Immersion in Mediated Environments: The Role of Personality Traits

David Weibel, Ph.D., Bartholomäus Wissmath, Ph.D., and Fred W. Mast, Ph.D.

Abstract

Previous research studies in the context of presence point out the importance of personality factors. Surprisingly, the relation between immersion and the Big Five personality factors has not yet been examined. Hence, we assessed these traits in an online survey (N = 220) and relate them to immersive tendency, a disposition that determines whether someone is receptive to immersive experiences during media exposure. Using structural equation modeling, we can show that openness to experience, neuroticism, and extraversion are positively related to immersive tendency. The immersive tendency subscale absorption is related to openness to experience, whereas the immersive tendency subscale emotional involvement is related to openness, extraversion, and neuroticism.

Introduction

Immersion in mediated environments occurs when people are reading books, watching movies, or playing computer games. Previous studies show that the sensation of being immersed is experienced as rather positive and satisfying. Even though some studies point out the importance of individual characteristics, relatively little is known about how personality factors can influence the experience of immersion. For example, Heeter assumes that personality may determine whether someone is “receptive to alternative types of virtual experiences.” This is in line with Lombard and Ditton, who state that certain personality traits facilitate the occurrence of (tele)presence—the sensation of “being there” in an environment portrayed by media. Wirth et al. developed a two-level process model that includes individual factors such as openness to experience and tendency to involve as preconditions of presence. Furthermore, people with high imagery abilities are supposed to be more immersed in a story when reading a book than are people with low imaginative abilities. A close relationship between visual imagery abilities and presence has been postulated in other studies.

In their review, Sacau et al. conclude that personality-related variables influence sensations of presence. To date, however, the impact of the five core personality traits on immersion has not yet been investigated. This lack of knowledge is surprising given that the Big Five personality traits are the most comprehensive dimensions and thus cover most aspects of what is commonly understood by the term personality.

The aim of this study is to examine the relation between the Big Five personality traits and immersion in mediated environments. The Big Five consist of five dimensions:

1. Openness to experience: This trait describes whether someone is creative and nonconformist (more open) or conventional and down-to-earth (less open). People scoring high on openness are adventurous, liberal, have a preference for variety, and are generally interested in new experiences. The trait also includes active imagination and a person’s receptiveness to new ideas and approaches.

2. Conscientiousness: People who score high on this dimension are hard-working and reliable. The dimension shows the extent to which someone is careful, well organized, reliable, and generally acts according to his or her conscience.

3. Extraversion: This dimension is defined as the degree to which a person’s basic orientation is turned outward...
toward the external world. Extraverts can be described as sociable, outgoing, gregarious, and assertive, whereas introverts are more aloof, retiring, reserved, and introspective.

4. **Agreeableness**: This trait indicates the extent to which someone is trusting and helpful. It measures differences concerning social harmony and cooperation. Agreeable persons can be described as pleasant and accommodating in social situations.

5. **Neuroticism**: This dimension indicates the emotional stability of a person. It refers to the extent to which someone is nervous and insecure (emotionally unstable, high on neuroticism) or calm and secure (emotionally stable, low on neuroticism). Someone who scores high on neuroticism is worrying, vulnerable, insecure, excitable, and likely to respond strongly to stressful and fearful situations.

**Immersive tendency**, as proposed by Witmer and Singer, is a disposition that determines the capability of individuals to become immersed or involved in mediated environments. It measures whether someone easily experiences presence. According to Witmer and Singer, someone who scores high on immersive tendency has the capability to become involved in different tasks and situations, shows a tendency to maintain focus on current activities, and generally likes playing video games.

**Method**

**Sample**

Two hundred twenty participants took part in the online survey. They were all recruited by means of personal e-mails. Sixty-five percent of the participants were female, and the average age was 26.86 years (SD = 8.59). The majority (77%) has a higher education. The invitation to take part in the survey was sent to 1,047 persons, and the response rate was 21%.

**Measuring instruments**

**Big Five.** The German version of the NEO Personality Inventory (NEO-FFI) was used to assess the participants’ personality in terms of the five dimensions extraversion (e.g., “I am spontaneous”), openness to experience (e.g., “I have a very active imagination”), conscientiousness (e.g., “I pay my debts promptly and in full”), neuroticism (e.g., “Frightening thoughts sometimes come into my head”), agreeableness (e.g., “I believe that most people will take advantage of you if you let them”). The scale consists of 60 items and turned out to be reliable (Cronbach’s α = 0.71–0.85). The instrument is frequently used, and its validity and dimensionality has been confirmed several times. The participants rated each item on a 5-point Likert scale.

