Psychology of Popular Media

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Digital Media Impacts Multiple Aspects of Self-Representation: An Investigation of Flow, Agency, Presence, Character Identification, and Time Perception

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Research in cognitive science is rapidly increasing our understanding of the cognitive mechanisms that give rise to our sense of being a unified conscious self and that allow us to interact in purposeful ways with the external environment. Laboratory research has shown that experimental manipulations involving computer-based tasks can alter aspects of our self-representation. In the current study, we investigated how complex digital media, experienced in real-world settings, impacts aspects of self-processing. Specifically, we investigated experiences of self-representation associated with interactive media such as video games and noninteractive media, such as film or TV, in naturalistic settings. A total of 220 participants completed measures of flow, sense of agency, presence, character involvement, and time perception, reporting on their engagement with both interactive and noninteractive media. Results showed reduced agentive involuntariness, but increased flow, presence, character involvement, and time perception for interactive compared to noninteractive media. Absorption was associated with increased flow, presence, and character involvement. Personality traits of openness and conscientiousness were also associated with moderate alteration of aspects self-representation during media engagement. This study presents nuanced differences in the way that interactive and noninteractive media impact self-processing and highlights features that may enhance engagement with digital media.

Public Policy Relevance Statement
Engaging with digital media can impact our sense of self-awareness and can shape the ways that we engage with the external world. We found that engagement with interactive media (such as video games) and noninteractive media (such as film or TV) involve alterations in distinct aspects of self-representation. Individuals with particular personality and cognitive characteristics are particularly responsive to changes in self-awareness following media engagement.

Keywords: media, self, agency, presence, absorption

Supplemental materials: http://dx.doi.org/10.1037/ppm0000330.supp

In recent years, considerable attention has been paid in cognitive science research to understanding the mechanisms underlying self representation, that is, to identifying and measuring those components of conscious experience that give rise to our sense of being a unified self and that allow us to interact in purposeful, responsive ways with the external environment (Blanke, Slater, & Serino, 2015; Haggard, 2017; Tsakiris, 2016). Much of this research has focused on exploring the operation of low-level multisensory perceptual or cognitive cues and mapping out how these cues influence the way individuals make sense of the world (Blanke, 2012). For example, this work has identified how cues such as visual form plausibility influence the degree to which ambiguous stimuli are recognized as either self-caused or externally generated (Pritchard, Zopf, Polito, Kaplan, & Williams, 2016). This research has been largely restricted to highly manipulated experimental paradigms that use controlled stimuli to influence alterations in self representation. Less attention has been paid to systematically exploring how complex and realistic digital environments influence and interact with our sense of self. In this study we explore (a) how real-world media engagement contributes to alteration in multiple components of self-representation and (b) how individual difference characteristics shape the quality of these interactions.

TV, movies, and videogames are ubiquitous forms of entertainment. They share a number of common characteristics, including a central visual aspect. The forms cross-pollinate, for example, with games spawning movies (e.g., *Tomb Raider*) and TV shows spawning games (e.g., *The Walking Dead*). Yet, there are significant differences between them. Not all games boast realistic,

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All data and analysis scripts are available at https://osf.io/pd5fb/.

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high-quality graphics, and even those that do are still recognizably a virtual construct. More significantly movies and TV do not offer their audiences the interactive opportunities that lie at the core of games. In this article, we refer to videogames as "interactive media" and film and TV as "noninteractive" media. We use these labels to refer to the presence of direct controls that influence media content, rather than as a comment on cognitive processes involved in these forms of media engagement.

Although it seems intuitively likely that engagement with interactive forms of media would have a greater impact on self representation than noninteractive media, this is not an area that has been well explored empirically. Understanding how these different kinds of media lead to different experiences of self representation has important implications for media producers, designers of computer technologies, and also for media consumers. The relationship between audience and media can be conceptualized in many ways, and there are multiple, interrelated cognitive and psychological variables related to self-representation that may be involved in processing media of different kinds, and these may turn out to function in nonobvious ways.

A viewer may become deeply engrossed in media content to the point that their experience takes on a flow-like quality of automaticity (Jung, Perez-Mira, & Wiley-Patton, 2009); they may regard themselves as having a level of agency over events depicted in media (J. H. Murray, 2017); they may conceive of themselves as actually present in the fictional/virtual world (Sheridan, 1992); they may explicitly identify with characters in the viewed media (Soutter & Hitchens, 2016); and they may experience distortions in time perception (Rau, Peng, & Yang, 2006). These five aspects of self-representation—experiences of flow, alterations to the sense of agency, feelings of presence, character involvement, and time distortions—provide a window into the ways that different kinds of media can interact with our self-concept.

Flow

Flow is a measure of the connection between one's self and events that are occurring in the moment (Csikszentmihalyi, 1991). Flow refers to an experience of intense subjective involvement in an activity or environment. A defining feature of flow is focused attention on the target activity to the exclusion of one's surrounds. Flow is often described as occurring during moments of intense performance by elite sportspeople or artists (Swann, Keegan, Piggott, & Crust, 2012), but flow can also be experienced as part of more typical daily events by nonexperts (Ullén et al., 2012). Csikszentmihalyi (1991) identified eight characteristics of flow: clear goals, high degree of concentration, a loss of the feeling of self-consciousness, distorted sense of time, direct and immediate feedback, balance between ability level and challenge, sense of personal control, and a sense of intrinsic reward. Each of these characteristics has been identified in theoretical analyses of media engagement (Chen, 2007). Flow is almost exclusively discussed with reference to performing actions, and, consequently, media researchers have mainly focused on exploring flow in interactive contexts of user engagement with media. Most attention has been directed at computer–human interactions (Kaur, Dhir, Chen, & Rajala, 2016; Webster, Trevino, & Ryan, 1993) and in particular video, games (Keller, Ringelhan, & Blomann, 2011; Weibel, Wissmath, Habegger, Steiner, & Groner, 2008). This work has explored, for example, flow experiences associated with differing types of computer games (Takatalo, Häkkinen, Kaistinen, & Nyman, 2010), the effects on flow of playing games with human compared to computer controlled teammates (Kaye & Bryce, 2014; Weibel et al., 2008), and the role of flow in accounting for perseverance in games (Hsu & Lu, 2004). Although there is evidence to suggest that flow can also be experienced in noninteractive imaginative experiences such as reading (Mcquillan & Conde, 1996), there has been little attention paid to experiences of flow associated with noninteractive media such as engagement with films or TV.

Several researchers have developed scales specifically aimed at quantifying flow associated with video games (Fox & Brockmyer, 2013; O'Brien & Toms, 2010), but the most commonly used measure in flow research on video games (and more generally), is the Dispositional Flow Scale (Jackson, Martin, & Eklund, 2008; Wang, Liu, & Khoo, 2009). Although there have been mixed reports of the precision of this measure in the context of video games (Procci, Singer, Levy, & Bowers, 2012; Wang et al., 2009), we selected this tool in the current study as it appeared the most likely to provide meaningful and psychometrically sound comparisons across both interactive and noninteractive media.

Sense of Agency

Sense of agency is a measure of the subjective feeling of self-control (Moore, 2016). The concept of agency occurs in the literature of a range of disciplines, including psychology, social theory, media theory, and behavioral studies, and is understood in each field in subtly different ways (Polito, Barnier, & Woody, 2013). Experimental psychologists and philosophers often describe the phenomenology of agency as comprising two components, an implicit feeling of involuntariness, and a more reflective judgment of effort (Gallagher, 2012; Synofzik, Vosgerau, & Newen, 2008).

Within the domain of media research, investigation of the cognitive mechanisms underlying agency alteration has been less emphasized, but there has been considerable attention paid to how different elements of human–computer interaction relate to a sense of agency. In particular, researchers such as Anstey (2005), Murray (2017) and Stern (2008) have discussed how the interactive nature of computer games captures and exaggerates a player's feeling of agency for their overall environment. In other work, Hammer (2007) proposed a theoretical account of how four different aspects of agentive experience (textual, narrative, psychological, and cultural agency) can be influenced by design choices in computer games.

Typically, empirical studies of media manipulate agency to explore how conditions with varying levels of interactive involvement influence some other measure. For example, Madsen (2016) showed that participants exhibited greater levels of fear response when playing compared to watching a horror themed computer game. Similarly, Lin (2013) showed increased physiological responses when participants played rather than watched a violent video game. To date, there has been little empirical investigation of how engagement with different types of media may itself influence individuals' sense of agency.

