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A Comparison of Cognitive Impacts of Narrative and Human-Computer Interaction as Two Sources of Perceived Realism in Video Games

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A Comparison of Cognitive Impacts of Narrative and Human-Computer Interaction as Two Sources of Perceived Realism in Video Games

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Abstract

A Comparison of Cognitive Impacts of Narrative and Human-Computer Interaction as Two Sources of Perceived Realism in Video Games

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Perceived realism in video games, indicating the degree game players perceive the game is realistic, influences game player's cognitions. Previous research has explored the dimensional structure of perceived realism from two aspects. Adopted from traditional media, the first aspect narrative plays an important role in facilitating perceived game realism. Interactivity of video games enables the other source of perceived realism, which is human-computer interaction (HCI). This study examines the structure of perceived realism in video games, categorizing dimensions of perceived game realism into narrative or HCI, and comparing the influence of these two types on players' cognitive outcomes, which are identification, immersion, and emotion. The results support the hypotheses that perceived HCI realism has stronger positive influence on people's identification, immersion, and positive emotions compared to perceived narrative realism. Impact of each

dimensions are also examined. Industry implications and future research directions are discussed.

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Chapter 1 Introduction

Video games are getting more popularity as an interactive entertainment phenomenon. In 2018, 64% of US households have a device for playing video games and 60% of Americans play video games daily (Entertainment Software Association, 2018). Media effect of video games have attracted scholars' attention for decades. For example, recent studies suggest that video games could enhance problem-solving skills (Prensky, 2012), intergroup relations (Adachi & Willoughby, 2017), and cognitive abilities (Granic, Lobel, & Engels, 2014) such as visual short-term memory (Blacker & Curby, 2013) and spatial skills (Uttal et al., 2013). Further, addictive game playing correlates to mental disorders such as anxiety and depression (Andreassen et al., 2016); and exposure to violent video games is positively related to aggressive cognition, affect and behavior (Anderson et al., 2010).

Perceived realism has been considered an influencer to the media effect of video games. After comparing realistic violent video games, unrealistic violent video games, and nonviolent video games, Bartlett and Rodenheffer (2009) found realistic factors in video games strengthen the influence of violent video games on aggressive feelings and arousal. One research perspective related to perceived realism takes a traditional narrative focus. Narrative includes the role of stories (Schneider, 2004), and the similarity between the events and characters in video games and those in reality (Malliet, 2006). Meanwhile, interactive features of video games enable another perspective in perceived game realism other than narrative, which is human-computer interaction (HCI). Here, HCI includes audio and visual effects (Shapiro, Peña-Herborn, and Hancock, 2006), and simulation ((Frasca, 2003; Ribbens & Malliet, 2009).

In this study, perceived narrative realism and perceived HCI realism in video games are compared through their impacts on game players' identification, immersion, and emotion. Identification, immersion and emotion are recognized as cognitive outcomes of perceived realism in video games. Identification to the character is important to video game enjoyment (Hefner, Klimmt, & Vorderer, 2007), and both stories and interactivity in video games could increase game players' identification (Lin, 2013; Schneider, 2004). Immersion is recognized as a motivation of playing games (Yee, 2006), and has been studied as a mediator to video game involvement and media effects (Nicovich, 2010; Shafer, Carbonara, & Popova, 2011). Emotional valence and arousal, including both positive affects, such as joy and negative feelings such as aggressive, have been studied as cognitive outcomes of perceived realism, narrative, and interactivity in video games (Arriaga, Esteves, Carneiro, & Monteiro, 2008; Gabbiadini, Riva, Andrighetto, Volpato, & Bushman, 2016; Ivory & Kalyanaraman, 2007a; Ravaja et al., 2005).

In the following chapters, literature review in perceived realism in video games will be covered in Chapter 2; research design and variables will be described in Chapter 3; Chapter 4 will show the data and results; and conclusions drawn from data, implications to game design and future research will be discussed in Chapter 5.

Chapter 2 Literature Review

In this chapter, previous research about perceived realism is reviewed, including the concept of perceived realism and its media effect, perceived game realism and its multi-dimensional structure, and cognitive outcomes covered in this study, which are identification, immersion, and emotion. Three research hypotheses are also proposed in this Chapter.

REALITY AND PERCEPTIONS OF REALITY

The concept of reality is discussed from the perspective of social reality (Hawkins & Pingree, 1982). One dimension of reality is "physical reality" ((Shapiro & McDonald, 1995, p. 324). Physical reality exists, when objects are confirmed by "first-hand observers". This objective concept is used to verify if there's errors or hallucination in reality perception judgement. The other more subjective dimension of reality is "information reality". Information reality indicates that people make presentations and perceptions of reality based on the information they received. The information received, in most cases, has been interpreted and mediated through media channels. The early process of constructing information reality occurs when people receive and process information simultaneously, and new information is absorbed and interpreted based on past experience. The subsequent process following the construction is the reconstruction of reality. Here, people establish their perception of the objective reality based on memories as well as emotional and cognitive responses generated by mediated messages (Hawkins & Pingree, 1982; Hawkins & Pingree, 1990; Shapiro & Lang, 1991). The output of construction is coded, filtered and stored through reconstruction to form people's perception of reality, which in return influences how people interpret new information for construction.