**Immersive tendency.** The immersive tendency questionnaire (ITQ) by Witmer and Singer was used. The questionnaire consists of 19 items that correlate significantly with the total score (e.g., “How frequently do you find yourself closely identifying with the characters in a story line? “Do you ever become so involved in a video game that it is as if you are inside the game rather than moving a joystick and watching the screen?”). The items were answered on a 5-point Likert scale. According to Witmer and Singer, the reliability of the scale is between 0.75 and 0.81. The scale consists of the three subdimensions involvement, focus, and tendency to play video games. These dimensions are based on theoretical considerations, and no statistical procedure has been used to confirm the postulated factors. Because the subdimensions of the ITQ have not yet been examined empirically, we first analyzed the scale by means of a factor analysis.

**Results**

**Dimensionality of immersive tendency**

We computed a factor analysis to examine the dimensionality of immersive tendency. First, it was tested whether the output variables are related. The measure of sampling adequacy (MSA) criterion turned out to be acceptable (MSA = 0.74). Table 1 shows the two-factor solution suggested by the scree test. This solution explains 25.43% of the variance. The varimax rotation extracts a first factor, which explains 17.32% of the variance and consists of five items. The second factor, which explains 8.11% of variance, consists of four items. The results show that the theoretical a priori classification suggested by Witmer and Singer could not be supported.

We classified the first factor, which consists of five items, as emotional involvement because the items all capture emotional reactions during media usage and during (day)dreaming. The second factor consists of four items. We classified this factor as absorption because the items refer to focused attention, lost track of time perception, and involvement in the sense of blocking out external distractors.

**Relationship between Big Five personality traits and immersive tendency**

In a second step, the connection between immersive tendency and the five personality traits was analyzed. We used structural equation modeling to investigate how the Big Five relate to immersive tendency. Therefore, immersive tendency was included as latent variable, which is estimated by the measured endogenous variables absorption and emotional involvement.

Openness, neuroticism, and extraversion are positively related to immersive tendency because these paths turned out to be highly significant. The results also indicate that conscientiousness and agreeableness are not related to immersive tendency, as the regarding paths failed to reach significance. The variables openness, neuroticism, and extraversion explain one third of variance of immersive tendency. Immersive tendency is almost entirely determined by emotional involvement. Furthermore, neuroticism and extraversion correlate negatively. The results are illustrated in Figure 1.

In order to gain further insights into whether the three personality factors neuroticism, openness, and extraversion are rather related to emotional involvement or absorption, we analyzed these relationships separately for the two ITQ subdimensions reported above. Figure 2 shows the path model for emotional involvement. Neuroticism shows the strongest influence, but openness and extraversion also significantly affect emotional involvement. About one third of the variance is explained in the endogenous variable emotional involvement.
<table>
<thead>
<tr>
<th>A priori classification</th>
<th>Item</th>
<th>Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Involvement: tendency to become involved in activities</td>
<td>Do you ever become so involved in a movie that you are not aware of things happening around you?</td>
<td>0.538</td>
</tr>
<tr>
<td></td>
<td>Do you ever become so involved in a TV program or book that people have problems getting your attention?</td>
<td>0.568</td>
</tr>
<tr>
<td></td>
<td>How frequently do you find yourself closely identifying with the characters in a story line?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>When watching sports, do you ever become so involved in the game that you react as if you were one of the players?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Do you ever become so involved in a daydream that you are not aware of things happening around you?</td>
<td>0.506</td>
</tr>
<tr>
<td></td>
<td>Do you ever have dreams that are so real that you feel disoriented?</td>
<td>0.508</td>
</tr>
<tr>
<td></td>
<td>Have you ever gotten scared by something happening on a TV show or in a movie?</td>
<td>0.784</td>
</tr>
<tr>
<td></td>
<td>Have you ever remained apprehensive or fearful long after watching a scary movie?</td>
<td>0.699</td>
</tr>
<tr>
<td>Focus: tendency to maintain focus on current activities</td>
<td>Do you easily become deeply involved in movies or TV dramas?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>How mentally alert do you feel at the present time?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>How physically fit do you feel today?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>How good are you at blocking out external distractors when you are involved in something?</td>
<td>0.510</td>
</tr>
<tr>
<td></td>
<td>When playing sports, do you become so involved in the game that you lose track of time?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>How well do you concentrate on enjoyable activities?</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Have you ever gotten excited during a chase or fight scene on TV or in the movies?</strong></td>
<td>0.570</td>
</tr>
<tr>
<td></td>
<td>How well do you concentrate on disagreeable tasks?</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Do you ever become so involved in doing something that you lose all track of time?</strong></td>
<td>0.543</td>
</tr>
<tr>
<td>Games: tendency to play video games</td>
<td>Do you ever become so involved in a video game that it is as if you are inside the game rather than moving a joystick and watching the screen?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>How often do you play arcade games? <em>(Often should be taken to mean every day or every two days on average.)</em></td>
<td></td>
</tr>
<tr>
<td>% variance explained</td>
<td></td>
<td>17.32 8.11</td>
</tr>
</tbody>
</table>