Presence

Presence is a measure of the relationship between self and the environment, in particular, the subjective experience of feeling situated in a mediated environment—of "being there" (Sanchez-Vives & Slater, 2005). The concept of presence originated from the work of Johnsen and Corliss (1971) and Minsky (1980). Minsky examined how a human operator can feel present at a remote location owing to the perceptual feedback received from the technology used. Similarly, Johnson and Corliss recommended that technology be designed such that it will "help the operator project his presence" (p. 37) into a workspace in which they are not physically located. Whereas both flow and sense of agency have been studied in many different contexts, the concept of presence is almost exclusively linked to human interaction with technology.

Researchers have proposed different conceptualizations of the structure underlying a sense of presence. IJsselsteijn, de Ridder, Freeman, and Avons (2000) described two broad aspects: spatial presence, which refers to the subjective experience of existing within a virtual environment, and social presence, which refers to the feeling of being together with another agent who is geographically separate. In a more detailed conceptualization, Lessiter, Freeman, Keogh, and Davidoff (2001) distinguished between spatial involvement, engagement with the environment, believability of content in the virtual world, and physiological impacts (see the section on Independent TV Commission Sense of Presence Inventory for more details).

There is a considerable body of research investigating the role of presence in media engagement (Lee, 2004; Lombard & Ditton, 1997). One stream of research has focused on exploring how different media technologies influence presence. This has shown that more immersive media technologies are associated with greater levels of felt presence. Increasing the size of a viewing screen, displaying stereoscopic rather than monoscopic content, and adding movement have all been found to increase subjective presence (IJsselsteijn, de Ridder, Freeman, Avons, & Bouwhuis, 2001). Similarly, when the same media content is experienced using a head mounted display, this is rated as involving greater presence than a semi-immersive video wall, which in turn is rated as involving greater presence than a PC monitor (Baños et al., 2004). A second stream of research has focused on affective and social aspects of media engagement. For example, Riva at al. (2007) showed that media content rated as highly emotional was more likely to influence presence than low emotion content. Ravaja et al. (2006) have shown that the social identity of other characters in the virtual world can profoundly influence presence. They found that playing a computer game with a human opponent led to more presence than playing with a computer opponent and that playing with a known friend led to more presence than playing with a stranger. To date, however, empirical research on presence has mainly involved media content chosen by experimenters, and the construct has usually been investigated in laboratory settings. Less is known about everyday experience of presence in natural settings.

Character Involvement

Character involvement is a measure of the narrative aspects of self identity (Moyer-Gusé, 2008). Character involvement has been studied from multiple theoretical and empirical viewpoints. There is no single, accepted understanding of the concept and no standardized measure of this construct. Instead, several frameworks have been suggested. These can be briefly summarized as empathy or sympathy for a character (*sympathy*; Oatley, 1999); a desire to be like or act like a character (*identification*; Hoffner & Buchanan, 2005); a perception of existing similarity to a character (*similarity*; Hefner, Klimmt, & Vorderer, 2007); positive appraisal of a character (*liking*; Giles, 2002); and a pseudorelationship between audience/player and character (*parasocial interaction*; Giles, 2002). Moyer-Gusé (2008) proposed the use of "character involvement" as an overarching term to cover the varying forms of these relationships. Several lines of previous research have linked character involvement to media engagement: Oatley (1999) conceptualized character involvement as an emotional, empathic experience whereby a viewer becomes the protagonist through taking on the protagonist's goals and plans, and experiencing emotions depending upon their success or failure. Smahel, Blinka, and Ledabyl (2008) described this process in terms of attachment theory. They investigated this empirically by measuring perceived similarity between players and characters in a massive multiplayer online role-playing game. Participants rated the similarity between player and character and also whether characters had greater skills than, or skills that compensated for, those of the player. They found that positive character involvement was closely related to compulsion to play the game.

Hoffner and Buchanan (2005), following on from earlier work on celebrity attachment, proposed conceptualizing character involvement in terms of "wishful identification." They described this as a desire or attempt to become like another person. Hoffner and Buchanan examined identification with characters from TV programs by asking participants to rate their desire to be like, or act like, their favorite characters. A similar theoretical approach was taken by van Reijmersdal, Jansz, Peters, and van Noort (2013), who looked at character involvement among young female gamers. They found that character involvement was a major motivation for video game engagement in this population.

Klimmt, Hefner, and Vorderer (2009) conceptualized character involvement as a shift in self-perception. For these authors, there is a distinct difference in identification between games and noninteractive media. For the latter, the observer perceives a social distinction between themselves and the character. In the former, the players cease to perceive themselves as distinct from the character, instead experiencing a merging of their self with the character.

Hefner et al. (2007) measured perceptual distance for participants playing versus watching a video game using questions such as "I had almost the feeling of being the game character" and "I have forgotten myself during the game." They found that character involvement was higher for those playing than for those watching. In a detailed qualitative study of interactive media, Banks (2015) proposed a typology that demonstrates the complex range of possible relationships that can occur in these kind of player/character relationships. According to this model, a player's view of a character can range across viewing the character merely as an object to be manipulated, the character being an extension of the player (*avatar as me*), the character being separate from but intertwined with the player (*avatar as symbiote*), to the character being viewed as a distinct social agent (*avatar as social other*).

Time Perception

Time perception is a measure of self-identity along a temporal dimension. It is a common intuition that enjoyable or engrossing activities are associated with reduction in subjective time duration (Droit-Volet & Meck, 2007). Media engagement is, for most people, a leisure activity and, anecdotally, seems to involve such time distortions. It is not, however, clear how different types of media engagement might affect the perception of time. Theoretically, changes in time perception may be a secondary effect of alteration to other aspects of self-representation. For example, time distortion is explicitly defined as a component of flow (Csikszentmihalyi, 1991). Similarly, agency changes have been closely linked with alterations in subjective time perception (Moore & Obhi, 2012), and distortion of time has been described as a characteristic of presence (Lessiter et al., 2001). These findings point toward time perception being a likely aspect of self-experience that may be impacted by media engagement. Given these overlaps, alterations in time perception may already be contributing to broader changes in self representation. Nevertheless, we have included a brief independent measure of time perception in the current study to explore how experiences of time vary in different types of media engagement.

Trait Influences

The work reviewed here shows different ways in which media engagement might be related to changes in self-representation. Most of this research has investigated how properties of the technology or media content might influence self representation. Another important source of variation for understanding media's influence on self representation is individual difference characteristics of media consumers. Very little is known about how such human factors relate to flow, sense of agency, character involvement, or time perception in the context of media engagement. There has been some research into individual differences in experiences of presence (see Alsina-Jurnet & Gutiérrez-Maldonado, 2010 for an overview). These studies, however, have mixed findings. Laarni, Ravaja, Saari, and Hartmann (2004) reported that extraversion is associated with increased presence, but Alsina-Jurnet and Gutiérrez-Maldonado (2010) reported that introversion is a predictor of increased presence for anxious participants. McCreery, Schrader, Krach, and Boone (2013) have also claimed that agreeableness predicts presence. Looking beyond classic personality traits, several researchers have investigated *absorption*—a tendency toward intense imaginative involvement with sensory experiences or with aspects of the external environment. Absorption is a stable individual difference characteristic that has been associated with increased ability to experience alterations in consciousness (Lifshitz, van Elk, & Luhrmann, 2019). Although there are reports of a robust relationship between absorption and presence (Baños et al., 1999; Kober & Neuper, 2013), not all studies have identified this association (C. D. Murray, Fox, & Pettifer, 2007; Sas & O'Hare, 2003).

Research on character involvement has also highlighted the importance of preexisting traits. Soutter and Hitchens (2016) showed that openness was positively associated with character involvement and that extraversion was negatively associated with character involvement. Conversely, McCreery, Kathleen Krach, Schrader, and Boone (2012) showed that players who were more agreeable in real life also played their character as more agreeable in a multiplayer role-playing computer game.

A challenge of comparing findings across studies is the lack of standardized paradigms in this area of research. Investigators tend to develop idiosyncratic experimental tasks suited to their specific research question. This makes generalizing about overall relationships between self-representation and individual difference characteristics difficult.

The Current Study

Previous research has shown that flow, agency, presence, character involvement, and time perception are all affected by media engagement. However, most previous studies have focused only on interactive media, and there has been very little comparative work done on how individuals experience these concepts across different forms of media in ecologically valid settings. The first aim of the current study was to investigate alterations in self-representation across both interactive (video games) and noninteractive media (film and TV). Our second aim was to explore the degree to which any differences in self-representation between interactive and noninteractive media were related to individual difference characteristics. In particular, we aimed to explore the influence of classic personality traits and absorption on media engagement with real-world content in naturalistic settings.