PERCEIVED REALISM IN MEDIA

Another concept closely related to perceived reality if perceived realism. They are sometimes used interchangeably, both depicting how realistic people perceived media messages, objects and contexts were (Popova, 2010). Compared with "reality", "realism" is the representational convention conveyed in narrative context (Gerbner G. & L., 1976), and indicates the degree to which representation in media corresponds to reality (Busselle & Greenberg, 2000). In this thesis, "perceived realism" is used to indicate how realistic people perceive media contents.

Media cultivate and influence audiences' perception of social reality as agencies of symbolic social norms and values (Gerbner G. & L., 1976). Violence and aggression have been the largest focus in the cultivation effects of perceived realism (Hawkins, 1977; Popova, 2010). Early on, Bandura et al. (1963) found that children exposed to mediated aggression showed much stronger aggressive reactions compared to children not exposed. In addition, compared with fantasy-based aggression, reality-based aggression in television could facilitate children's aggressive behavior (Feshbach, 1972), such as playing destructively (Noble, 1973). Similarly, research suggests that exposure to real news violence increased the aggressive responses among children compared to fictional entertainment violence (Atkin & Wood, 1976).

Further, there is research showing people's perception of reality is relevant across individual differences such as demographic and psychographic audience characteristics (e.g. Greenberg & Reeves, 1974; Potter, 1986, 1988). While perceived realism is considered an intervention to the media effects on audiences' attitude and behavior (Hawkins, 1977; Pingree, 1978; Potter, 1986), the research is not conclusive and thus consistent with Popova (2010), this research will not consider perceived realism an intervening variable.

Perceived realism was studied in other aspects of social judgements and behaviors. For instance, after watching more realistic or factual media content such as documentaries, children demonstrated more traditional attitudes toward women (Pingree, 1978), received and processed more schema information about occupations (Huston, Wright, Fitch, Wroblewski, & Piemyat, 2002).

PERCEIVED REALISM IN VIDEO GAMES

Perceived game realism is defined as how realistic players perceive the video game. The concept assesses the extent players believe the stories, characters, and events are a reflection of the reality, and the realistic effects created by video game design technologies (Barlett & Rodeheffer, 2009; Malliet, 2006). Narrative contents and quality are considered important in generating perceived realism (e.g., Green & Clark, 2013; Cho, Shen, & Wilson, 2014). Schneider (2004) quantitatively examine the effects of storylines in video games and found narratives could increase player's identification and sense of presence. Interactive and immersive game features also stimulate perceptions of realism which mediate the aggressive arousal (Barlett & Rodeheffer, 2009; Jeong, Biocca, & Bohil, 2012).

Narrative in video games

"Narrative is one of the oldest constructs humans use for understanding and giving meaning to the world" (Mallon & Webb, 2000, p. 270). There are many early definitions of narrative, and most of them share two elements: *"story"* and *"plot"* (Lee, Park, & Jin, 2006), which respectively define a series of sequent events (Labov & Waletzky, 1997; Abbot, 2002) and the metehod of delivering the story (Ryan, 1997, 2001). Traditional entertainment media such as films and television convey a linear narrative from creator to

audience. Therefore, early definitions were limited when applying to interactive media, where the audience participates in a dynamic relationship with other people, objects or the media agencies (Lee et al., 2006).

Murray (2004) suggested that video games are a good channel for narrative contents because of the rich media characteristics and similarity in structures. According to Murray, video games are *"procedural"* and *"participatory"*. Video games convey various types of content such as image, text, and sounds, all of which are suitable for telling stories. Further, they are similar with stories on their structure of the contest and the puzzle. Narrative is important because it could reduce the cognitive burden and thus motivate game playing (Murray, 2004, Lee et al., 2006).

Human-computer interaction in video games

Besides regarding video games as an extension of narrative, other research perspectives in video games deal with simulation and interactivity (Frasca, 2003). Lee et al. (2006) modified early definitions of interactivity, emphasizing the interactivity component:

"Interactivity is a perceived degree that a person in a communication process with at least one more intelligent being can bring a reciprocal effect to other participants of the communication process by turn-taking, feedback, and choice behaviors" (p. 263).

The nature of interactivity makes video games a simulation instead of a type of representational media (Frasca, 2003). As such, the game simulation of the rules in real life could increase perceived game realism (Juul, 2005). Considering the different perspectives of narratology and ludology in video game studies, Malliet (2006) highlighted the importance of behavior in realism judgments and pointed out that the human-computer interaction could be a dimension of perceived game realism. Focusing on the design

features, human-computer interaction (HCI) includes audio and visual features. Also, better graphics and sound fidelity could facilitate stronger game realism (Shapiro et al., 2006).

Although non-narrative HCI features have been mentioned and discussed in previous studies focusing on perceived realism, their inner structure and impact on cognitive outcomes hasn't been fully examined. That is, there lacks a distinctive comparison regarding the roles of narrative and HCI in perceived game realism. The current study groups the conceptual dimensions of perceived realism into narrative-relevant and HCI-relevant sources and compares the roles of these two content sources in game player's realism judgments and cognitive outcomes.