*Rotation method: varimax with Kaiser normalization.
Note: values less than 0.5 are suppressed.
The connection between the three Big Five dimensions and absorption is shown in Figure 3. According to this path model, absorption is not dependent on neuroticism and extraversion and thus is influenced only by openness to experience. This factor explains 15% of the variance in the endogenous variable immersive tendency.

Discussion

It has not yet been examined how immersive experiences are related to the Big Five personality traits. This is surprising because these factors are the core traits of personality most researchers agree on. Thus, the main purpose of this study was to clarify the influence of the five personality factors on the experience in mediated environments. We used structural equation modeling to examine the connection between the Big Five and immersive tendency.

First, we tested the dimensionality of immersive tendency, and the results based on factor analysis suggest a two-factor solution. Interestingly, the two factors do not match the a priori classification proposed by Witmer and Singer. According to them, immersive tendency consists of the three dimensions involvement, focus, and the tendency to play video games. It must be noted that their dimensions are not based on empirical evidence but on intuitive and theoretical plausibility. Therefore, we first tested whether the postulated factors can be confirmed by statistical analyses. They cannot. Our results suggest two subdimensions only: emotional involvement (five items) and absorption (four items). The latter explains more variance, and no items scored high on both factors. Absorption is the capability to concentrate and block out external and distracting stimuli. People who score high on absorption are able to easily focus their attention on TV programs, books, or video games. Emotional involvement covers affective aspects of immersion and refers to strong emotional reactions toward media exposure; these reactions can be negative (e.g., fear) or positive (e.g., excitement). Emotional involvement is related to the tendency of getting involved in dreams and daydreams. To sum up, our results suggest that immersive tendency is composed of two independent dimensions: emotional involvement and absorption.

The results of the subsequent structural equation modeling show that media users are prone to immersive experience when they score high on neuroticism and/or on extraversion and openness to experience. Neuroticism exerts the strongest influence. In contrast, conscientiousness and agreeableness are not related to immersive tendency. Further analyses concerning the two components of immersive tendency—emotional involvement and absorption—show that neurotic but also open and extraverted people get more easily emotionally involved. In contrast, absorption is determined only by openness to experience.

How can the results be explained, and what are their implications? First, the findings show that people who score high on the Big Five dimensions openness to experience, extraversion, and neuroticism more likely immerse in media than do individuals scoring low on those dimensions. Therefore, we can conclude that personality traits determine how people experience media exposure and whether someone easily experiences sensations of presence while being
confronted with mediated environments. We found that immersive tendency consists of the two independent subdimensions emotional involvement and absorption. Deeper analyses concerning the relationship among the three relevant Big Five personality dimensions and these two subdimensions reveal that people who score high on openness for experience show an increased tendency to get emotionally involved as well as to get absorbed by media exposure. In contrast, extraversion and neuroticism influence emotional involvement but not absorption.

Thus, absorption is determined only by openness to experience. It is known that openness refers to the appreciation of art and a desire for aesthetic experiences and intellectual stimulation.\textsuperscript{15,20} It is thus plausible that people scoring high on this trait are more easily absorbed by mediated stimuli (e.g., when reading a book or playing online games with a high degree of realism). Interestingly, Finn\textsuperscript{21} reported that unlike reading books and watching movies, TV programs are not appealing to people scoring high on openness to experience. This difference could be caused by the immediate media environment, since watching TV programs is often less demanding than reading books, which requires one’s own imagination. Movies, on the other hand, are often perceived as visually more aesthetic than TV programs. If we apply these assumptions to computer games, we suggest that games, which put high cognitive demand on the users (e.g., real-time strategy games) are more appealing for people open to new experiences than are games, which emphasize physical challenges like reaction time or hand–eye coordination (e.g., action games). As curiosity and receptiveness to new experiences and ideas are yet other aspects of openness, Schroeder's\textsuperscript{22} assumption that virtual reality (VR) technologies can elicit stronger experiences of presence than conventional media such as TV might be particularly true for people with high openness scores. Thus, it is likely that the confrontation with a VR technology like a CAVE satisfies the curiosity of such individuals and therefore causes strong immersive experiences. We can therefore conclude that the influence of new media, which were designed to absorb and immerse their users—such as e-learning or cybertherapy settings—might be most effective for users scoring high on openness to experience. In the future, personality traits can play a more important role as they influence how media exposure is received by users.