Participants were asked to report on their everyday experiences of both interactive and noninteractive media. Participants completed standardized measures of self representation (tapping flow, sense of agency, presence, character involvement, and time perception) associated with each kind of media experience, as well as individual difference measures (personality traits and absorption). We had two broad hypotheses. First, we expected more pronounced self-representation changes for interactive compared to noninteractive media across each of our primary measures. That is, we expected greater distortions of flow, agency, presence, character involvement, and time perception for video games compared to film or TV. Second, we expected that key trait variables that have been identified in previous research as predictors of altered self-representation would have a general impact on participants' overall level of media engagement. Specifically, we expected that extraversion, openness, agreeableness, and absorption would be associated with increased levels of alteration in self representation regardless of media type.

Method

Participants

A total of 350 participants completed the study online; however, only 220 participants met the inclusion criteria of providing complete responses and nominating both a specific video game and a specific movie or TV show that they engaged with for more than 1 hr per week. A further participant was excluded due to recording multiple outlier values (detailed below). In all, 219 participants were retained (140 male, 79 female). Sixty-one (27.9%) participants were aged 18 to 25 years, 83 (37.9%) aged 26 to 35 years, 51 (23.3%) aged 36 to 45 years, 18 (8.2%) aged 46 to 55 years, and six (2.7%) aged over 55 years. A total of 176 (80.4%) participants were from the United States, 38 (17.4%) participants were from

Australia, and the remainder were from the United Kingdom, Norway, and the Philippines. Ninety-three (42.5%) participants reported their highest education as high school, 104 (47.5%) had an undergraduate degree, and 22 (10%) had a postgraduate degree. Participants were recruited through posts on online gaming forums and entered into a prize draw for a $50 Amazon voucher or were recruited through TurkPrime (Litman, Robinson, & Abberbock, 2017) and compensated $7.50 for participation. This research was approved by the Macquarie University Ethics Review Committee (Human Research).

Materials

This study involved a set of demographic questions, five measures of self representation, and two trait measures.

Demographic questions. We constructed a set of questions recording participants' age range, gender, level of education, country of residence, and media preferences. To characterize individuals' engagement with media, participants were first asked to nominate a specific video game and also a specific movie/TV show that they enjoyed. For the nominated titles, participants were then asked to report the genre and plot; the amount of time spent engaging with this media each week; and the social context of media engagement (alone, physically present with others, virtually connected with others).

Each of the self representation measures focused on experiences associated with a specific media type (interactive or noninteractive) and were repeated so that participants provided reports both for engagement with a video game and reports for engagement with a movie or TV show (see the following sections). The self-representation measures used were:

Short Dispositional Flow Scale. The subjective sense of flow is a positive feeling of being optimally engaged and focused on a target experience (Jackson et al., 2008). The Short Dispositional Flow Scale (S-DFS) is a short from of the dispositional flow scale (Jackson & Eklund, 2002) that measures the tendency to experience flow in a given setting. Alternate forms of this scale exist that seem at first glance to be a better fit for a state focused assessment of flow (e.g., Flow State Scale, Short Flow State Scale), but those measures are designed for assessment of a target experience immediately after the experience has concluded. As participants in the current study retrospectively evaluated their typical media experiences, the dispositional form of the scale was deemed more appropriate. This version of the scale asks participants to report on their typical feelings in a given context. Specifically, the S-DFS consists of nine items scored on a 5-point Likert scale, which assess the nine dimensions of flow identified by, Csikszentmihalyi (1991): (a) a balance between the challenge of the task and skills of the individual, (b) a merging of action and awareness, that is, one performs the activity almost "automatically," (c) clear perceived goals, (d) unambiguous feedback, (e) focusing on the task at hand, (f) a sense of control of the activity, (g) a loss of self consciousness or a reduced awareness of self, (h) time transformation, that is, sense of time becomes distorted, and (i) an autotelic, intrinsically rewarding experience, implying that the activity in itself is a reason for performing it instead of any external objectives. This short form is scored as a single factor.

The Sense of Agency Rating Scale. The Sense of Agency Rating Scale (SOARS) is a 10-item scale that measures subjective alterations to the sense of agency related to some specific experience (Polito et al., 2013). Participants were instructed to think of their media experience and to rate their level of agreement with a series of statements on a 7-point Likert scale from *strongly disagree* to *strongly agree*. The scale has two factors: (a) Involuntariness, with items such as "I felt that my experiences and actions were not caused by me", which represent a subjectively experienced reduction in control over one's own actions; and (b) Effortlessness, with items such as "My experiences and actions occurred effortlessly", which represent a subjectively experienced increase in the ease and automaticity with which actions occur. Although the SOARS was originally developed for use in hypnosis (Költö & Polito, 2017; Polito, Barnier, & Connors, 2018), it has also been used in research on psychopathology (Polito, Langdon, & Barnier, 2015), and we used a modified, general form, which is applicable in any context (Pritchard et al., 2016).

Independent TV Commission Sense of Presence Inventory. The Independent TV Commission Sense of Presence Inventory (ITC-SOPI) measures presence, the subjective feeling of being immersed in a media experience (Lessiter et al., 2001). Whereas most psychometric measures of presence specifically target experiences of virtual reality, the ITC-SOPI taps experiences of presence associated with all forms of media. Participants rate their level of agreement with 44 items on a 5-point Likert scale. The scale has four factors: (a) Spatial Presence, with items such as "I had a sense of being in the scenes displayed"; (b) Engagement, with items such as "my experience was intense"; (c) Ecological Validity, with items such as "the content seemed believable to me"; and (d) Negative Effects, with items such as "I felt disoriented."

Character Identification questions. Participants were also asked a series of five questions about the main character portrayed in the target media. They rated (a) the degree to which the character acts similarly to them, (b) how similar the character looks to them, (c) how much they felt that they were the character, (d) the degree to which the character's body becomes their own, and (e) how much they would like to become like the character. All questions were rated on a 7-point Likert scale. We calculated a Character Identification score, which was the mean of these five ratings.

Time perception questions. We included a measure of time perception, adapted from Wittmann and Lehnhoff (2005). This scale consisted of a single item asking participants to rate their subjective experience of time on a 5-point Likert scale from 1 (*very slow*) to 5 (*very fast*) in each media context. Specifically, participants were asked to rate their typical experience of time associated with video games ("How fast does time usually pass for you when playing video games?") and their typical experience of time associated with movies or TV ("How fast does time usually pass for you when watching movies or TV?").

The trait measures were:

M5-50 personality questionnaire. The M5-50 is a personality measure based on the International Personality Item Pool (Goldberg et al., 2006; Socha, Cooper, & McCord, 2010). It consists of 10 items for each of the traits in the five-factor model of personality (Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism). Participants score each item on 5-point Likert scale, indicating how accurate each statement is as a self descriptor.

Tellegen Absorption Scale. The Tellegen Absorption Scale (TAS) measures a disposition toward subjective restructuring of the phenomenal self and world characterized by increased levels of mental involvement with a specific attentional object (Tellegen & Atkinson, 1974). Individuals who are high in trait absorption are likely to have intense imaginative responses to sensory events and become deeply immersed in their own internal experiences. The TAS is a 34-item true/false scale. A number of different scoring schemas have been proposed for the TAS (Roche & McConkey, 1990); however, to minimize the number of statistical tests performed, we investigated only the TAS total score.

Procedure

All measures were presented online using the Qualtrics platform. The study consisted of four parts. First, participants answered demographics questions. Second, participants completed the two trait measures, presented in random order: the M5-50 personality questionnaire, and the TAS. Third, participants completed a battery including questions about their media engagement and self representation measures (Flow State Scale, Sense of Agency Rating Scale, ITC-SOPI, Character Identification questions and Time Perception questions) targeting their experience of video games. Fourth, participants completed the same battery of measures targeting their experience of movies/TV. These final two blocks were presented in counterbalanced order. The study took approximately 30 min.

Results

All data and analysis scripts are available on the Open Science Framework at https://osf.io/pd5fb/.

Media Habits

Participants nominated a wide variety of genres for their selected media. For TV/movies the most popular genres given were fantasy (13.2%) drama (16.4%), comedy (15.5%), action (3.7%), and crime (9.1%). Genre is a more difficult concept in videogames. As noted by Apperley (2006), here genre may refer to perspective (e.g., first or third person), playstyle (e.g., sports, roleplaying game, shooter), or representational aspect (e.g., fantasy, science fiction). In this sample, games were mainly categorized by their play style. The most popular categories were first person shooters online shooter (25.6%), role playing games (20.5%), action (20.1%), sports (10.0%), strategy/simulation (9.6%), and Multiplayer Online Battle Arena (5.5%).