DEVELOPMENT OF DIMENSIONAL PERCEIVED REALISM

In early research, perceived realism was a unitary concept (Lyle & Hoffman, 1972; Greenberg & Reeves, 1974), but with the emerging varieties and dissimilarities of measurements, Hawkins (1977) proposed two dimensions in perceived realism: *"magic window reality"* and *"social expectations"*. Hawkins' research set the two major perspectives for following research on the conceptual structure of perceived realism.

"Magic window reality" (Hawkins, 1977) indicates the degree to which audiences perceive media content as dramatic or the projection of the ongoing real life as a "magic window". Following this perspective, Potter (1981) adopted this dimension in his multi-dimensional structure. Elliott, Rudd and Good (1983) proposed *"perceived plausibility"* in their measurement scales, indicating the extent audiences think the characters or events in television are similar to those in the real life. Wright, Huston, Reitz, and Piemyat (1994) came up with "*factuality"* to enrich the meaning of magic window, which was defined as if the events or characters in media actually exist somewhere else in the real life. Busselle

and Greenberg (2000) included "*probability*" in their proposed conceptual model of perceived realism. Here they defined probability as the likelihood the audience will think the events and characters in media could happen in reality. Derived from "magic window", these dimensions, though slightly different, all emphasize the degree media depict the events and characters in reality.

The second perspective, *"social expectation"* (Hawkins, 1977) also discusses the connection between media content and reality. Different with "magic window", it focuses on how well the media content fits with audience's actual expectation. Potter (1981) used *"instruction"* to measure the degree to which people feel the media content is instructional to their real life; Elliott, Rudd and Good (1983) used *"personal utility",* referring to how useful the viewers perceive the media content. And, finally, Busselle and Greenberg (2000) applied *"social realism",* indicating the fitness of the world portrayed in the television to the nature of the real society.

Quality of media content is another perspective. Here, Elliott, Rudd and Good (1983) proposed *"perceived superficiality"* as a way to define audience feelings that the program repeatedly shows unimportant content. Shapiro, Weisbein, and Shen (2002) separated absolute and relative realism and stated audiences made two types of judgement on media realism separately by evaluating how likely the content will actually occur or how inherently realistic the content is. Based on this, Hall (2003) later conducted qualitative interview and suggested a most innovative dimension *"perceptual persuasiveness"*, which concluded that the visual and audio effects could also facilitate perceived media realism.

In the current study, participants are asked to recall their latest game playing experience and answer questions about the perceived realism of that specific play. Thus,

their responses will be reflection-based judgements abstracted from their reconstruction of information reality.

DIMENSIONS OF PERCEIVED GAME REALISM

When perceived realism research is applied to video games, the resemblance and match between game content with real life are still a focus (e.g. Shapiro et al., 2006; Malliet, 2006), and much of the research investigates the constructs of plausibility and factuality. However, compared with tradition media, factors of human-computer interaction attract more attention. For example, Schwartz (2006) found that games are realistic because of the virtual geographic environment, visual design and audio effects. Similarly, Shapiro et al. (2006) discussed the importance of game design factors such as visual and audio elements. Malliet (2006) proposed *"perceptual pervasiveness",* referring to the overwhelming graphics and sounds; *"authenticity", or the* emphasis on how much players believe in the game designer's efforts and intention to make the game more real; and *"games as a virtual experience",* highlighting the perceived realism facilitated by interaction.

In this current study, perceived realism is divided into two categories: narrative and human-computer interaction.

Perceived narrative realism in video games

Dimensions derived from "magic window" indicate the similarity between events and characters in media and those in reality, and most of this research focuses on narrative factors. Cho et al. (2014) suggested and tested a structure model of perceived narrative realism with 5 dimensions: *"plausibility"*, *"typicality"*, *"factuality"*, *"narrative consistency"*, and *"perceptual quality"*. Of note, because *"perceptual quality"* refers to

the audio and visual effects that make the narrative more compelling, it overlaps with the human-computer interaction features which will be discussed later.

Factuality

Factuality is defined as the degree audiences think the events of characters are a projection of reality. It is similar to the concept of *"magic window"* (Hawkins, 1977), and was used as an evaluation to separate factual and fantasy media contents (Hall, 2003; Wright, Huston, Reitz, & Piemyat, 1994). More factual media contents can generate stronger perceived realism and thus impact audiences' attitudes (e.g., Baams et al., 2015; Feshbach, 1972) By using the *"utility"* in the research of Elliott et al. (1983) and Potter (1988), Ribbens and Malliet (2010) explained the effect of factuality on perceived realism that the experience and consequences from video games which could be applied to the real life might also increase players' perceived realism.

Plausibility and typicality

Plausibility is defined as the extent players think the objects in games, such as events, characters, behaviors, and relationship, resemble the reality and could probably happen in the real life. Most people, especially adult game players, easily separate facts from fantasy, and make realism judgments based on imagination and subjective understanding (Shapiro et al., 2006). Even though some game narrative are not factual and contain content people haven't witnessed or experienced, they might still think the content is realistic because it "could happen" in the real world (Hall, 2003).

