



## Full length article

## Perceived realism in shooting games: Towards scale validation

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## ABSTRACT

Perceived realism is a key concept in explaining the mental processing of media messages and the societal impact of media. Despite its importance, few studies have examined its conceptualization and dimensional structure from an empirical point of view, especially with regard to digital games. In this paper we present three studies aimed at 1) validating a dimensional structure of realism judgements on shooting games and 2) creating a valid measurement instrument. Exploratory and confirmatory factor analyses support five dimensions of perceived game realism that are commonly presented in previous studies. An investigation of the internal reliability and psychometric properties of the constructs reveals that the measurement instrument conforms to a large extent to the requirements of scale validation.

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## 1. Introduction

Perceived realism is a key concept in explaining the mental processes underlying game play and possible media effects (Busselle & Bilandzic, 2008). The degree to which players consider games as realistic has been linked to the evaluation of violent content (Schott, 2016), aggression (McGloin, Farrar, & Fishlock, 2015), attitudes towards in-game advertising (Poels, Janssens, & Herrewijn, 2013), game play preferences (Ribbens & Malliet, 2015), and transfer of game reflexes and perceptions into daily life (Ortiz de Gortari, Aronsson, & Griffiths, 2011). A recurrent argumentation in these studies is that the more realistic a game is perceived to be, the more likely it is to influence players' cognitions and attitudes (Busselle & Bilandzic, 2008). As an illustration of this rationale, one can point at the measures taken by policy makers in several countries, aiming to restrict the graphical realism of depictions of virtual violence. For instance, in Germany the makers of fighting and shooting games have to modify the visual presentation

of characters (e.g. the color of blood has to be modified from red to green) before a shooting or fighting game is granted permission to be officially sold (FJ, 2014). Similarly, countries such as Japan and China have a tradition of requiring game developers to avoid depictions of blood and dismembered body's if they want to receive permission to enter the market (Ashcraft, 2015). In response to such policy decisions researchers have raised the question what it specifically means that a game is perceived as realistic (e.g. Malliet, 2006). Does it mean that it is realistically looking? That its protagonists are reminiscent of real people? That it deals with real life-like occurrences? While it seems that policy makers have a tendency to equate realism to graphical realism, research strongly indicates that it is necessary to account for other aspects as well (Popova, 2010b; Ribbens & Malliet, 2010).

Game realism has also been used to explain the attractions (e.g. Shafer, Carbonara, & Popova, 2014) and motivational aspects (Lin & Peng, 2015) of game play. A more realistic game is experienced as more authentic (Malliet, 2006), resulting in higher degrees of immersion (Ribbens & Vanden Abeele, 2008), which in turn leads to enhanced enjoyment (Bilandzic & Busselle, 2011). Although a theoretical link has been established between perceived realism and engagement (Caroux, Isbister, Le Bigot, & Vibert, 2015) this relationship has not been empirically tested.

As is often the case in media research (cfr. Valkenburg & Peter, 2013), there exists a gap between theory, describing a

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comprehensive rationale on virtuality, and empirical research, deriving from this a delineated set of variables. Because there does not yet exist a generally accepted conceptualization or instrument for measuring perceived game realism, different researchers have implemented perceived game realism in varying ways, which makes it difficult to compare their results. For instance, self-report survey measures sometimes define game realism in terms of social realism (Konijn, Bijvank, & Bushman, 2007) and at other times in terms of telepresence (Lombard & Ditton, 1997). This has resulted in considerable amounts of debate regarding the relationship between perceived realism and various outcomes such as the transfer of cognitions (see Popova, 2010a).

In order to bridge the gap between theory and research the current paper aims to develop and validate a perceived realism scale, as applied to the genre of shooting games. We first present a theoretical overview of the dimensional structure of perceived game realism, after which the results of three studies are presented, defining and confirming a set of items operationalizing the different dimensions of perceived realism in the context of shooting games.

## 2. Perceived game realism

Perceived game realism is a multidimensional construct that harbors different definitions of virtuality. Research has shown that players use different criteria to judge the degree of realism of a game and that, dependent on the benchmark applied, a game can be evaluated in different ways (Shapiro, Peña-Herborn, & Hancock, 2006). For example, Malliet (2006) observed that, although many players considered Grand Theft Auto: Vice City as a highly realistic game regarding its audio-visual characteristics, when asked about the credibility of its protagonists, the same respondents referred to the game as highly non-realistic. The fact that perceived game realism is a difficult concept to grasp has motivated several scholars to identify a dimensional structure, consisting of layers that operate relatively independently of one another. Depending on the scholarly background of the researcher(s) these conceptualizations are either grounded in television studies (Popova, 2010b), game theory (Galloway, 2004) or in a combination of both (Breuer, Festl, & Quandt, 2012; Ribbens, 2013b).

Because most research on perceived game realism has its roots in television research, many dimensions have been adapted from the general taxonomies developed by Hawkins (1977), Potter (1988), Busselle and Greenberg (2000) and Hall (2003). Table 1 summarizes concepts that have been translated to the context of game research. The table shows that perceived media realism refers to, among others, how realistically looking a media message is

(perceptual pervasiveness), how instrumental a media message is regarding real-life matters (utility), how strongly a media message refers to real-life occurrences or persons (social realism or external realism), and whether or not a media message elicits credible emotions (identity) or presents a consistent sequence of events (internal realism).

Several authors however have advocated for including medium-specific dimensions of realism. Malliet (2006), Popova (2010a,b), Breuer et al. (2012) therefore add a dimension that is unique to the medium of the video game: virtual experience, defined by Popova (2010b, p.66) as “the extent to which a person can interact with the environment in the media message”. Malliet (2006; Ribbens & Malliet, 2010) coins the term simulational realism to describe that the rules of a game can implement the underlying logic of any system that exists in real life. Breuer et al. (2012, p. 218) use the term behavioral realism, and link this to the credible simulation of real life-like interactions and consequences. Malliet (2006) additionally emphasizes the role of agency and freedom of exploration in adding to the realness of a game play experience.