Participants reported engaging with interactive media on more days per week ($M = 4.97$, $SD = 1.76$) than noninteractive media ($M = 3.15$, $SD = 1.76$, $t = 9.66$, $p = < 0.001$, 95% confidence interval [CI] [1.45, 2.19]). Participants also reported engaging with interactive media for more hours per week ($M = 17.94$, $SD = 17.11$) than noninteractive media ($M = 10.09$, $SD = 17.11$, $t = 5.17$, $p = < 0.001$, 95% CI [4.86, 10.82]).

Table 1 shows the social context of media engagement. There was a significant association between type of media and social context, $\chi^2(2) = 84.49$, $p < .001$. This represents the fact that individuals were more likely to connect with others in person when watching noninteractive media and more likely to connect with others remotely while playing games (interactive media).

Table 1
Social Context of Interactive and Noninteractive Media

Media type	Alone	With others	Connect remotely
Interactive media	139	39	92
Non-interactive media	145	92	11

Preliminary Analyses

We first checked for outliers on all measures. Outliers were defined as any score >3 standard deviations from the mean. Twenty-seven outlier scores were identified and excluded from all analyses. In addition, one participant was completely excluded for recording more than three outlier scores. There were no indications of skewness or kurtosis for any variables (see Table S1 in the online supplemental materials). Reliability was good for all measures (all $\omega \geq 0.72$). Detailed reliability metrics are provided in Table S2 in the online supplemental materials.

Our main research question was whether scores on our measures of self representation (i.e., flow, sense of agency, presence, character involvement, and time perception) differed between interactive and noninteractive media. However, before proceeding to our main analyses we first investigated a number of demographic and experimental factors that may have influenced our results. Specifically, there were three potential confounds: First, our sample consisted of participants recruited from online gaming forums and also through TurkPrime. Second, in our design participants rated their experiences associated with both interactive and noninteractive media in counterbalanced order. Third, results may have been influenced by participant gender. We ran a series of preliminary repeated-measures analyses of variance (ANOVA) analyses to test these potential confounds. For each of our dependent variables (flow, involuntariness, effortlessness, spatial presence, engagement, ecological validity, negative effects, character involvement, and time perception), we ran three separate 2 × 2 ANOVAs with media type (interactive v noninteractive) as a repeated measures factor and recruitment source, order, or gender as the second factor. We were interested in whether these potential confounding factors interacted with media type for any measure of self-representation.

We found a Dataset × Media type interaction for our measure of flow, $F(1, 210) = 4.56$, $p = .034$. We also found Order × Media type interactions for flow, $F(1, 210) = 10.44$, $p = .001$, involuntariness, $F(1, 209) = 5.79$, $p = .017$, effortlessness, $F(1, 210) = 5.44$, $p = .021$, engagement, $F(1, 211) = 4.92$, $p = .028$, and ecological validity, $F(1, 211) = 8.95$, $p = .003$. Gender did not interact with media type for any measure. Details of all tested interactions are reported in Table S3 in the online supplemental materials.

Self-Representation in Interactive and Noninteractive Media

We ran an analysis of covariance (ANCOVA) analysis for each dependent variable, with media type (interactive v noninteractive) as a repeated within-subjects variable. Absorption and personality trait scores were covariates, and each of these variables was mean-centered. Where potential confounds were indicated by the

preliminary analyses (dataset or order), we included these variables as between-subjects factors.

In these analyses, we were interested in three things: First, did each measure of self representation differ between interactive and noninteractive media (i.e., "Was there a main effect of media type?")? Second, did any of the covariates have a general influence on our self representation measures (i.e., "Was there a main effect of any covariate?")? Third, did any of the covariates have a specific influence on self representation for either interactive or noninteractive media (i.e., "Was there an interaction of any covariate and media type?")?

Results in the following sections summarize the key findings from each analysis. In the figures, Panel A always shows the overall difference between interactive and noninteractive media. For simplicity, the subsequent panels show only significant confounds, and covariates that had significant main effects or interactions with media type. Full output for all analyses can be found in Tables S4 to S12 in the online supplemental materials.

Flow. DFS was higher for interactive media ($M = 3.92$, $SD = 0.48$, 95% CI [3.87, 4.00]) than for noninteractive media, $M = 3.59$, $SD = 0.53$, 95% CI [3.51, 3.64]; $F(1, 202) = 82.03$, $p < .001$, $\eta_p^2 = 0.29$.

Three traits impacted participants' DFS scores: There was an overall effect of Absorption, $F(1, 202) = 9.04$, $p = .003$, $\eta_p^2 = 0.04$, such that DFS scores increased by 0.013 for each point increase in Absorption. In addition, there was a significant interaction of Extraversion × MediaType, $F(1, 202) = 8.03$, $p = .005$, $\eta_p^2 = 0.04$, such that DFS scores decreased by −0.064 for each point increase in Extraversion for interactive media, and DFS scores increased by 0.059 for each point increase in Extraversion for noninteractive media. There was also a significant main effect of Conscientiousness, $F(1, 202) = 6.63$, $p = .011$, $\eta_p^2 = 0.03$, and a significant interaction of Conscientiousness x MediaType, $F(1, 202) = 5.75$, $p = .017$, $\eta_p^2 = 0.03$, such that DFS scores increased by 0.054 for each point increase in Conscientiousness for interactive media, and DFS scores increased by 0.188 for each point increase in Conscientiousness for noninteractive media.

Finally, there was an Order × MediaType interaction, $F(1, 202) = 4.94$, $p = .027$, $\eta_p^2 = 0.02$, such that the difference in DFS scores between interactive and noninteractive media was more pronounced when participants answered questions about noninteractive media first (0.453), compared to when they answered questions about interactive media first (0.275; $t = -2.222$ $p = .027$). Dataset was identified as a potential confounding factor for Flow scores, but there was no significant Dataset × MediaType interaction, $F(1, 202) = 1.15$, $p = .286$, $\eta_p^2 = 0.01$ (Figure 1).

Sense of agency. The SOARS scale measured two components of Sense of Agency: Involuntariness and Effortlessness. Involuntariness was higher for noninteractive media ($M = 15.94$, $SD = 5.83$, 95% CI [15.22, 16.56]) than for interactive media, $M = 12.98$, $SD = 4.26$, 95% CI [12.30, 13.64; $F(1, 203) = 45.06$, $p < .001$, $\eta_p^2 = 0.18$.

Two traits impacted participants' Involuntariness scores: There was an overall effect of Conscientiousness, $F(1, 203) = 8.94$, $p = .003$, $\eta_p^2 = 0.04$, such that Involuntariness scores decreased by −1.260 for each point increase in Conscientiousness, and there was an overall effect of Openness, $F(1, 203) = 8.66$, $p = .004$, $\eta_p^2 = 0.04$, such that Involuntariness scores decreased by −1.456 for each point increase in Openness.

Finally, there was an Order × MediaType interaction, $F(1, 203) = 7.56$, $p = .007$, $\eta_p^2 = 0.04$, such that the difference in Involuntariness scores between interactive and noninteractive media was more pronounced when participants answered questions about interactive media first (−4.150), compared to when they answered questions about noninteractive media first (−1.698; $t = -2.749$ $p = .007$; Figure 2).