Similar with but more specific than the concept of plausibility, typicality is defined as the likelihood the game events could happen to players themselves. A game player could think a game event is plausible because he or she believes it could happen, but to think it's

typical, the player also needs to believe it could happen to most people. Typicality is distinct from plausibility. That is, narrative contents could be perceived as plausible but not typical (Cho et al., 2014; Hall, 2003).

Narrative consistency

In Hall's (2003) qualitative research, narrative consistency is defined as the degree the narrative is inherently consistent and logically congruent. It was mentioned in the interview when the media contents are not factual, typical, or plausible, and interviewees said that as long as the stories are consistent, they would perceive media content as realistic even it contained unreal factors. In video games, the consistency is derived from the rules and regulations of the whole game environment.

Perceived HCI realism in video games

Besides narrative storytelling, game design elements, such as audio and visual effects and simulation, are grouped in the category of human-computer interaction.

Authenticity in HCI design

Authenticity is defined as the degree players perceive the game design features as authentic compared with reality, such as the fitness of objects in the environment and the credibility of characters' actions in certain situations (Ribbens, Malliet, Van Eck, & Larkin, 2016). Malliet et al. (2006) emphasized that authenticity covered both narrative and game design features. In the current study, the narrative elements of authenticity have been covered in the concepts of plausibility and typicality in perceived narrative realism. Therefore, the authenticity dimension will focuses more on the game environment and design, such as if the action of characters is credible.

Simulation realism and freedom of choice

In the debate of storytelling and simulation in video games, people holding the ludology perspective emphasized simulational realism, which is defined as the inherent rules in the game environment (Frasca, 2003; Juul, 2005). If the simulative rules and logics are inconsistent with those in the real world, game players should feel stronger perceived realism while interacting within the game world (Juul, 2005).

Freedom of choice is an important indicator of the simulation characteristic (Frasca, 2003). In Malliet's (2006) research, interactivity makes games more realistic by enabling players to take control and determine the game outcome. In video games, players control and decide the game flow by making choices dynamically. Therefore, freedom of choice lies at the core of the distinctions between traditional narrative media and interactive media.

Perceptual pervasiveness

Perceptual pervasiveness refines the sensory features such as images and sounds in video games. These features combine to create compelling and overwhelming or realistic effects (Malliet, 2006; Shapiro et al., 2006). This is to the concept of *"perceptual persuasiveness"* (Hall, 2003). For example, advanced technologies enable higher qualities of general visual and audio effects to facilitate game realism (Shapiro et al., 2006), and detailed sensory features such as blood color also influence players' perception of realism (Jeong et al., 2012).

MEDIA EFFECTS OF PERCEIVED GAME REALISM

Perceived realism was studied from the sociopsychological perspective with the focus on people's cognition conditions for predicting behaviors (Potter, 1988; Ribbens & Malliet, 2010). Krcmar, Farrar and McGloin (2011) did experiments using video game

contents with different levels of realism, and found that higher perceived realism could increase attention, identification and presence, and thus stimulate aggressive behavioral outcomes. Additional research included cognitive outcomes into the conceptual dimensions of perceived realism, such as presence and identity (CITE). However, when exploring the mechanism of perceived realism, dimensions relevant to media features should be separated from absolute cognitive concepts (CITE). Therefore, in the current study, identification, immersion, and emotion are three cognitive aspects used to examine the effects of perceived game realism.

Identification

Identification is the cognitive process "through which audience members experience reception and interpretation of the text from the inside" (Cohen, 2001, p. 245). Identification with media characters has been studied as a core mechanism to explain and predict media effects. For example, Maccoby and Wilson (1957) found that stronger identification with characters in films facilitated learning. They also found that while similarity in demographic characteristics (gender) could be a stimulus to identification, psychographic aspects such as social class, people were more likely to identify those at the "aspired" class.

When the media context is specified with video games, identification is often studied as a determinant of game enjoyment (Hefner et al., 2007). Factors that influence video game players' identification include audiences' self-perception (Klimmt, Hefner, & Vorderer, 2009; Klimmt, Hefner, Vorderer, Roth, & Blake, 2010), as well as perceived similarities and wishful attributes of the media characters (Hoffner & Buchanan, 2005). The feature of interactivity in video games have been suggested to help the engagement

role-taking process, and thus, generate stronger behavioral outcomes (Peng, Lee, & Heeter, 2010).

Identification indicates the loss of self-awareness (Cohen, 2001). Different from traditional media such as television and films, the interactivity of video games strongly generates merging of self-identity and game-identity because the distance between the audience and characters is decreased (Lin, 2013). Therefore, this research hypothesizes that the HCI features in perceived game realism facilitate stronger identification compared to narrative features.

H1: Perceived HCI realism in video games has stronger positive effects on players' identification compared to perceived narrative realism.