The second subscale of immersive tendency is emotional involvement. Results showed that this subdimension is determined by neuroticism, extraversion, and openness to experience. The relationship between openness to experience and emotional involvement appears plausible. People scoring high on openness to experience evaluate their inner emotional states and seek emotional experiences.\textsuperscript{17} This might enhance the probability of the occurrence of emotional involvement in the context of media use.

Neuroticism and extraversion correlate negatively. This finding is in line with previous research.\textsuperscript{14,15,17,23} However, it is somewhat surprising that both variables positively influence emotional involvement. Therefore, it is important to know that emotional involvement can refer to positive and negative emotional reactions. As persons scoring high on neuroticism experience unpleasant emotions strongly, it seems reasonable that this trait refers to strong reactions toward unpleasant stimuli. Winter and Kuiper report that neuroticism is “characterized by a temperamental sensitivity toward painful or negative stimuli.”\textsuperscript{24(p.793)} Thus, media users scoring high on neuroticism might strongly immerse when they are exposed to media contents with a negative connotation and easily feel present in a murder mystery, a horror film, a violent computer game, or a cybertherapy setting for treating phobia. Because the aim of the latter is to intentionally sensitize treatment, we assume that cybertherapy should be effective for persons scoring high on neuroticism. On the other hand, it is plausible that these people generally show a tendency to avoid negative media contents because these contents are likely to induce negative affects such as sadness, anxiety, guilt, or hostility. In contrast to neuroticism, extraversion is related to positive emotions and characterized by a sensitivity to pleasant stimuli.\textsuperscript{24} Therefore, it is likely that extraverts experience more immersion and presence when they are exposed to pleasurable (e.g., funny, joyful) media contents. Thus, they might easily immerse in comedies, TV shows, or funny computer games. Furthermore, because extraverts can be described as sociable, they might rather immerse in interactive settings such as online games. Taken together, we assume that media users can be emotionally involved in a negative or in a positive way, whereby extraverts are prone to positive emotional reactions, and persons scoring high on neuroticism are prone to negative emotional reactions towards mediated stimuli.

To sum up, our findings indicate that immersion consists of the two independent subdimensions emotional involvement
and absorption. These two dimensions underlining the tendency to immerse in mediated environments are influenced by three of the Big Five personality traits: neuroticism, extraversion, and openness to experience. This again suggests that presence, in line with the assumptions of Sacau et al. and Wirth et al., is influenced by personality traits. Therefore, the three core personality factors, which we showed to be important in the context of immersion and presence, should be considered when studying media effects in general and immersion and presence in particular. What are the practical implications of our findings? For example, presence is one determinant for successful cybertherapy and e-learning. Thus, it would be possible assess the Big Five to figure out for which potential users such settings would probably be most effective. Our findings are also relevant to media designers. To facilitate immersion and to enhance sensations of presence, prior assessment of the users’ personality might effectively help in tailoring the most suitable environment for each user. Game designers could then increase the level of immersion and presence, what is one of their main objectives. Researchers, on the other hand, should consider personality factors as covariates when analyzing their data. Besides these conceivable implications, our study is also relevant in the context of presence research, as we could show that some of the Big Five personality traits influence immersion. So far, this has not yet been investigated.

Disclosure Statement
No competing financial interests exist.

References
4. Wirth W, Hartmann T, Boècking S, et al. A process model of immersion and presence, what is one of their main objectives. To facilitate immersion and to enhance sensations of presence, prior assessment of the users’ personality might effectively help in tailoring the most suitable environment for each user. Game designers could then increase the level of immersion and presence, what is one of their main objectives. Researchers, on the other hand, should consider personality factors as covariates when analyzing their data. Besides these conceivable implications, our study is also relevant in the context of presence research, as we could show that some of the Big Five personality traits influence immersion. So far, this has not yet been investigated.

Disclosure Statement
No competing financial interests exist.

References

Address correspondence to:
Dr. David Weibel
Department of Psychology
University of Bern
Muesmattstrasse 45
CH-3000 Bern 9
Switzerland

E-mail: david.weibel@psy.unibe.ch