There was no main effect of MediaType for Effortlessness, $F(1, 204) < 0.00$, $p = .999$, $\eta_p^2 < 0.00$. Four traits impacted participants' Effortlessness scores: there was an overall effect of Extraversion, $F(1, 204) = 4.72$, $p = .031$, $\eta_p^2 = 0.02$, such that Effortlessness scores decreased by −0.678 for each point increase in Extraversion; there was an overall effect of Conscientiousness, $F(1, 204) = 13.90$, $p < .001$, $\eta_p^2 = 0.06$, such that Effortlessness scores increased by 1.445 for each point increase in Conscientious-

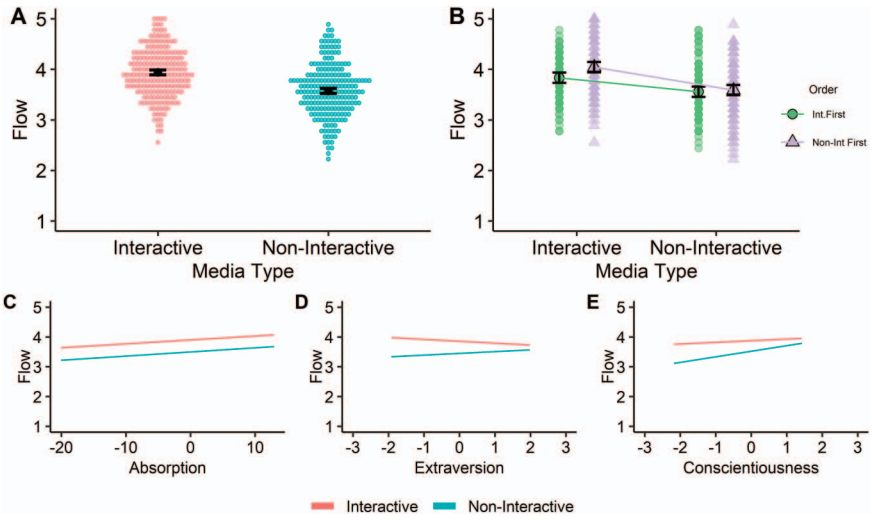

Figure 1. Flow. (A) shows the overall main effect of Media Type; (B) shows the significant interaction of Media Type × Order; (C–E) show trends for covariates that had significant main effects or interactions with Media Type. See the online article for the color version of this figure.

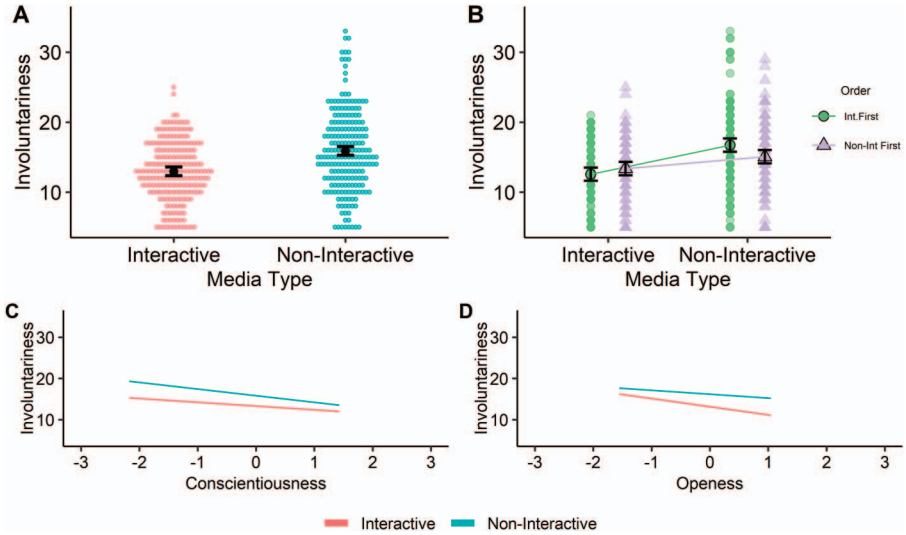

Figure 2. Sense of agency: Involuntariness. (A) shows the overall main effect of Media Type; (B) shows the significant interaction of Media Type × Order; (C–D) show trends for covariates that had significant main effects. See the online article for the color version of this figure.

ness; and there was an overall effect of Openness, $F(1, 204) = 25.01$, $p < .001$, $\eta_p^2 = 0.11$, such that Effortlessness scores increased by 2.283 for each point increase in Openness. In addition, there was a significant interaction of Absorption × MediaType, $F(1, 204) = 4.07$, $p = .045$, $\eta_p^2 = 0.02$, such that Effortlessness scores increased by 0.019 for each point increase in Absorption for interactive media, and Effortlessness scores decreased by −0.078 for each point increase in Absorption for noninteractive media.

Finally, there was an Order × MediaType interaction, $F(1, 204) = 4.09$, $p = .045$, $\eta_p^2 = 0.02$. Follow up tests revealed no significant difference between interactive and non interactive media in the interactive-first condition ($t = -1.49$, $p = .446$), and no significant difference between conditions in the noninteractive-first condition, $t = 1.40$, $p = .499$ (Figure 3).

Presence. The ITC-SOPI scale measured four components of presence: Spatial Presence, Engagement, Ecological Validity, and Negative Effects. Spatial Presence was higher for interactive media ($M = 3.20$, $SD = 0.93$, 95% CI [3.09, 3.31]) than for noninteractive media, $M = 2.63$, $SD = 0.97$, 95% CI [2.52, 2.75]; $F(1, 206) = 106.17$, $p < .001$, $\eta_p^2 = 0.34$.

Two traits impacted participants' Spatial Presence scores: There was a main effect of Absorption, $F(1, 206) = 65.76$, $p < .001$, $\eta_p^2 = 0.24$, and also an Absorption × MediaType interaction, $F(1, 206) = 5.75$, $p = .017$, $\eta_p^2 = 0.03$, such that Spatial Presence scores increased by 0.055 for each point increase in Absorption for

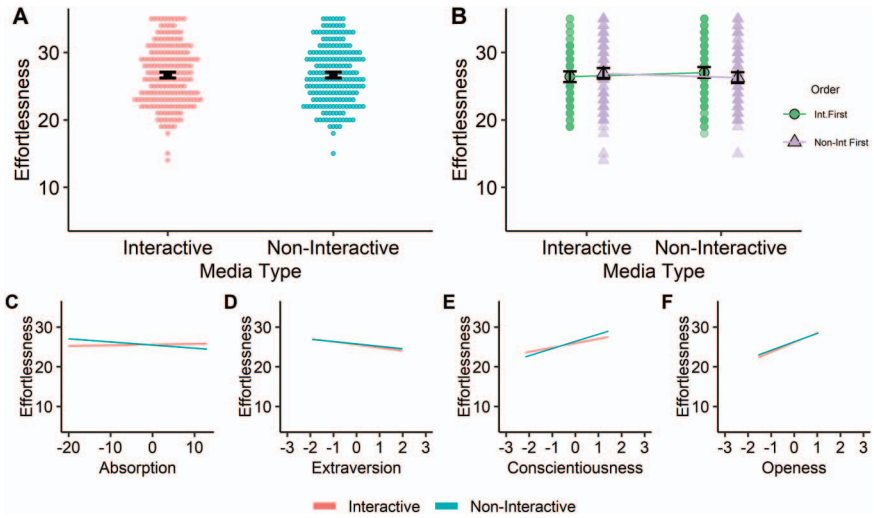

Figure 3. Sense of agency: Effortlessness. (A) shows the (nonsignificant) overall main effect of Media Type; (B) shows the significant interaction of Media Type × Order; (C–F) show trends for covariates that had significant main effects or interactions with Media Type. See the online article for the color version of this figure.

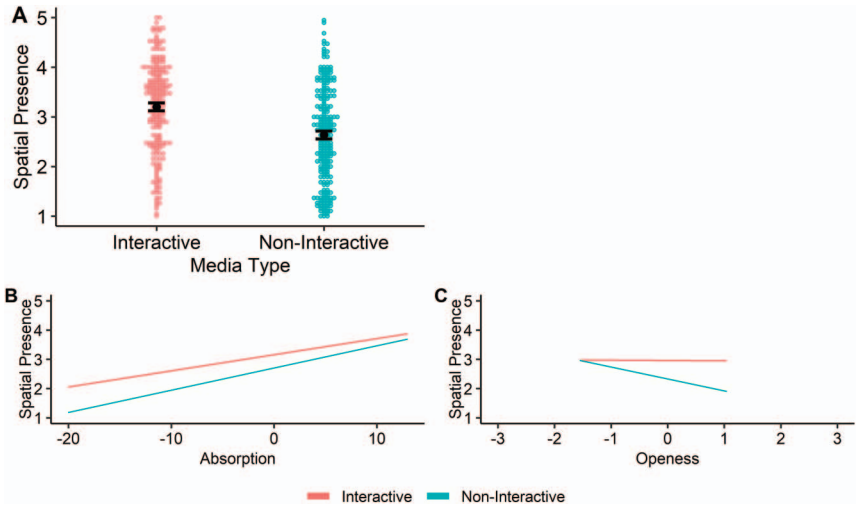

Figure 4. Presence: Spatial presence. A) shows the overall main effect of Media Type; B-C) show trends for covariates that had significant main effects and interactions with Media Type. See the online article for the color version of this figure.

interactive media, and Spatial Presence scores increased by 0.076 for each point increase in Absorption for noninteractive media. There was also a main effect of Openness, $F(1, 206) = 4.82$, $p = .029$, $\eta_p^2 = 0.02$ and an interaction of Openness × MediaType, $F(1, 206) = 14.68$, $p < .001$, $\eta_p^2 = 0.07$, such that Spatial Presence scores decreased by −0.012 for each point increase in Openness for interactive media, and Spatial Presence scores decreased by −0.409 for each point increase in Openness for noninteractive media (Figure 4).