A few studies to date have empirically investigated the dimensional structure of perceived game realism. Ribbens and Malliet (2010) used exploratory factor analysis to assess which of the abovementioned dimensions are relevant for further inquiry. They concluded that both representational and rule-based characteristics of digital games are important constituents of perceived game realism and that future research should explore six dimensions: Simulational realism, freedom of choice, character involvement, perceptual pervasiveness (or perceptual fidelity), social realism, and authenticity (or internal realism). Ribbens (2013a) validated this dimensional structure for the shooting game ‘Half-Life 2’ using confirmatory factor analysis. Popova (2010b) applied her adapted conceptualization of perceived reality of television messages – consisting of magic window realism, typicality, identity, utility, perceptual fidelity, and adding virtual experience – to the game ‘Home Run King Challenge’. Although this conceptualization has a strong theoretical basis, it did not provide a good fit to the data.

Although Ribbens and Malliet (2010; 2013a) and Popova (2010b) use different terms, the dimensional structures they propose overlap to a considerable extent. Simulational realism and character involvement (Ribbens & Malliet, 2010) are game-specific conceptualizations of respectively utility and identity (Popova, 2010b); social realism mirrors typicality; virtual experience is similar to freedom of choice; and perceptual fidelity relates to perceptual pervasiveness. Two noticeable differences can be observed. First, Ribbens and Malliet (2010) and Ribbens (2013a) exclude magic window realism (which refers to the belief that media offer a factual view upon reality) because the dimension did

**Table 1**  
Overview of perceived realism concepts translated to fit in a video game context.

Dimension	Conceptualization	Implemented by
Magic window realism	The belief that the video game shows events and objects that exist in real life regardless of the fact whether viewers can see them or not.	Popova, 2010b
Utility	The degree of applicability of the information learned from the video game to real life.	Gonçalves, Croset, Ney, Balacheff, & Bosson, 2010; Popova, 2010b; Ribbens & Malliet, 2010; Ribbens, 2013a
Identity ((character) involvement)	The degree to which characters in a game can elicit emotional responses.	Bell, 2000; Malliet, 2006; Popova, 2010b; Ribbens & Malliet, 2010;; Ribbens, 2013a;
Social realism (external realism)	The degree to which events and people in a video game are considered similar to events and people in real life.	Breuer et al., 2012; Galloway, 2004; Gonçalves et al., 2010; Malliet, 2006; Popova, 2010b; Ribbens & Malliet, 2010; Ribbens, 2013b; Shapiro et al., 2006
Internal realism	The degree to which a video game's message is considered internally consistent or logical.	Gonçalves et al., 2010; Malliet, 2006; Ribbens & Malliet, 2010; Ribbens, 2013a,b; Shapiro et al., 2006
Perceptual pervasiveness/ Perceptual fidelity environment	The degree to which visual, auditory, kinaesthetic, and other features of a mediated representation conform to the features of an unmediated environment	Breuer et al., 2012; Malliet, 2006; Galloway, 2004; Popova, 2010b; Ribbens & Malliet, 2010; Ribbens, 2013a; Shapiro et al., 2006

For a more in-depth discussion of how these dimensions have been translated to a game context, we refer to Ribbens (2013b).

not come forward in exploratory factor analysis (Ribbens & Malliet, 2010). Malliet (2006) already pointed out that digital games are only rarely ascribed a general sense of factual realism because of their computational nature. Second, Malliet (2006) derived – based on qualitative interview data – a game-specific conceptualization of internal realism judgements. He found that, in the context of some games, players have belief in the game designers' intention and ability to convey an authentic, emotionally convincing, or consistent message, and use this as a criterion to ascribe high degrees of realism to a game. Popova (2010b, p.54) however does not consider the distinction between an external (the real world is used as a referent of one's reality judgment (i.e. social realism)) and internal (logic and consistency of the fictional world are used as referent of one's reality judgment (i.e. authenticity)) realism judgement as valid because this distinction only relates to a different standard of evaluation. Nonetheless, this division is held central by many communication scholars, because evidence is growing that audience members do not suspend disbelief but actively create belief to produce a compelling media experience (Busselle & Bilandzic, 2008).

Based on the abovementioned findings we conceptualize a six-dimensional structure:

1. **Simulational realism:** The degree to which the programmed rules and the different types of behavior that are possible within these rules credibly simulate the real world, thereby making the game potentially instructive for life.
2. **Freedom of choice:** The degree to which the choices in a video game reflect the nature of choices one has in real life.
3. **Social realism:** The degree to which events and characters in a video game are considered similar to events in real life.
4. **Perceptual pervasiveness:** The degree to which a text creates a compelling audio-visual illusion, independent of the degree to which the content of the text may relate to real-world experience.
5. **(character) Involvement:** The degree to which a player feels embodied in the video game world through the engagement with an avatar and the video game world.
6. **Authenticity:** The degree to which the players have belief in the game designers' intention and ability to convey an authentic, emotionally convincing, or consistent message.

This six-dimensional structure will be used to provide the initial impetus for the creation and validation of a perceived game realism scale.

### 3. This investigation: focus on shooting games

Most theories of perceived game realism have been developed by reference to games that feature complex virtual worlds such as Grand Theft Auto (Malliet, 2006), Half-Life 2 (Ribbens, 2013a), Everquest (Shapiro et al., 2006) or Call of Duty (Breuer et al., 2012). We therefore expect that the six-dimensional structure will apply to various game genres such shooting games, MMORPGs, and adventure games. Shooting games are a particularly interesting genre to study because they are highly popular, yet contested, and perceived realism is often suggested as a moderator in the negative effects of violent game play (McGloin, Farrar, & Krcmar, 2013).

There is discussion on the level of specificity that should be adopted when measuring perceived game realism: the level of the medium (e.g. video games), genre (e.g. military-themed shooting games), entity (e.g. Call of Duty: Modern Warfare), scene (e.g. level 'The Bog') or element (e.g. specific interactions). This is an important choice for the researcher to make, as it affects realism judgements (Busselle & Greenberg, 2000; Popova, 2010b). In line with

Popova (2010b), we believe that evaluations above the entity level should be considered as memory-based opinions rather than pure realism judgements. Because previous research has examined the factor structure of perceived realism for either video games in general (Ribbens & Malliet, 2010) or one specific shooting game (Popova, 2010a,b; Ribbens, 2013a), this study explores whether the dimensional structure holds when combining realism judgements on games that belong to particular shooting game genres.