Immersion

Immersion is a broadly accepted motivational factor to game play (Yee, 2006). The definition of immersion has been discussed together with other several concepts indicating similar cognitive processes such as flow and presence (e.g., Nacke & Lindley, 2008; Zumbach, Seitz, & Bluemke, 2015). Flow is defined as a state of total involvement in an activity (Csikzentmihalyi, 1990). Flow is regarded as an intrinsic motivation of creativity and enjoyment that requires strong concentration (Csikzentmihalyi & Csikzentmihalyi, 1992). This involvement experience has been studied in human-computer interaction (Ghani & Deshpande, 1994; Chen et al., 1998; Rettie, 2001). Compared with the concept of flow, immersion is similar in terms of the loss of time tracking and challenge, however, while immersion is a graded experience whereas flow is an extreme involvement (Brown & Cairns, 2004).

Another concept relevant to immersion is presence, which is defined as a psychological state enabled by media technology (Slater, 1999; R Tamborini & Skalski,

2009; Ron Tamborini & Bowman, 2010). Presence is important when examining cognitive processing such as aggressive thoughts (Eastin, 2006; Eastin & Griffiths, 2006). Nowak, Krcmar, and Farrar (2008) found past playing experience influenced perceived presence, and higher level of presence predicted stronger hostility and aggressive intention. Vividness and interactivity are two key factors on generating presence (Steuer, 1992). Technology advancements in video games increase the sense of presence (Ivory & Kalyanaraman, 2007b). Jennett et al. (2008) suggest that while presence is "a state of mind", immersion is more of an experience.

According to research conducted by Brown and Cairns (2004), immersion contains three levels: "engagement" as the entry level which requires gamers to overcome the barriers of access and investment of efforts, "engrossment", which has the barrier of game construction, and the highest level "total immersion", which is consistent with the "flow" and "presence". Considering that interactivity is important in evoking presence (Steuer, 1992) and overcoming barriers to immersion (Brown & Cairns, 2004; Jennett et al., 2008), the features of human-computer interaction are hypothesized to generate higher levels of immersion compared to narrative features.

H2: Perceived HCI realism in video games has stronger positive effects on players' immersion compared to perceived narrative realism.

Emotion

Many different definitions of emotion have been discussed from various research areas, such as neuro science (Tomkins, 1962), physiology (Ekman & Friesen, 1975), and social psychology (Plutchik, 1980; Arnold, 1960). There are also several conceptual models of emotion and affects, such as the discrete-emotion model (Nabi, 1999, 2002; Smith & Ellsworth, 1985; Roseman, 1984), and the dimensional model (Barrett, 1998;

Feldman, 1995). Among these studies, emotion is agreed by scholars as having two key qualities: *"valence"* and *"arousal"* (Barrett, 1998). The concept of *"valence"* is similar as the "subjective feeling state" (Nabi, 1999), and typically indicates a continuum from positive affects to negative (Feldman, 1995; Watson & Tellegen, 1985). *"Arousal"*, on the other hand, defines the action tendency and motivational cognitive conditions (Nabi, 1999).

Neuroscientific experiments showed nonviolent players have larger emotional response brain regions after playing violent video games (Gentile, Swing, Anderson, Rinker, & Thomas, 2014). Further, antisocial behaviors in video games can actually stimulate players' emotion of guilty (Grizzard, Tamborini, Lewis, Wang, & Prabhu, 2014; Weaver & Lewis, 2012), and past playing experience is relational to nostalgia, enjoyment, and challenge (Wulf, Bowman, Velez, & Breuer, 2018). In terms of perceived realism, high perceived realism in video games could facilitates stronger arousal to cognition, behavior (e.g., Barlett & Rodeheffer, 2009; Jeong et al., 2012; Mcgloin, Farrar, & Fishlock, 2015; Ron Tamborini et al., 2004), and game enjoyment (Shafer et al., 2011).

Research shows both narrative and interactivity in video games facilitates emotions (Ivory & Kalyanaraman, 2007a; Lin, 2013; Schneider, 2004). In addition, identification and immersion while playing facilitates game enjoyment (Hefner et al., 2007; Lee, Chung, & Lee, 2013). Consistent with H1 and H2 HCI realism is also predicted to have stronger positive impact on emotional valence, especially positive emotions.

H3: Perceived HCI realism in video games has stronger positive effects on players' emotional valence compared to perceived narrative realism.

Chapter 3 Method

This quantitative research is conducted by designing and using a survey questionnaire. This chapter discusses the questionnaire design, participants, and dependent variables, which are identification, immersion, and emotion

DESIGN

This study was a self-report survey consisting of six sections: demographic information and past playing experience, perceived narrative realism, perceived HCI realism, identification, immersion, and emotion. Participants are asked to recall their latest playing experience of role-playing video games in the first section, including the name of the game, their roles, playing frequency et al., and they are instructed to answer questions based on their latest experience. There are four dimensions in the section of perceived narrative realism and four dimensions in perceived HCI realism as discussed above, and the questions in each dimension are concluded from Hall's (2003) interviews and adopted from the quantitative research of the conceptual structure of perceived game realism (e.g., Ribbens, 2013; Ribbens & Malliet, 2009; Ribbens, Malliet, Van Eck, & Larkin, 2016). The score of perceived narrative realism is the mean of factuality (α = .89), plausibility (α = .90), typicality (α = .93), and narrative consistency (α = .92) (M = 3.58, SD = 1.27). The score of perceived HCI realism is the mean of authenticity (α = .81), freedom of choice (α = .93), perceptual pervasiveness (α = .87), and simulational realism (α = .80) (M = 4.35, SD = 1.00).

