientists with ages in the range of 20 to 22.

C. Procedure

Before participating in the study, each volunteer was asked to give informed consent to take part. The participants were then read a statement, explaining the controls of the game along with information relevant to the particular game condition which they were playing. Participants were then randomly assigned to the 2d or 3d version of the game. In the non-immersive game conditions, they were asked to take control of the avatar and navigate their way through the maze, from the start square through to the exit. They were not timed and no pressure was put on them to complete the task. They were allowed as

long as they needed to find their way to the end of the maze, upon which they were asked to inform the researcher.

In the immersive game modes, they were given a set of headphones to hear the music and were asked to begin playing when the music started. They were informed that they should try to get to the end of the maze before the music reached the end. They were asked to inform the researcher either upon completion of the maze, or when the alarm sounded at the end of the music.

Upon informing the researcher of the end of the experiment, each participant was given the two questionnaires. They were asked to fill these out immediately after playing so that their memory of the game would be fresh and their answers would be most relevant. After completing the questionnaires, participants were thanked and once again given the opportunity to ask questions.

D. Results

The IEQ data are summarised in Table 1. They show a clear effect of the immersion manipulation but no particular effect of the presence manipulation. This is confirmed by a two-way ANOVA where there a main effect of the immersive manipulation on IEQ scores ($F(1; 22) = 34.39, p < 0.001$), but no main effect for the presence manipulation ($F(1; 22) = 0.1, p = 0.76$) nor an interaction effect ($F(1; 22) = 0.46, p = 0.51$).

The presence data are summarized in Table 2. As there is no widely recognised non-parametric equivalent of two-way ANOVA, we instead test for each main effect separately with a Mann-Whitney test. There is a significant difference due to the presence manipulation ($U = 44, p = 0.039$) but no difference due to the immersive manipulation ($U = 63, p = 0.28$). It is not possible to evaluate non-parametric interaction effects. (For reasons of parity and completeness, it is worth noting that a similar non-parametric analysis of the main effects on the IEQ scores produces identical results with a significant main effect for immersive manipulation ($U = 10, p < 0.001$) and no main effect for presence manipulation ($U = 78.5, p = 0.76$).)

	2d	3d
Low immersion	87.4 (11.6) N = 7	89.1 (10.8) N=7
High immersion	118.3 (11.3) N= 6	113.7 (10.4) N=6

Table 1: Mean (sd) of IEQ Scores and number of participants in each condition of the experiment

	2d	3d
Low immersion	10.7 (2.4) N = 7	13.4 (3.8) N=7
High immersion	12.7 (5.2) N= 6	15.7 (3.4) N=6

Table 2: Mean (sd) of Presence Scores and number of participants in each condition of the experiment

E. Discussion

The results support both experimental hypotheses and therefore the double dissociation of immersion from spatial presence. First, the level of immersive experience was influenced by the effect of music and time pressure compared to neither music nor time pressure. There was a substantial effect on immersive experience as measured by the IEQ of at least 2 standard deviations. However, there was no effect due to whether the game was in 2 dimensions or 3 dimensions. Thus, a well-known presentational feature which is considered highly relevant to the sense of spatial presence produced no effect on the immersive experience.

What is interesting is that this result runs in the face of current trends in game technology where increasingly sophisticated consoles are used to produce higher-fidelity graphics with increased realism. At the very least, good 3d representations would seem a

standard for most modern console games, even for essentially 2d games like *Little Big Planet*. Yet, apparently, this does not actually alter the playing experience. This is perhaps not so surprising to gamers who recognize the importance of gameplay over appearance. Also, there is an increasing fashion for retro-style games in the casual gaming community where very low resolution and limited palettes are used to produce rich and complex games, for example *Cave Story*.

Additionally, it would seem that the immersiveness of the gameplay experience does not add to the sense of spatial presence in the game. This, of course, should be viewed more cautiously. The method for measuring presence was very simple (even if well-established) and perhaps was too crude to see the effect of immersion on presence. Nonetheless it is indicative of what was expected. This then undermines Wirth et al.'s model of spatial presence where they proposed that high involvement, like immersion, would support presence when other factors were absent or insufficient. Also, it questions the role of immersive tendency in the experience of presence [60]. Further, if spatial presence is equated with sensory immersion [48], then sensory immersion stands apart from our notions of immersion.