#### 3.1. Research goals

The main goal of this paper is twofold: To contribute to the conceptualization of perceived game realism by validating a dimensional structure, and to provide a step towards the creation of a validated perceived realism scale. We progressed through three studies with three independent samples of respondents who played a shooting game and subsequently completed an online questionnaire.

Following the recommendations of Ribbens and Malliet (2010) and Ribbens (2013a), a study was devised to pay attention to item development and to create a dimensional structure for perceived realism in shooting games that can be validated. In a second and third study, we examined whether the proposed dimensional structure of study 1 would hold for particular shooting game genres. Study 2 built on data from bachelor-level and master-level students at the [University deleted], while study 3 used data from bachelor-level and master-level students at the [University deleted]. Finally, the data from study 2 and 3 were used to examine the psychometric properties of the measurement instrument (Carmines & Zeller, 1979).

Different types of validity are often used for scale validation (Carmines & Zeller, 1979; DeVellis, 1991, pp. 43–46). Construct validity refers to how well an instrument measures the constructs it is supposed to measure. Convergent validity refers to the degree to which the operationalization is similar to other operationalizations that it theoretically should be similar to. Predictive validity is established when there is an overlap in explained variance between the operationalization of perceived game realism and an explained concept that can be theoretically linked to it. Construct validity was assessed by examining whether the proposed conceptualization fits the data using factor analysis. The concept of 'social richness', which refers to the warmth and closeness of a medium (Lombard & Ditton, 1997), was used to establish convergent validity because both concepts have in common that they are used to measure the immediacy of a media experience (Skalski & Whitbred, 2010). Two measures were used to examine predictive validity. Perceived realism has been associated with diverse concepts related to the user experience such as transportation (Bilandzic & Busselle, 2011; Green, 2004) and immersion or engagement (Bilandzic & Busselle, 2011; van Vugt, Konijn, Hoorn, Keur, & Eliëns, 2007). There is a consensus that perceived realism positively impacts different types of player involvement. We therefore expected that, in general, the dimensions of perceived game realism would predict player immersion. We also examined whether perceived game realism was associated with dehumanization of adversaries. Two theoretical frameworks link violent game play and perceived game realism to dehumanization. First, following the General Aggression Model, perceived realism is believed to intensify priming effects (Anderson & Dill, 2000). Consequently, players of violent games who score higher on perceived realism measurements are believed to score higher on aggression-related outcomes. Second, moral disengagement theory suggests that "violent media can produce enjoyment if it does not violate inner moral standards or cause aversion" (Hartmann & Vorderer, 2010, p. 868). Media users are believed to actively employ strategies to morally disengage from

the violence, which becomes increasingly important when violent media portrayals are perceived as realistic. One described strategy is to deny the humanness of the victims (Hartmann & Vorderer, 2010; Klimmt, Schmid, Nosper, Hartmann, & Vorderer, 2006). Based on these theories, we expected that perceived realism would predict dehumanization of opponents.

Table 2 gives an overview of the sociodemographic information of the participants in all studies.

#### 4. Study 1: construction of a set of items and a factor structure

The goal of study 1 was to create a parsimonious set of indicators to measure perceived realism for further testing and to identify dimensions of perceived realism in shooter games.

##### 4.1. Methods

###### 4.1.1. Procedure

Bachelor-level and master-level students in communication sciences at the [university deleted] played a level ('The Bog') from the military-themed shooting game 'Call of Duty: Modern Warfare' and recruited another participant who needed to be enrolled in higher education. Participants played for 20 min or until they finished the level, after which they completed an online questionnaire. Playing the game and completing the online questionnaire could be done either at home or at the University library.

###### 4.1.2. Measures

The vast majority of the items were based on the study of Ribbens (2013a), but in line with one of the purposes of study, i.e. scale development, additional items were added. Each dimension of the conceptualization presented in the theoretical framework was accounted for by five or six items. All dimensions were measured using a 5-point Likert-type scale ranging from '1 = Totally disagree' to '5 = Totally agree'. All items can be found in appendix A. In addition, we asked respondents to provide sociodemographic information as well as asked how often they currently play shooting games and video games in general using a 5-point Likert type scale ranging from '1 = Never' to '5 = Daily'. To prevent order effects, scale items were randomized in three different versions of questionnaires.

###### 4.1.3. Data analysis

Univariate non-normality was assessed using the guidelines of Muthén and Kaplan (1992), who suggest that factor analysis is robust against non-normally distributed data if most skewness and kurtosis values range between +1.0 and -1.0. This was the case for all analyses. Principal components analysis (PCA) with an orthogonal rotation (varimax) was used to reduce the number of items, while principal axis factoring (PAF) with an oblique rotation (direct oblimin) was used to evaluate the obtained structure (for a similar

procedure see Busselle & Bilandzic, 2009). A parallel analysis (random permutations approach; 1000 parallel datasets; 5 per cent alpha level), in combination with a visual inspection of the scree plot, was used to determine the cut-off point (Preacher & MacCallum, 2003). Following Field (2005) all items with factor loadings below 0.5 and items with high cross-loadings (>0.2) were deleted.

##### 4.2. Results

Exploratory factor analysis was used to establish a first factor structure for perceived game realism with the newly developed set of items. The PCA (KMO = 0.872; Bartlett's test of sphericity = 0.000) revealed seven components with eigenvalues larger than one. However, the structure required revisions because some factor loadings dropped below 0.5 and items with high cross-loadings (>0.2) were present. These items were deleted stepwise. The final structure revealed seven components with eigenvalues larger than one, explaining 65% of the total variance.