PARTICIPANTS

The study was conducted on undergraduate students at the University of Texas at Austin. Of the 142 valid responses, 33%were male, and 67% female. Ages ranged from

19 to 24 (M=21, SD=1.14); 51% were Caucasian, 28% were Asian, 18% were Hispanic or Latino, 1% were African American, and the remaining 4% were other. 23% were freshmen, 36% were sophomores, 34% were juniors, 7.0% were seniors, and the remaining 1% were 5th year or more of undergraduate. 52% of participants played multi-player games, 45% played single-player games, and remaining 3% player other types.

DEPENDENT VARIABLES

Identification. Van Looy, Courtois, De Vocht et al. (2012) proposed and tested a measurement scale of player's identification in massively multiplayer online games. This scale includes three dimensions: avatar identification, group identification, and game identification. There are three sub-dimensions in avatar identification, which are similarity identification, wishful identification, and embodied presence. This measurement scale is used here, while items of group identification only show up when participants indicate the video game that they played most recently is a multi-player game. There are 25 statements covering all the dimensions, such as: "My character is similar to me" (similarity identification); "I would like to be more like my character" (wishful identification); "I feel like I am inside my character when playing" (embodied presence); "This game is more than a hobby to me" (game identification); and "I feel connected with the members of my guild/team" (group identification). Participants indicate their agreement with each statement on a 7-point Likert scale ranging from strongly disagree (score = 1) to strongly agree (score = 7) (M = 3.22, SD = 1.25, α = .96).

Immersion. Jennett, Cox, and Cairns et al. (2008) conducted three experiments on immersion experience in games, with self-report surveys and physiological measurements respectively, and proved immersion could be measured subjectively. They suggest both the single general question and detailed dimensions are valid. There are three dimensions:

cognitive involvement, real world dissociation, and emotional involvement. The questionnaire proposed by Jennett et al. (2008) is used and there are in total 32 questions, such as: “To what extent did the game hold your attention” (cognitive involvement); “To what extent did you lose track of time” (real world dissociation); and “to what extent did you feel motivated while playing” (emotional involvement). Participants answer each question on a 7-point scale from not at all (score = 1) to very much so (score = 7) (M = 4.40, SD = 0.96, α = .91).

Emotion. Watson, Clark, and Tellegen (1988) concluded terms in describing emotions and moods, proposed and tested the simple model of measuring positive affects (PA) and negative affects (NA). Both PA and NA include 10 scale items. Scales of positive affects are enthusiastic, interested, determined, excited, inspired, alert, active, strong, proud, and attentive; and negative are scared, afraid, upset, distressed, jittery, nervous, ashamed, guilty, irritable, and hostile. Participants are asked to indicate to what extent they feel these emotions, and the score of each item is recalculated to the 7-point scale from low (score = 1) to high (score = 7) (PA: M = 4.23, SD = 1.28, α = .92; NA: M = 1.90, SD = 0.88, α = .89).

Chapter 4 Results

This chapter shows data analysis and results of hypotheses. Correlation between perceived realism and cognitive outcomes is tested as a prerequisite for regression analysis. The impacts of perceived narrative realism and perceived HCI realism on identification, immersion, and emotion are examined and compared via stepwise regression. Influence of each detailed dimensions of perceived game realism is also tested.

CORRELATION

To gain a general understanding of each of the variables under investigation, a correlational analysis is presented (See Table 1). According to the data, both perceived narrative and HCI realism have significant positive relationships with identification (r=.33, p<.01; r=.53, p<.01), immersion, (r=.22, p<.01; r=.57, p<.01), and positive emotions (r=.19, p<.05; r=.51, p<.01) (See Table 1).

	Identification	Immersion	PA	NA
Narrative	.33**	.22**	.19*	-.05
HCI	.53**	.57**	.51**	.13

**. Significant at p < .05*
***. Significant at p < .01*

Table 1: Correlation of Variables.

HYPOTHESES TEST

Stepwise regression is used to examine the effect of perceived narrative and HCI realism on identification, immersion, and emotion.

Hypothesis 1

Perceived HCI realism in video games has stronger positive effects on players' identification compared to perceived narrative realism.

	R	R^2	F
Identification	.53	.28	55.16***

****. Significant at p < .001*

Table 2: Identification Model Summary (Category).

Variable	Beta	t
HCI	.66	7.43***

****. Significant at p < .001*

Table 3: Variable Summary of Identification Model (Category).

Supporting H1, the stepwise regression indicated that HCI realism has the stronger relationship in the regression model. The model shows that only perceived HCI realism is predictive to identification and predicts 28% of the variance of identification (R=.53, F=55.16, p<.001).