VII. CONTRIBUTIONS

This chapter has set out to define and position the role of immersion in the gaming experience. Our approach is very much a data-driven approach. The notion of immersion emerged from what players, reviewers and designers say about gaming and this has led to many studies, primarily experimental but also qualitative, that aim to better understand what immersion is. As such, the first contribution of this chapter is to demonstrate that despite gaming experience being rich, multi-faceted and highly subjective, by focusing down on one aspect and carefully investigating it, it is possible to make concrete statements about that aspect of gaming experience and moreover support such statements with empirical evidence. The experiment just reported demonstrates this very clearly. Starting from a theoretical view about how immersion could support a sense of presence, it was possible to see how the proposed relationship was not always sustained and that

there is no necessary link between presence and immersion even when they clearly co-occur and could conceivably reinforce each other.

The second contribution is a review of the state-of-the-art literature on attempts to define, measure and evaluate gaming experiences. Given the abundance of digital games and digital game players, understanding the gaming experience is intrinsically interesting but also potentially useful for those trying to design those experiences. As can be seen, current formulations of gaming experience take widely different approaches to considering games to merely provide another route into experiences such as flow whereas as some consider very game specific approaches such as narrative in games. It is not always clear how these different approaches relate but by positioning them in relation to immersion and therefore indirectly with each other, it is possible to see how the different approaches both overlap and differ.

The third contribution though, is of course a clear review of the literature in relation to immersion, an aspect of gaming that seems to run through, and have relevance for, all gaming experiences and one that we therefore think is very important to understand better. What the review attempts to do is to not say that everything is immersion. There is definitely a role for fun, flow, socializing, story-telling and so on in digital games and that these stand apart from immersion. But immersion can be experienced alongside all of these things and, when it comes to talking about immersion, it has concrete, data-driven properties. Immersion is a cognitive phenomenon that is influenced by the design of games, their structures and mechanisms and also factors outside of the games themselves. Immersion is related to attention but it is not solely attention. Feedback and thinking are as important to building immersive experiences as simply having something to keep doing. Immersion is influenced by social presence but not necessarily by spatial presence: being “in the game” is about what the mind is thinking about not where it thinks it is but at the same time others can be “in the game” with you.

Naturally for us, our work has come from a primarily research perspective and as such speaks little to game design. This is appropriate. We are not game designers and to attempt game design would not play to our strengths and would perhaps also show a

degree of arrogance over those who really do game design and do it successfully. However, this is perhaps an important demonstration of what research work can offer in terms of turning hard to express concepts into quantifiable phenomena. As such we hope this chapter provides an alternative to sweeping generalizations, offered by gurus, pundits and critics, about how games could/should/might to be made better or worse, why particular games are bad or unpopular. This is not to say we offer an answer for every situation but that there are suggestions and indications of what some answers might look like. However we would not advocate the specific use of the IEQ as a way to inform game design as done by Huhtala et al [12]. Rather the IEQ is a research instrument that allows us to isolate features of games and make causal associations to the experiences people have. In the context of specific games and changes to the games, it is unlikely that the IEQ is sufficiently precise to make the detailed comparisons that designers need. Of course, in the final cut, it will be designers themselves who say how useful this research is and how best (or not!) to use it.

VIII. CONCLUSIONS

Across common accounts of gaming experience and the wide range of research conducted into gaming experience, immersion continues to appear as an important component of the gaming experience and one that players actively seek when they play games. Immersion is a cognitive state that is influenced both by activities with the game, the social connections made through the game and external factors around the game. However, immersion is clearly distinct from existing concepts such as attention, flow and fun. What exactly it is though remains unclear. Our best current understanding is that it is a confluence of different psychological faculties such as attention, planning and perception that when unified in a game lead to focused state of mind. In this state, players are less aware of the world around them and become immersed in the game. Moreover, this is a self-sustaining state because of the pleasures associated with being immersed in a game.

This understanding though forces upon us further questions. What exactly are the psychological functions involved in immersion? What is the best balance of these functions for immersion? And how might games achieve such a balance? We are a long

way from clear answers to these questions but the problems they present are sufficient to keep many researchers immersed for a long time to come.

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