A parallel analysis and examination of the scree plot suggested retaining only five dimensions. A PAF with oblique rotation requesting five factors (KMO = 0.854; Bartlett's test of sphericity = 0.000) replicated the dimensional structure of the principal components analysis and explained 65% of the total variance. The PAF, however, suggested deleting two more items. One item from the 'social realism' factor had a low factor loading (0.481) and one item from the factor '(character) involvement' had a high cross-loading with the factor 'simulational realism'. The final factor structure, factor correlations, and the internal reliability coefficient of each scale is reported in Table 3.

##### 4.3. Discussion

The five-dimensional structure deviates from the six-dimensional structure proposed by Ribbens and Malliet (2010; 2013a). First, authenticity was not retained because some of its items cross-loaded on the dimensions of 'perceptual pervasiveness' and 'social realism', and had to be deleted. We believe that the overlap between 'authenticity' and 'perceptual pervasiveness' can be attributed to the fact that one particular game was used, and more specific, one that has been applauded for its audio-visual qualities and coherent game design. Respondents may therefore have answered similarly to the questions of 'authenticity' and 'perceptual pervasiveness'. In other words, using only one game may have caused a low amount of variance in the data. The observation that the mean score of the preconceived scale for 'perceptual pervasiveness' (M = 4.02; SD = 0.59) is similar to the mean score of the preconceived scale for 'authenticity' (M = 4.05; SD = 0.50) supports this argument. As for the overlap between an item from the 'authenticity' dimension and the 'social realism' dimension, in the literature overview we discussed that these dimensions may be conceptually similar or at least difficult to

**Table 2**  
Overview of information of participants.

	N	Dropped cases	Gender (%)		Age		Frequency video games in general		Frequency shooter games	
			Male	Female	M	SD	M	SD	M	SD
Study 1	356	16	71.7	28.3	21.59	1.86	3.27	1.12	2.70	1.08
Study 2 – military-themed shooter games	526	3	51.8	48.2	20.68	2.01	2.61	1.29	2.05	1.13
Study 2 – Fantasy-themed shooter games	115	2	66	34	20.94	1.67	3.04	1.33	2.34	1.04
Study 3	128	3	35.4	64.6	20.85	2.51	2.51	1.24	2.21	1.15

Note. Male and female respondents differed significantly on all game-related variables.

**Table 3**  
Structure matrix of a principal axis factoring with oblique rotation, requesting five factors.

No	Item	Factor				
		(Char.) inv.	Perc. perv.	soc. real.	Free.	sim. real.
1	While playing this game, I felt like I was present in the video game world.	0.821				
2	While playing this game, I felt that I was part of the video game world.	0.735				
3	While playing this game, I felt that the character was a part of me.	0.678				
4	While playing this game, I felt as if I was a part of the action.	0.669				
5	The picture quality of the game was overwhelming.		−0.940			
6	Graphically, the game looked very impressive		−0.837			
7	This game created an absorbing visual experience.		−0.580			
8	The events in this game bear similarities with events in the real world.			0.838		
9	I perceive similarities between the events that occur in this game and the events that occur in real life.			0.737		
10	The things that happen in the game could occur somewhere in the real world.			0.629		
11	I felt I determined the course of the game.				0.806	
12	In this game I felt I was pulling the strings.				0.763	
13	I felt that I could choose my own path in the game world.				0.735	
14	While playing this game, I felt I was creating my own story.	0.458			0.703	
15	I felt I determined the outcome of the fight.				0.517	
16	By playing this game, I feel better prepared for certain lifelike situations.					0.847
17	By playing this game, I can learn how certain problems in the real world are solved.					0.730
18	By playing this game, I can learn how to behave in real life.					0.725
19	By playing this game, I can learn something about the real world.			0.474		0.708
20	By playing this game, I can learn how to control certain real world situations.					0.693
	Cronbach's alpha	0.84	0.83	0.83	0.85	0.86
	Correlation with factor 1	1				
	Correlation with factor 2	0.288	1			
	Correlation with factor 3	0.249	0.241	1		
	Correlation with factor 4	0.451	0.300	0.091	1	
	Correlation with factor 5	0.414	0.053	0.340	0.249	1

Note. KMO = 0.849; Bartlett's test of sphericity = 0.000; All factor loadings below 0.5 were deleted; Items with high cross-loadings (<0.2) were removed from the analysis. (char.) inv. = (character) involvement; perc. perv. = perceptual pervasiveness; soc. real. = social realism; free. = freedom of choice; sim. real. = simulational realism. Deleted items in the principal axis factoring: 'In this game, aspects from real life are incorporated' (social realism: low factor loading 0.481); 'I felt the character in this game was an extension of me' (character involvement: high cross-loading (<0.2) with factor 'simulational realism').

separate in an empirical analysis because one standard of evaluation may be dominant, especially immediately after exposure (Popova, 2010b). Because 'Call of Duty: Modern Warfare' attempts to provide a simulation of what a real, contemporary battlefield would look and feel like, it might be that real world schema were used to answer the questions instead of the narrative of the game. Internal realism judgements may be more relevant in games that have no real life referent or only partially relate to a real life referent. A different result might have been obtained when a science fiction shooting game would have been used for data gathering in study 1. Future research should further investigate to what extent internal realism judgements can be separated from external realism judgements during or immediately after exposure, and whether internal realism judgements are only found when using games that make use of a fantasy world.

A second difference with the proposed six-dimensional structure, but on par with the results of Hawkins (1977) and Ribbens and Malliet (2010), relates to a distinction between 'events' and 'characters' within the component that relates to the verisimilitude between the content of a game and real life. This may be explained by the fact that respondents played an offline shooter in which characters were controlled by the computer, thereby making them feel less real than the events that happened while playing. These results imply that context serves as a modifier of perceived game realism judgements (see also Hawkins, 1977). However, the items related to the social realism of characters did not meet the criteria for inclusion of the PAF.

## 5. Study 2: validation in a Flemish sample

The goal of study 2 was to examine whether the proposed structure in study 1 would uphold for different genres of shooting games using a sample of Flemish bachelor- and master students.

### 5.1. Method

Bachelor-level and master-level students in communication sciences at the KU Leuven University played a level from any offline shooting game they preferred for 20 min or until the level was completed, as well as recruited one other participant who was enrolled in higher education. There were no restrictions regarding where the game could be played or regarding the platform, with the exception that handheld gaming was not allowed. From the 729 completed participants, 529 had played a contemporary military-themed shooting game and 117 a science-fiction themed shooting game.