There was no main effect of MediaType for Engagement, $F(1, 205) = 0.07$, $p = .795$, $\eta_p^2 < 0.01$. Two traits impacted participants' Engagement scores: There was an overall effect of Absorption, $F(1, 205) = 35.53$, $p < .001$, $\eta_p^2 = 0.15$, such that Engagement scores increased by 0.031 for each point increase in Absorption; and there was an overall effect of Openness, $F(1, 205) = 5.38$, $p = .021$, $\eta_p^2 = 0.03$, such that Engagement scores increased by 0.145 for each point increase in Openness.

There was also a main effect of Order, $F(1, 205) = 6.79$, $p = .010$, $\eta_p^2 = 0.03$, and an Order × MediaType interaction, $F(1, 205) = 4.41$, $p = .037$, $\eta_p^2 = 0.02$. Follow-up tests revealed no significant difference between interactive and non interactive media in the interactive-first condition ($t = -1.35$, $p = .531$), and no significant difference between conditions in the noninteractive-first condition, $t = 1.64$, $p = .360$ (Figure 5).

Ecological Validity was higher for noninteractive media ($M = 3.38$, $SD = 0.89$, 95% CI [3.26, 3.49]) than for interactive media,

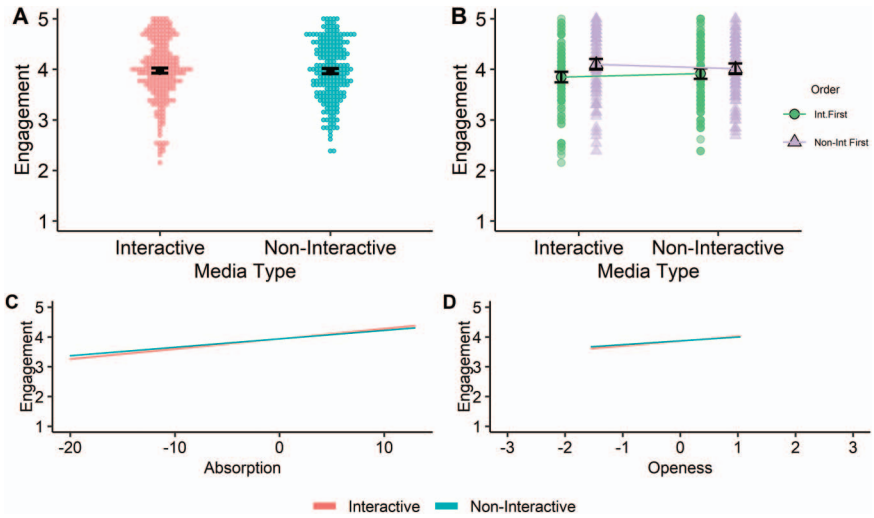

Figure 5. Presence: Engagement. (A) shows the (nonsignificant) overall main effect of Media Type; (B) shows the significant interaction of Media Type × Order; (C–D) show trends for covariates that had significant main effects. See the online article for the color version of this figure.

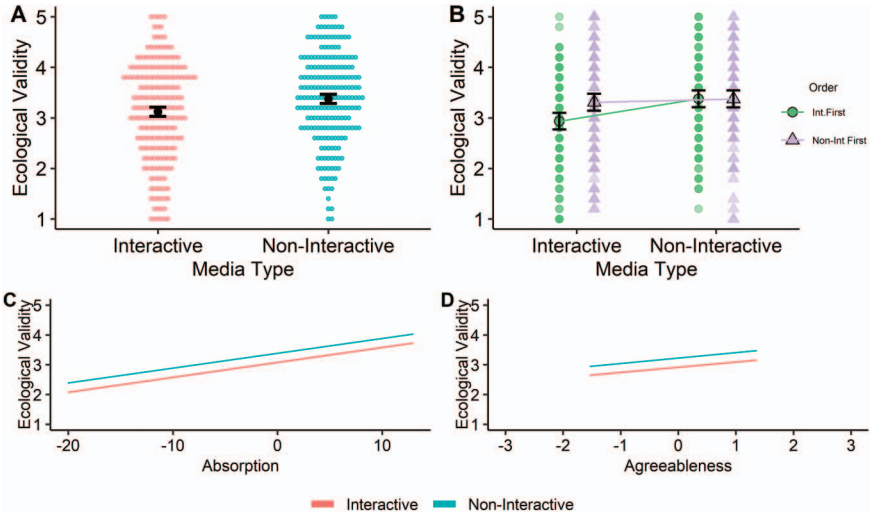

Figure 6. Presence: Ecological validity. (A) shows the overall main effect of Media Type; (B) shows the significant interaction of Media Type × Order; (C–D) show trends for covariates that had significant main effects. See the online article for the color version of this figure.

$M = 3.12$, $SD = 0.98$, 95% CI [3.01, 3.24; $F(1, 205) = 15.27$, $p < .001$, $\eta_p^2 = 0.07$.

Two traits impacted participants' Ecological Validity scores: there was an overall effect of Absorption, $F(1, 205) = 40.27$, $p < .001$, $\eta_p^2 = 0.16$, such that Ecological Validity scores increased by 0.050 for each point increase in Absorption; and there was an overall effect of Agreeableness, $F(1, 205) = 3.98$, $p = .047$, $\eta_p^2 = 0.02$, such that Ecological Validity scores increased by 0.178 for each point increase in Agreeableness.

Finally, there was an Order × MediaType interaction, $F(1, 205) = 8.00$, $p = .005$, $\eta_p^2 = 0.04$, such that the difference in Ecological Validity scores between interactive and noninteractive media was more pronounced when participants answered questions about interactive media first (−0.442), compared to when they answered questions about noninteractive media first (−0.067; $t = -2.829$ $p = .005$; Figure 6).

Negative Effects was higher for interactive media ($M = 1.82$, $SD = 0.66$, CI [1.73, 1.89]) than for noninteractive media ($M = 1.67$, $SD = 0.60$, 95% CI [1.59, 1.75]; $F(1, 202) = 14.86$, $p < .001$, $\eta_p^2 = 0.07$).

Four traits impacted participants' Negative Effects scores: there was a main effect of Extraversion, $F(1, 202) = 7.94$, $p = .005$, $\eta_p^2 = 0.04$, and also a significant interaction of Extraversion × MediaType, $F(1, 202) = 11.94$, $p = .001$, $\eta_p^2 = 0.06$, such that Negative Effects scores increased by 0.214 for each point increase in Extraversion for interactive media, and Negative Effects scores

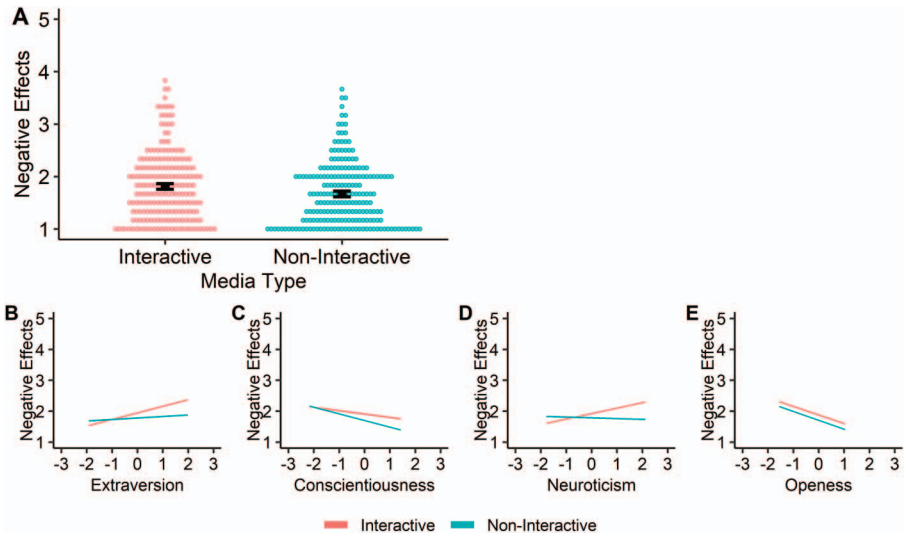

Figure 7. Presence: Negative effects. (A) shows the overall main effect of Media Type; (B–E) show trends for covariates that had significant main effects or interactions with Media Type. See the online article for the color version of this figure.