Hypothesis 2

Perceived HCI realism in video games has stronger positive effects on players' immersion compared to perceived narrative realism.

	R	R^2	F
Immersion	.60	.36	38.25***

***. *Significant at p < .001*

Table 4: Immersion Model Summary (Category).

Variable	Beta	t
Narrative	-.15	-2.33*
HCI	.66	8.12***

* *Significant at p < .05*
***. *Significant at p < .001*

Table 5: Variable Summary of Immersion Model (Category).

The regression model shows a statistically significant amount of variance (R^2 = .36) is explained in player's immersion (R=.60, F=38.25, p<.001). The beta coefficients of both independent variables are statistically significant (t=-2.33, p<.05; t=8.12, p<.001). The absolute beta value of perceived narrative realism is 0.15, and the beta value of perceived HCI realism is 0.66. The data shows perceived narrative realism influence immersion negatively, and in comparison, perceived HCI realism has stronger positive influence on player's immersion than perceived narrative realism does, supporting H2.

Hypothesis 3

Perceived HCI realism in video games has stronger positive effects on players' emotional valence compared to perceived narrative realism.

	R	R^2	F
PA	.53	.28	27.16***

***. *Significant at p < .001*

Table 6: Positive Affects Model Summary (Category).

Variable	Beta	t
Narrative	-.18	-2.02*
HCI	.79	6.87***

* *Significant at p < .05*
***. *Significant at p < .001*

Table 7: Variable Summary of Positive Affects Model (Category).

The regression model shows a statistically significant amount of variance (R^2 = .28) is explained in player's positive affects (R=.53, F=27.16, p<.001). The beta coefficients of both independent variables are statistically significant (t=-2.02, p<0.05; t=6.87, p<.001). The absolute beta value of perceived narrative realism is 0.18, and the beta value of perceived HCI realism is 0.79. The data shows perceived narrative realism influence positive emotions negatively, and in comparison, perceived HCI realism has stronger positive influence on player's positive emotions, supporting H3.

IMPACT OF EACH DIMENSIONS OF PERCEIVED GAME REALISM

	R	R^2	F
Identification	.55	.31	30.49***
Immersion	.68	.46	23.21***
PA	.61	.38	20.64***

***. *Significant at p < .001*

Table 8: Model Summary of Cognitive Outcomes (Dimension).

	Variable	Beta	t
HCI	Perceptual Pervasiveness	.40	6.02***
	Freedom of Choice	.20	3.47***

***. *Significant at p < .001*

Table 9: Variable Summary of Identification (Dimensions).

	Variable	Beta	t
Narrative	Typicality	-.15	-3.70***
	Narrative Consistency	.15	2.82**
HCI	Authenticity	.19	2.76**
	Perceptual Pervasiveness	.20	4.16***
	Freedom of Choice	.12	2.60**

** *Significant at p < .01*
***. *Significant at p < .001*

Table 10: Variable Summary of Immersion (Dimensions).

	Variable	Beta	t
Narrative	Typicality	-.17	-2.94**
	Narrative Consistency	.20	2.60**
HCI	Authenticity	.30	3.23**
	Perceptual Pervasiveness	.26	3.74***

** *Significant at p < .01*
***. *Significant at p < .001*

Table 11: Variable Summary of Positive Affects (Dimensions).

To better understand the effect of different dimensions, a stepwise regression analysis was conducted on each of the dependent measures. In the regression model of identification, only two dimensions in perceived HCI realism are significant, which are *perceptual pervasiveness* and *freedom of choice*. This indicate that these two dimensions play the major role in predicting video game player's identification. The model predicts 31% of the variance of identification (R=.55, F=30.49, p<.01). Perceptual pervasiveness (b=.40, t=6.02, p<.01) has stronger influence than freedom of choice (b=.20, t=3.45, p<.01) does.

In the regression model of immersion, five dimensions are significant in predicting player's immersion: *typicality, narrative consistency, authenticity, perceptual pervasiveness,* and *freedom of choice*. The model predicts 46% of the variance of immersion (R=.68, F=23.21, p<.001). Perceptual pervasiveness (b=.20, t=4.16, p<.001) has the strongest influence on immersion, followed by authenticity (b=.19, t=2.76, p<.01), narrative consistency (b=.15, t=2.82, p<.01), typicality (b=-.15, t=-3.70, p<.001), and freedom of choice (b=.12, t=2.60, p<.01). In addition, typicality has negative impact on immersion, whereas other 4 dimensions have positive impact.

In the regression model of emotion, four dimensions are significant in predicting player's positive affects: *typicality, narrative consistency, authenticity,* and *perceptual pervasiveness*. The model predicts 38% of the variance of positive emotions (R=.61, F=20.64, p<.001). Authenticity (b=.30, t=3.23, p<.01) has the strongest influence on emotion, followed by perceptual pervasiveness (b=.26, t=3.74 t<.001), narrative consistency (b=.20, t=2.60, p<.01), and typicality (b=-.17, t=-2.94, p<.01). Typicality influence positive emotions negatively, whereas other 3 dimensions have positive influence.