#### 5.1.1. Measures

The online questionnaire included the perceived realism items that came forward in the results of study 1 as well as the questions on socio-demographic characteristics and video game playing habits.

#### 5.1.2. Data analysis

Univariate normality was assessed using the criteria proposed by Muthén and Kaplan (1992). Violation of multivariate kurtosis was corrected by examining the Mahalanobis distance ( $D^2$ ) values and deleting multivariate outliers. Confirmatory factor analysis was used to examine the construct validity of the proposed dimensional structure. Cut-off values that were used for assessing model fit are  $\chi^2/df$  close or below 3, the Comparative Fit Index (CFI < 0.90), and the Root Mean Square Error of Approximation (RMSEA < 0.08) (Bollen, 1989; Byrne, 2010).

### 5.2. Results

As displayed in Table 4, the final model for perceived game

**Table 4**  
Fit indices confirmatory factor analyses.

	N	$\chi^2/df$	CFI	RMSEA	CI90-	CI90+
Military-themed shooter games (FI)	526	3.35	0.92	0.067	0.061	0.073
Science-fiction themed shooter games (FI)	115	1.57	0.92	0.071	0.054	0.087
Military-themed shooter games (US)	128	2.26	0.86	0.099	0.086	0.113

Note. CFI = Comparative fit index; RMSEA = root mean square error of approximation; CI90- = lower bound 90% confidence interval; CI90+ = upper bound 90% confidence interval.

realism in military-themed shooting games (three multivariate outliers deleted) and the final model for perceived game realism in science-fiction themed shooting games (two multivariate outliers deleted) yielded a good model fit. For military-themed shooting games, the range of loadings was between 0.61 and 0.93. The Cronbach's alpha estimates of internal reliability of all subscales were satisfactory, ranging from 0.83 to 0.86 (full information provided in [appendix B](#)). For science-fiction-themed shooting games, the range of loadings was between 0.56 and 0.97. The Cronbach's alpha estimates of internal reliability of all subscales were satisfactory, ranging from 0.83 to 0.87 (full information displayed in [appendix C](#)).

### 5.3. Discussion

These results support the five-dimensional structures and provide construct validity for the scale proposed in study 1. The structure holds for both military-themed and science fiction shooting games.

## 6. Study 3. validation in a USA sample

The goal of study 3 was to examine whether the structure proposed in study 1 would uphold for different genres of shooting game using a USA sample of bachelor- and master students.

### 6.1. Method

The procedure, measurement instrument and data analysis techniques for study 3 were equal to those of study 2 as both studies aimed to examine whether the proposed structure in study 1 would uphold for different genres of shooting game as well to give the initial impetus for scale development. Items were translated back and forth from Dutch to English with the help of author 3 and author 4. Students in the [country] sample did not recruit an additional participant, resulting in a lower sample size. 131 of the 192 participants from study 3 could be categorized as having played a military-themed shooting game.

### 6.2. Results

The final model for military-themed shooting games (three multivariate outliers deleted) yielded a poor model fit ([Table 4](#)). The range of factor loadings was between 0.42 and 0.93. The Cronbach's alpha estimates of internal reliability of all subscales ranged from mediocre ( $\alpha = 0.66$ ) to excellent ( $\alpha = 0.90$ ) (full information provided in [appendix D](#)). In particular, one item of perceptual pervasiveness had a low factor loading and modification indices indicated possible cross-loadings.

### 6.3. Discussion

The results of this study pose a challenge that is difficult to explain by the small sample size only. Although the 5-dimension structure is confirmed, it appears that the phrasing of a (small)

number of items should be reconsidered in a different context than the Flemish sample. Further inquiry should explore alternative wordings for one item in the 'perceptual pervasiveness' dimension ("The picture quality of the game was overwhelming") and two items in the 'freedom of choice' dimension ("While playing this game, I felt I was creating my own story" and "I felt that I could choose my own path in the game world"). It should be noted that both items displayed high factor loadings in both study 1 and study 2, and that the required rephrasing is likely to include small modifications.

## 7. Studies 2 and 3: convergent validity and predictive validity

Based on studies 2 and 3, the psychometric properties of the scale were assessed.

### 7.1. Measures

Convergent validity was assessed using the 'social richness' 7-point semantic differential of the Temple Presence Inventory ([Lombard, Ditton, & Weinstein, 2009](#)). The scale had an acceptable internal reliability coefficient (between 0.77 and 0.84). Regarding predictive validity, immersion was measured using the 5-point Likert-type 'flow' subscale from the Gaming Experience Questionnaire ([de Kort, Ijsselstein, & Poels, 2007](#)). The scale internal reliability coefficient ranged between 0.85 and 0.90. To measure dehumanization, we adapted a validated 7-point Likert type subscale of the 'moral disengagement in sport scale' ([Boardley & Kavussanu, 2007](#)) to fit in a video game context. The internal reliability coefficient was satisfactory in all subsamples (between 0.86 and 0.94).

### 7.2. Results

We provide, based on data from study 2 and study 3, an overview of the subscales (items, internal reliability coefficients), and the correlations between the subscales and variables to examine the validity of the measurement instrument. We report these values for each subscale, each subgenre, and each sample separately.

[Table 5](#) reports the mean and standard deviation of each item, as well as the internal reliability estimates of each subscale. Among the subscales (five scales x three datasets), only one internal reliability coefficient fell below 0.70.