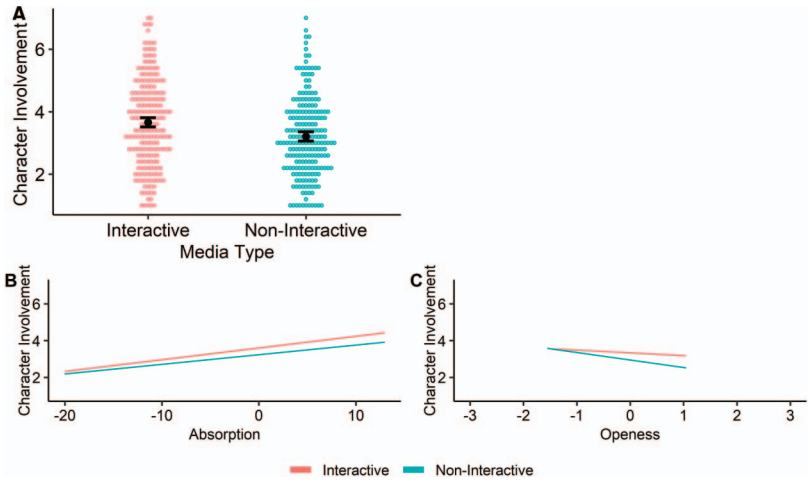

Figure 8. Character involvement. (A) shows the overall main effect of Media Type; (B–C) show trends for covariates that had significant main effects. See the online article for the color version of this figure.

increased by 0.048 for each point increase in Extraversion for noninteractive media; there was an overall effect of Conscientiousness, $F(1, 202) = 7.77$, $p = .006$, $\eta_p^2 = 0.04$, such that Negative Effects scores decreased by −0.161 for each point increase in Conscientiousness; there was an overall effect of Openness, $F(1, 202) = 17.10$, $p < .001$, $\eta_p^2 = 0.08$, such that Negative Effects scores decreased by −0.283 for each point increase in Openness; and there was a significant interaction of Neuroticism × MediaType, $F(1, 202) = 12.78$, $p < .001$, $\eta_p^2 = 0.06$, such that Negative Effects scores increased by 0.177 for each point increase in Neuroticism for interactive media, and Negative Effects scores decreased by −0.025 for each point increase in Neuroticism for noninteractive media (Figure 7).

Character involvement. Character Involvement was higher for interactive media ($M = 3.66$, $SD = 1.41$, 95% CI [3.48, 3.83]) than for noninteractive media, $M = 3.21$, $SD = 1.27$, 95% CI [3.03, 3.38]; $F(1, 206) = 18.13$, $p < .001$, $\eta_p^2 = 0.08$.

Two traits impacted participants' Character Involvement scores: There was an overall effect of Absorption, $F(1, 206) = 26.61$, $p < .001$, $\eta_p^2 = 0.11$, such that Character Involvement scores increased by 0.058 for each point increase in Absorption; and there was an overall effect of Openness, $F(1, 206) = 4.35$, $p = .038$, $\eta_p^2 = 0.02$, such that Character Involvement scores decreased by −0.278 for each point increase in Openness (Figure 8).

Time perception. Time Perception was higher for interactive media ($M = 4.36$, $SD = 0.81$, 95%CI [4.27, 4.49]) than for noninteractive media, $M = 3.78$, $SD = 0.86$, 95% CI [3.67, 3.89]; $F(1, 204) = 79.30$, $p < .001$, $\eta_p^2 = 0.28$.

Two traits impacted participants' Time Perception scores: there was an overall effect of Agreeableness, $F(1, 204) = 9.10$, $p =$

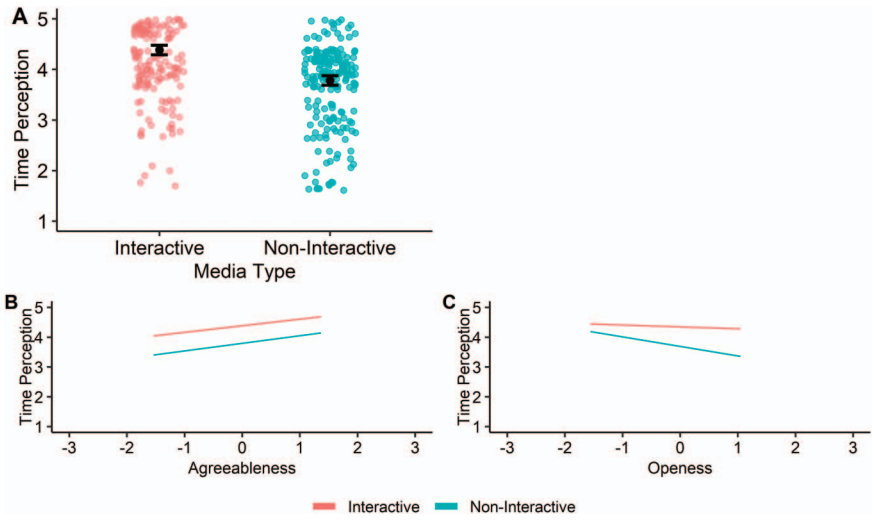

Figure 9. Time Perception. (A) shows the overall main effect of Media Type; (B–C) show trends for covariates that had significant main effects or interactions with Media Type. See the online article for the color version of this figure.

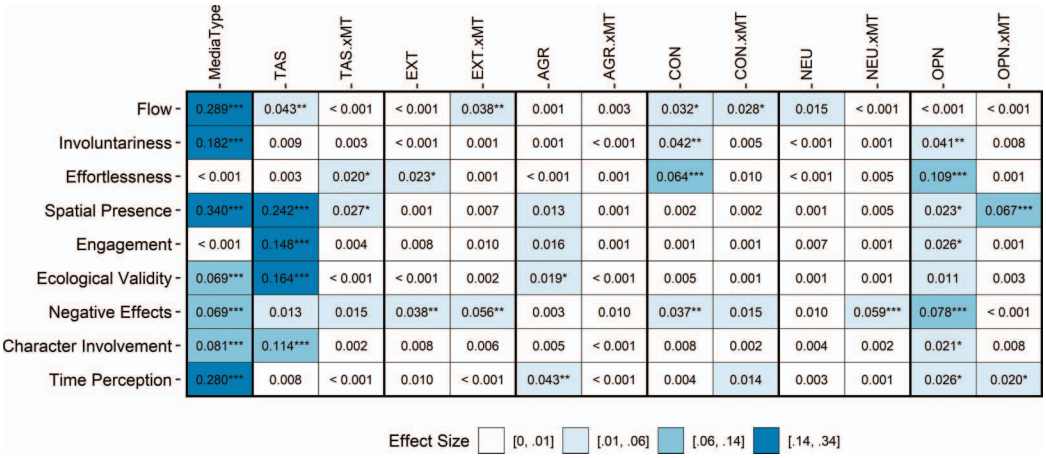

Figure 10. Heatmap showing effect sizes of Media Type and covariates on each measure of self-representation. Effect sizes are partial η_p^2 values from the analyses of covariance reported earlier. Heatmap is colored according to Cohen's (1988) guidelines, which suggest 0.01 is a small effect, 0.06 is a medium effect, and 0.14 is a large effect. TAS = Absorption, EXT = Extraversion, AGR = Agreeableness, CON = Conscientiousness, NEU = Neuroticism, OPN = Openness. "xMT" indicates an interaction between the covariate and Media Type. * $p < .05$. ** $p < .01$. *** $p < .001$. See the online article for the color version of this figure.

.003, $\eta_p^2 = 0.04$, such that Time Perception scores increased by 0.238 for each point increase in Agreeableness. There was also a main effect, $F(1, 204) = 5.41$, $p = .021$, $\eta_p^2 = 0.03$, and interaction of Openness × MediaType, $F(1, 204) = 4.10$, $p = .044$, $\eta_p^2 = 0.02$, such that Time Perception scores decreased by −0.064 for each point increase in Openness for interactive media, and Time Perception scores decreased by −0.320 for each point increase in Openness for noninteractive media (Figure 9).

Summary. Effect sizes from all ANCOVA analyses are summarized in Figure 10. There are several key takeaways from this heatmap and the preceding results: First, all measures of self representation, apart from Effortless and Engagement, differed significantly between interactive and noninteractive media. Flow, Spatial Presence, Negative Effects, Character Involvement, and Time Perception scores were all higher for interactive media. Involuntariness and Ecological Validity scores were higher for noninteractive media.