Chapter 5 Discussion

The impacts of perceived realism in video games on cognitive outcomes are discussed in this chapter. The comparison of two categories of perceived game realism, narrative and HCI, as well as detailed dimensions within these two categories is covered. Implications to game industry and directions for future research are also discussed.

COGNITIVE OUTCOMES

Perceived narrative realism and perceived HCI realism in video games are both positively related to player identification. Comparatively, perceived HCI realism has stronger correlation as well as stronger positive influence on identification. Having a closer look at each dimensions, *perceptual pervasiveness* and *freedom of choice* predict and explain identification. Identification happens when gamers' self-perception is transferred into the game (Cohen, 2001; Klimmt et al., 2009; Van Looy, Courtois, De Vocht, & De Marez, 2012). Higher perceptual pervasiveness refers to the quality of visual and audio effects, such as high graphic resolution and sound fidelity. When the perceptual effects are overwhelming, it is easier for game players to be transported into the game and avatar (Shapiro et al., 2006), and thus players identify themselves with the game to a stronger extent. Similar effects are found for immersion and emotion.

Another predictive dimension is freedom of control. When there's high freedom for players to control the game, they are able to create their own story by choosing the path and determining the outcome. Therefore, considering the dimensions of identification, players could create their avatar and game experience in a more desired way, which generates wishful identification. By controlling the action of avatars, it is more likely for players to feel their game characters resembles them, which facilitates similarity identification and embodied presence.

Perceived narrative realism and perceived HCI realism both positively predict player immersion, and each of the five dimensions were significant. *Perceptual pervasiveness* had the strongest influence on immersion. The second strongest dimension is *authenticity*, followed by *narrative consistency.* Though these authenticity and narrative consistency belong to HCI and narrative features, they both focus on logic coherency. Authenticity increased when participants believe the game is natural, such as action of characters are credible, and objects (e.g. weapons) and matches with the game context. Finding reality incongruencies will decrease attention and thus reduce cognitive involvement. Therefore, coherency of the inherent logic (i.e., perceived reality) of games is important to increase immersion. *Freedom of choice* also positively predict immersion. Here, the ability to control movement and behavior increased immersion levels. Unexpectedly, typicality had a negative influence on immersion. *Typicality* refers to players believing the story and character in the game narrative are similar to themselves. Here, the data showed that when the narrative is similar to common real-world situations, immersion decreases.

Perceived game realism is positively related to positive emotions, and HCI features influence positive affect compared to narrative. The correlation found between perceived realism and negative emotions was not significant. Two dimensions of perceived narrative realism (i.e. *typicality* and *narrative consistency*) and two dimensions of perceived HCI realism (i.e. *authenticity* and *perceptual pervasiveness*) predicted positive emotions. Therefore, two aspects generate pleasant emotions in game players, which are good quality of design quality and coherent game logic.

PERCEIVED GAME REALISM

Perceived realism in video games are categorized into two aspects in the study, and perceived narrative realism and perceived HCI realism both positively correlate to identification, immersion, and positive emotions. The more realistic game players felt about the game, including both the story and game design HCI features, the greater the identification, immersion, and enjoyment. That said, as expected, perceived realism generated from human-computer interaction had a stronger influence on cognitive outcomes.

Dimensions in each aspects of perceived realism were also examined. In perceived narrative realism, *factuality* and *plausibility* are not predictive on any cognitive outcomes, and *typicality* had a negative impact on immersion and positive emotions. These three dimensions could be grouped as the resemblance of game narrative to the reality. Therefore, the study shows that creating a narrative that imitates reality doesn't help facilitate players' identification, immersion and positive emotions to the game. When the stories or characters are highly similar to real-life, immersion and pleasant emotions actually decrease. The fourth dimension in perceived narrative realism is *narrative consistency*. Being logically coherent and convincing in both narrative and HCI features can significantly increase immersion and positive affects from play, but they don't help with identification. Among the other dimensions in perceived HCI realism, *perceptual pervasiveness* significantly influenced all cognitive outcomes, indicating that better quality of graphic and sounds design and more overwhelming effects could help increase identification, immersion and pleasant feelings. In terms of *freedom of choice*, the more freedom players have to the game, the stronger identification they have and more immersed they are.

IMPLICATIONS TO GAME DESIGN

Analysis on each dimension of perceived game realism affords some implications to game designers. First of all, based on these data, it is not necessary that stories and characters in video games imitate real-life situations. Second, coherency in both narrative storylines and HCI deign are important to attract immersion and positive affect. Third, better visual and audio effects increase positive cognitive outcomes. Finally, enabling players high freedom of choice in games increases identification with the character and the game as well as increases immersion during game play.

DIRECTIONS FOR FUTURE RESEARCH

First of all, future research should conduct experimental studies to control the video game content, which would help eliminate the influence caused by differences across games. Second, besides self-report questionnaire, physiological measures should be used to measure player immersion, and emotional arousal can be included with the cognitive outcomes. Finally, future studies could explore and examine the cognitive models of perceived narrative and HCI realism. Here, research would begin to explain differences in influencing people's identification, immersion, and emotion.

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