[Table 6](#) presents the strength of the correlations between the subscales and the concepts used to assess convergent ('social richness') and predictive ('immersion', 'dehumanization') validity. All dimensions of perceived realism were moderately to highly correlated with 'social richness' in all three samples, thereby establishing convergent validity. In order to examine the predictive validity of the perceived realism scale, we explored its relations with 'immersion' and 'dehumanization'. In both samples in which a military-themed shooting game was played, the subscales of perceived realism were positively associated with the 'immersion' scale. Interestingly, in the sample that consisted of respondents

**Table 5**  
20-item perceived realism scale, subscales, items, means, and standard deviations for each dataset.

	Military-themed (Belgium) (N = 526)		Science fiction (Belgium) (N = 115)		Military-themed (USA) (N = 128)	
	Mean	SD	Mean	SD	Mean	SD
<b>(Character) Involvement</b>						
While playing this game, I felt like I was present in the video game world.	2.88	1.04	2.95	1.05	2.58	1.20
While playing this game, I felt that I was part of the video game world.	3.02	1.02	3.17	1.01	2.88	1.24
While playing this game, I felt that the character was a part of me.	2.88	1.03	2.89	1.07	2.84	1.13
While playing this game, I felt as if I was a part of the action.	3.48	0.97	3.61	0.92	3.20	1.18
<i>Cronbach's alpha</i>	(0.84)		(0.84)		(0.83)	
<b>Perceptual pervasiveness</b>						
The picture quality of the game was overwhelming.	3.72	0.94	3.58	1.06	3.03	0.99
Graphically, the game looked very impressive.	3.88	0.90	3.71	1.05	4.14	0.81
This game created an absorbing visual experience.	3.91	0.91	4.03	0.86	3.55	0.99
<i>Cronbach's alpha</i>	(0.83)		(0.87)		(0.66)	
<b>Social realism</b>						
The events in this game bear similarities with events in the real world.	3.20	0.94	2.00	0.89	2.85	1.19
I perceive similarities between the events that occur in this game and the events that occur in real life.	3.09	0.96	2.04	0.96	2.66	1.20
The things that happen in the game could occur somewhere in the real world.	3.52	0.97	1.76	0.864	3.29	1.14
<i>Cronbach's alpha</i>	(0.83)		(0.83)		(0.84)	
<b>Freedom of choice</b>						
I felt I determined the course of the game.	3.21	1.03	3.15	1.06	3.21	1.19
In this game I felt I was pulling the strings.	3.09	0.99	3.13	0.86	2.93	1.00
I felt that I could choose my own path in the game world.	3.01	1.00	2.94	0.99	3.12	1.03
While playing this game, I felt I was creating my own story.	2.62	0.98	2.54	1.00	2.35	1.02
I felt I determined the outcome of the fight.	3.47	0.99	3.59	0.95	3.23	1.15
<i>Cronbach's alpha</i>	(0.85)		(0.87)		(0.80)	
<b>Simulational realism</b>						
By playing this game, I feel better prepared for certain lifelike situations.	1.81	0.80	1.60	0.72	2.22	1.10
By playing this game, I can learn how certain problems in the real world are solved.	1.75	0.79	1.70	0.91	2.03	1.01
By playing this game, I can learn how to behave in real life.	1.63	0.66	1.48	0.63	1.81	0.90
By playing this game, I can learn something about the real world.	2.18	0.90	1.75	0.76	2.33	1.10
By playing this game, I can learn how to control certain real world situations.	1.92	0.82	1.93	0.90	2.10	1.01
<i>Cronbach's alpha</i>	(0.85)		(0.86)		(0.90)	

**Table 6**  
Correlations among all subscales of perceived game realism and measures of convergent and predictive validity.

Military-themed [EU country]	1	2	3	4	5	6	7	8
1. (Character) Involvement	1							
2. Perceptual pervasiveness	0.343**	1						
3. Social realism	0.161**	0.157**	1					
4. Freedom	0.412**	0.332**	0.076	1				
5. Simulational realism	0.336**	0.143**	0.396**	0.242**	1			
6. Social richness	0.567**	0.372**	0.225**	0.426**	0.276**	1		
7. Immersion	0.484**	0.302**	0.132**	0.295**	0.308**	0.489**	1	
8. Dehumanization	0.226**	0.200**	0.162**	0.175**	0.265**	0.248**	0.332**	1
Science fiction [EU country]	1	2	3	4	5	6	7	8
1. (character) involvement	1							
2. Perceptual pervasiveness	0.273**	1						
3. Social realism	0.160	0.183	1					
4. Freedom	0.330**	0.162	0.080	1				
5. Simulational realism	0.286**	0.235**	0.462**	0.068	1			
6. Social richness	0.600**	0.454**	0.360**	0.294**	0.456**	1		
7. Immersion	0.410**	0.166	0.120	0.202*	0.312**	0.544**	1	
8. Dehumanization	0.176	0.122	0.058	0.159	0.006	0.179	0.271**	1
Military-themed (USA)	1	2	3	4	5	6	7	8
1. (character) Involvement	1							
2. Perceptual pervasiveness	0.497**	1						
3. Social realism	0.391**	0.306**	1					
4. Freedom	0.553**	0.513**	0.368**	1				
5. Simulational realism	0.544**	0.267**	0.582**	0.497**	1			
6. Social richness	0.498**	0.448**	0.398**	0.500**	0.413**	1		
7. Immersion	0.455**	0.280**	0.315**	0.436**	0.393**	0.528**	1	
8. Dehumanization	0.203*	0.071	0.166	0.238**	0.292**	0.337**	0.351**	1

Note. \* < 0.05, \*\* < 0.01.

who had played a science fiction game, 'perceptual pervasiveness' and 'social realism' did not correlate with immersion. Finally, we expected that higher scores on the subscales of perceived game realism would be related to an increased dehumanization of the opponents. In the samples that consisted of respondents who played a military-themed shooting game, most correlations were in the expected direction. Only for US respondents, 'perceptual pervasiveness' and 'social realism' were not related to dehumanizing opponents. Interestingly, for science fiction shooting games, no significant correlations were observed between the subscales of perceived game realism and 'dehumanization'.