Second, Absorption (TAS) had a strong influence on most aspects of self representation. In particular, all presence measures, Character Involvement and Flow scores showed a positive relationship with Absorption.

Third, Openness had a small to medium influence on most aspects of self representation. Higher openness scores were associated with significantly increased Effortlessness and Engagement scores and with significantly reduced Involuntariness, Negative Effects, Character Involvement, and Time Perception scores. There was an interaction of Openness and Spatial Presence, such that scores were significantly lower for noninteractive media only.

Fourth, Conscientiousness was associated with increased Flow and Effortless scores, but reduced Involuntariness scores. Fifth, there were some small effects for other traits. In particular, Extraversion was associated with reduced Effortlessness and reduced Negative effects; Agreeableness was associated with increased Time Perception and increased Ecological Validity; and Neuroticism was associated with an increase in Negative Effects for interactive media but a decrease in Negative Effects for noninteractive media.

Discussion

This study explored how different kinds of media impacted the ways that individuals experienced and represented aspects of bodily self consciousness. We expected that interactive media (i.e., computer games) would be experienced quite differently from noninteractive media (i.e., movies and TV). In terms of exposure, we found that participants viewed interactive media on more days and for more hours during each viewing, compared to noninteractive media. We also found significant differences between interactive and noninteractive media across most dimensions of self representation.

Participants reported increased levels of flow for interactive media compared to noninteractive media. This is consistent with previous work that has shown that video games are associated with flow experiences (Kaye, 2016; Sherry, 2004). Notably, although flow was significantly lower for noninteractive media, the difference in mean ratings between conditions was not pronounced (mean difference: 0.33 on a 7-point scale). This suggests that individuals also did experience some degree of flow when engaging with movies and TV.

Findings related to sense of agency were mixed. Participants reported significantly higher levels of Involuntariness for noninteractive compared to interactive media. This is consistent with participants having less objective control over noninteractive media (i.e., participants' decisions do not have a causal influence on the content of noninteractive media, whereas they can influence interactive media). However, we found no difference in reported levels of Effortless for interactive and noninteractive media. This finding is surprising, as there appear to be objective differences in the level of physical activity between these media types. When consuming noninteractive media participants are not required to make any body movements, whereas interactive media depends on some form of physical response with a human–computer interface device. The null finding here may reflect similar levels of mental engagement across media types. That is, it may be that participants

use similar levels of mental effort to follow and interpret the plot of movies/TV as they do when planning responses in video games. Sense of agency measurement tools that explicitly distinguish between physical and mental effort would be needed to test this interpretation. This is something our lab is working on.

Findings related to presence were similarly nuanced. Interactive media involved higher levels of Spatial Presence and also higher levels of Negative Effects than noninteractive media. Noninteractive media, by contrast, involved higher levels of Ecological Validity. These findings indicate that although video games are more able to activate many multisensory cues relevant for self representation, noninteractive media still tends to be experienced as more real, despite typically being viewed on less sophisticated technology.

As expected, interactive media was associated with significantly greater character involvement than noninteractive media. Consistent with Klimmt et al. (2009), this suggests that character involvement is specifically enhanced by exerting a causal influence on a character's actions (as occurs in interactive media), and less connected to realism or narrative.

Interactive media was associated with significantly greater time distortion than noninteractive media. Specifically, participants reported that time passed more quickly when engaged with video games compared to movies/TV. Previous research has shown time perception changes associated with video game play (Rau et al., 2006; Tobin & Grondin, 2009; Wood, Griffiths, & Parke, 2007), but time perception in noninteractive media is relatively understudied (although see Kweon, Hwang, & Jo, 2011). The current results suggest that time perception changes require interactive involvement with media and that such perceptual distortion may occur regardless of other alterations in self-representation.

We found evidence that individual difference characteristics had a pronounced influence on media experiences. Trait absorption was strongly associated with increased experiences of Flow, all measures of presence, and Character Involvement for both interactive and noninteractive media. The magnitude of the relationships between Absorption and positive aspects of presence indicates that this variable may be an important predictor of engaging media experiences. This is consistent with earlier findings linking more immersive media experiences with absorption (Baños et al., 1999; Kober & Neuper, 2013) and also with work showing that absorption predicts general alterations in self consciousness (Mohr, 2018).

Openness was a significant covariate in most analyses. Greater openness was associated with higher levels of Effortlessness and Engagement, and with lower Negative Effects scores (i.e., a reduction in negative aspects of presence). Unexpectedly however, Openness was also associated with lower scores for Involuntariness, Character Involvement and Time Perception. Additionally, Openness was associated with reduced Spatial Presence scores for noninteractive media. This varied set of results is compatible with earlier work linking Openness with increased immersive media tendencies (Weibel, Wissmath, & Mast, 2010), but at odds with findings that have shown openness is positively related to character identification (Soutter & Hitchens, 2016). The overall picture that emerges indicates that increased Openness may be associated with greater ease of engagement and subjective involvement in the moment, but also that individuals high in Openness may be more aware that they are deliberately interacting with media. These are somewhat puzzling results, and given the relatively high effect sizes for Openness in most analyses, these warrant further investigation to clarify why a tendency to engage more readily with novel concepts in general would lead to different trends for these measures of self-representation.

Other personality traits had more idiosyncratic relationships with self-representation: Participants high on Conscientiousness tended to score higher on measures of Flow and Effortlessness but lower on Involuntariness. This suggests that these individuals were likely to experience both forms of media as spontaneous and surprising, yet they maintained an overall sense of control over what was happening. Participants high on Extraversion tended to score lower on Effortlessness and Negative Effects. This suggests that these individuals engaged with media in a deliberate manner that avoided unpleasant aspects of immersion. Participants high on Agreeableness tended to score higher on Time Perception and Ecological Validity. This suggests that these individuals experienced media environments as subjectively compelling and that time passed quickly during media engagement. Finally, participants high on Neuroticism tended to experience more Negative Effects for interactive media but a decrease in Negative Effects for noninteractive media.

Together, these findings suggest a relatively complex set of relationships between individual difference characteristics and media experiences. Broadly, individuals with higher levels of Absorption, and to a lesser degree Conscientiousness, and Agreeableness tended to experience more pronounced alterations of self representation when engaging with both interactive and noninteractive media. Individuals high in Openness tended to have quite mixed experiences across the various measures of self representation.

Limitations and Future Directions

There were some limitations to this study. First, our preliminary analyses identified a number of potential confounds. When these confounds were entered into the main analyses, we found some significant effects related to Order. For Flow, Involuntariness, and Ecological Validity, order effects exaggerated the overall difference between interactive and noninteractive media (see Figures 1B, 2B and 6B). Order was also a significant factor in analyses of Effortless and Engagement; however, for these variables, there was no overall difference between interactive and noninteractive media, and no difference for either Order condition analyzed separately. Overall, these effects related to Order turned out not to be problematic for the interpretation of our results. Nevertheless, it may be sensible to avoid this potential confound by employing between-subjects designs in future studies of this kind.

Second, we aimed at a broad investigation of naturalistic media experiences. As such, participants reported on their engagement with a wide variety of media content. Here we only distinguished between interactive and noninteractive media types. An important direction for future research is to investigate potential differences in self representation related to specific media content (e.g., by targeting specific genres). Similarly, some of our dependent variables were themselves relatively broad measures. In particular, our conceptualization of Character Involvement quantified only the overall intensity of involvement with media characters. A further

interesting extension of this work would be to explore more fine-grained changes in multiple types of character involvement.

Third, a further limitation is the generalizability of these findings. Because we aimed at comparing interactive and noninteractive media experiences, we necessarily recruited participants who regularly spend considerable amounts of time both playing video games and watching movies/TV. The media experiences of these individuals may not reflect the experiences of people with different profiles of media engagement.

Conclusion

Overall the current findings indicate that interactive media leads to more pronounced alterations in most aspects of self representation compared to noninteractive media, but that the difference between media types is not as clear cut as might be expected. Specifically, we found evidence of greater levels of Flow, Involuntariness, most aspects of presence, Character Involvement, and Time Perception for interactive compared to noninteractive media. We found no significant differences in Effortlessness or Engagement. We also found strong evidence that individual difference characteristics may modulate media experience. These findings suggest that self representation depends both on properties of the media stimulus and characteristic of the individual. Media targeted to toward particular individual difference characteristics may lead to noticeably different forms of self experience for media consumers. Researchers and media creators wanting to create content that leads to changes in self representation may find it useful to target high absorption individuals.

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