## 8. Discussion

These results provide convergent validity for the scale in the context of both military shooting games and science fiction-themed shooting games. Furthermore predictive validity is largely established with respect to military shooting games. However, predictive validity could not be established in the context of science fiction shooting games. The absence of a relationship between 'social realism' and 'immersion' is easily explained. In line with the framework on the distinction between internal and external realism judgements (Busselle & Bilandzic, 2008), the use of real world referents to assess the realness of a situation in a science fiction game may interfere with a tendency to actively create belief, and therefore not affect immersion and enjoyment. A possible explanation for not discovering any relationship between perceived realism in science fiction games and dehumanization of opponents might be that respondents approached the realism in military-themed shooting games differently than the realism in science fiction shooting games. Shapiro and Kim (2012) have argued that initial perceptions of realism anchor one's realism judgements, and that when few mental resources are available, which is often the case while playing games, the player's initial judgement remains unaltered. Because players may have perceived the science fiction game as unrealistic from the beginning, there may have been less need for dehumanizing the opponents to reduce possible moral conflicts or too little resources may have been available to alter this initial realism judgement.

## 9. Conclusions

The goal of this study was to validate a dimensional structure of realism judgements on shooting games and to create a valid measurement instrument. This study furthers our conceptual understanding of perceived realism in two ways. First, the results indicate that the proposed dimensional structure holds, with the exception of the 'authenticity' dimension. The five factors that made up the final dimensional structure of perceived game realism in this paper have now been replicated with.

- a sample of Flemish, male, experienced gamers who judged the realism of 'Half-Life 2' using memory-based reflections (Ribbens, 2013a).
- a sample of Flemish, male and female students with diverse gaming experience who judged the realism of a military-themed shooting game immediately after exposure.
- a sample of Flemish, male and female students with diverse gaming experience who judged the realism of a science fiction shooting game immediately after exposure.

These results are also to a considerable extent in line with conceptualizations of perceived realism that also refer to a representational (e.g., perceptual fidelity), narrative (e.g., social realism), and behavioral component (e.g., virtual experience) of perceived

game realism (Breuer et al., 2012; Popova, 2010b; Ribbens & Malliet, 2010).

As regards the second goal of developing and validating a perceived realism scale, we paid attention to item development, validation of the scale in different independent samples, and criteria for reliability and validity, which is in line with recent studies on scale validation (e.g. Busselle & Bilandzic, 2009). The scales used to measure the different factors have a good internal consistency and conform to a considerable extent to criteria for convergent and predictive validity. Nevertheless, more conceptual and empirical research is needed that exposes and explains the possible paths between perceived game realism and variables that relate to the game play experience.

In sum, media effects research has yielded inconsistent results regarding the relationship between perceived realism and diverse behavioral outcomes in the last decades (Popova, 2010b). It was therefore essential to take one step back and improve our conceptual understanding of perceived realism. Just as the research of Busselle and Bilandzic (2008), Hall (2003), and Popova (2010b) has paved the road to examine the potential diverse impact of the different dimensions of perceived television realism, the results of this study can theoretically be used to examine the potentially diverse impact of the dimensions of perceived game realism on diverse attitudinal and behavioral outcomes (see also the work of Breuer et al., 2012). In the case of violent video games, for instance, it may be important to differentiate between the potential impact of improvements in graphics (e.g. 'perceptual pervasiveness') and an increase in the experienced realness of the agency (e.g. 'freedom of choice', see also Ribbens & Malliet, 2010). A clear view on the role that the different dimensions of perceived realism play in the learning effects that are associated with digital game play will refine current research and might create a healthier atmosphere to discuss the societal impact of digital games.

### 9.1. Limitations and future research

Despite our belief that we vastly improved the conceptualization and operationalization of perceived game realism, still a number of limitations deserve consideration. The choice of using one game to establish the initial factor structure affected the result we obtained later on, and the fact that not all hypothesized dimensions came forward may be due to a low amount of variation in the data. In addition, we have no data on other relatively popular subgenres such as shooting games that revolve around crime or mafia (e.g. 'Mafia II') or action-adventure shooting games (e.g. 'Uncharted' franchise). Although the conceptualization of perceived realism is based on research that associated the concept with diverse games such as 'EverQuest' (Shapiro et al., 2006) or 'Grand Theft Auto' (Malliet, 2006), more research is needed that replicates these findings with other game genres. Likewise, the robustness of the dimensional structure will increase if tested with samples that differ in gaming experience. Additionally, we do not claim that the perceived realism scale we forward in this chapter is beyond improvement. In the PAF in study 1, the diversity of the items within the different factors was reduced, especially in the case of 'social realism' and 'perceptual pervasiveness'. Finally, in the case of the Flemish sample, the dimensions of perceived game realism were associated with the measures for establishing validity in expected ways. However, in the case of the sample of US students, some correlations came forward that are less easy to explain. Additional research should be conducted to examine whether these differences are due to methodological issues of the scale, the relatively small sample size, or cultural differences.



## Appendix A

Items included in study 1

	Dimension	Item
1	Simulational realism	By playing this game, I feel better prepared for certain lifelike situations.
2	Simulational realism	By playing this game, I can learn how to control certain real world situations.
3	Simulational realism	By playing this game, I can learn how certain problems in the real world are solved.
4	Simulational realism	By playing this game, I can learn how to behave in real life.
5	Simulational realism	By playing this game, I can learn something about the real world.
6	Freedom of choice	I felt I determined the course of the game.
7	Freedom of choice	I felt I determined the outcome of the fight.
8	Freedom of choice	While playing this game, I felt I was creating my own story.
9	Freedom of choice	I felt that I could choose my own path in the game world.
10	Freedom of choice	In this game I felt I was pulling the strings.
11	Perceptual pervasiveness	The sound effects in the game helped to create a compelling atmosphere.
12	Perceptual pervasiveness	The picture quality of the game was overwhelming.
13	Perceptual pervasiveness	The sound effects in the game were impressive.
14	Perceptual pervasiveness	Graphically, the game looked very impressive.
15	Perceptual pervasiveness	This game created an absorbing visual experience.
16	Social realism	The things that happened in the game could occur somewhere in the real world.
17	Social realism	The characters in the game acted like people would act in real life.
18	Social realism	The dialogues in the game were plausible.
19	Social realism	I perceive similarities between the events that occurred in this game and events that occur in real life.
20	Social realism	The events in this game bear similarities with events in the real world.
21	Social realism	The interactions the characters had in this game are similar to interactions people have in real life.
22	Social realism	In this game, aspects from real life are incorporated.
23	Authenticity	The developers of the game have spent a lot of time and effort to make the game feel natural.
24	Authenticity	The developers of the game have made sure that everything in the game makes sense.
25	Authenticity	The developers of the game have examined which objects (e.g. weapons) fit within the context of the game.
26	Authenticity	The developers have made sure that the action in the game is credible.
27	Authenticity	The developers of the game have attended to make sure that they built a credible world.
28	(character) Involvement	While playing this game, I felt that the character was a part of me.
29	(character) Involvement	I felt as if the character in this game was an extension of me.
30	(character) Involvement	While playing this game, I felt like I was present in the video game world.
31	(character) Involvement	While playing this game, I felt as if I was a part of the action.
32	(character) Involvement	While playing this game, I felt that I was part of the video game world.

## Appendix B

Confirmatory factor analysis of perceived game realism in military-themed shooting games with a sample of 529 male and female students from Belgium.

No	Item	Factor				
		(Char.) inv.	Perc. perv.	soc. real.	Free.	sim. real.
1	While playing this game, I felt like I was present in the video game world.	0.874				
2	While playing this game, I felt that I was part of the video game world.	0.796				
3	While playing this game, I felt as if I was a part of the action.	0.726				
4	While playing this game, I felt that the character was a part of me.	0.614				
5	Graphically, the game looked very impressive.		0.877			
6	The picture quality of the game was overwhelming.		0.865			
7	This game created an absorbing visual experience.		0.637			
8	The events in this game bear similarities with events in the real world.			0.934		
9	I perceive similarities between the events that occur in this game and the events that occur in real life.			0.837		
10	The things that happen in the game could occur somewhere in the real world.			0.613		
11	In this game I felt I was pulling the strings.				0.798	
12	I felt that I could choose my own path in the game world.				0.775	
13	I felt I determined the course of the game.				0.729	
14	I felt I determined the outcome of the fight.				0.684	
15	While playing this game, I felt I was creating my own story.				0.676	
16	By playing this game, I can learn how to control certain real world situations.					0.797
17	By playing this game, I can learn how certain problems in the real world are solved.					0.778
18	By playing this game, I can learn how to behave in real life.					0.749
19	By playing this game, I feel better prepared for certain lifelike situations.					0.734
20	By playing this game, I can learn something about the real world					0.709
Cronbach's alpha		0.84	0.83	0.83	0.85	0.86

Note. (char.) inv. = (character) involvement; perc. perv. = perceptual pervasiveness; soc. real. = social realism; free = freedom of choice; sim. real. = simulational realism.

## Appendix C

Confirmatory factor analysis of perceived game realism in science fiction shooting games with a sample of 115 male and female students from Belgium.

No	Item	Factor				
		(Char.) inv.	Perc. perv.	soc. real.	Free.	sim. real.
1	While playing this game, I felt that I was part of the video game world.	0.869				
2	While playing this game, I felt like I was present in the video game world.	0.760				
3	While playing this game, I felt as if I was a part of the action.	0.720				
4	While playing this game, I felt that the character was a part of me.	0.680				
5	Graphically, the game looked very impressive.		0.974			
6	The picture quality of the game was overwhelming.		0.859			
7	This game created an absorbing visual experience.		0.690			
8	The events in this game bear similarities with events in the real world.			0.926		
9	I perceive similarities between the events that occur in this game and the events that occur in real life.			0.869		
10	The things that happen in the game could occur somewhere in the real world.			0.576		
11	In this game I felt I was pulling the strings.				0.885	
12	I felt that I could choose my own path in the game world.				0.871	
13	I felt I determined the course of the game.				0.717	
14	While playing this game, I felt I was creating my own story.				0.688	
15	I felt I determined the outcome of the fight.				0.557	
16	By playing this game, I can learn something about the real world.					0.795
17	By playing this game, I feel better prepared for certain lifelike situations.					0.772
18	By playing this game, I can learn how certain problems in the real world are solved.					0.736
19	By playing this game, I can learn how to control certain real world situations.					0.727
20	By playing this game, I can learn how to behave in real life.					0.706
Cronbach's alpha		0.84	0.87	0.83	0.87	0.86

Note. (char.) inv. = (character) involvement; perc. perv. = perceptual pervasiveness; soc. real. = social realism; free = freedom of choice; sim. real. = simulational realism.

## Appendix D

Confirmatory factor analysis of perceived game realism in military-themed shooting games with a sample of 128 male and female students from the USA.

No	Item	Factor				
		(Char.) inv.	Perc. perv.	soc. real.	Free.	sim. real.
1	While playing this game, I felt like I was present in the video game world.	0.811				
2	While playing this game, I felt that I was part of the video game world.	0.752				
3	While playing this game, I felt as if I was a part of the action.	0.713				
4	While playing this game, I felt that the character was a part of me.	0.701				
5	This game created an absorbing visual experience.		0.779			
6	Graphically, the game looked very impressive.		0.672			
7	The picture quality of the game was overwhelming.		0.423			
8	The events in this game bear similarities with events in the real world.			0.930		
9	I perceive similarities between the events that occur in this game and the events that occur in real life.			0.882		
10	The things that happen in the game could occur somewhere in the real world.			0.602		
11	I felt I determined the course of the game.				0.804	
12	I felt I determined the outcome of the fight.				0.790	
13	In this game I felt I was pulling the strings.				0.635	
14	While playing this game, I felt I was creating my own story.				0.571	
15	I felt that I could choose my own path in the game world.				0.544	
16	By playing this game, I can learn how to control certain real world situations.					0.912
17	By playing this game, I feel better prepared for certain lifelike situations.					0.836
18	By playing this game, I can learn how certain problems in the real world are solved.					0.825
19	By playing this game, I can learn how to behave in real life.					0.764
20	By playing this game, I can learn something about the real world.					0.713
Cronbach's alpha		0.83	0.66	0.84	0.80	0.90

Note. (char.) inv. = (character) involvement; perc. perv. = perceptual pervasiveness; soc. real. = social realism; free = freedom of choice; sim. real. = simulational realism.

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