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Measuring Presence: The Use Trends of Five Canonical Presence Questionnaires from 1998-2012

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Abstract. Reflecting the nebulous nature of the concept of presence, the popularity and nature of presence questionnaires have greatly varied across time. To determine the temporal evolution of presence questionnaires and assess the possible underlying conceptual changes reflected therein, use trends for five canonical questionnaires (SUS, PQ, IPQ, ITC-SOPI, Lombard & Ditton questionnaire) were analyzed from 1998-2012. We also examined how common the practice was to extensively report questionnaire items. The findings and a follow-up discussion on the nature of using presence questionnaires are presented, as well as future directions for presence research aimed at determining various forms of study validity.

Keywords. History of Presence, Presence, Questionnaire, Scholary Exchange

Introduction

While presence has always been subject to great scholarly attention, researchers often use different terminologies "to refer to the same concept, sometimes in noninterchangeable ways" (Lee, 2004, p. 28). This lack of scholarly consensus makes the exact conceptualization of presence difficult. In the present study, we adopt a meta-evaluative approach to examine how and when questionnaires have been adopted and used over time to measure presence. Focusing on the use and promulgation of measurement instruments represents a more ethnographic approach in understanding presence, and may provide deeper insights into the evolution of thought regarding the concept. This approach is in line with recent efforts to "to provide new perspectives on the history and evolution of the concept" (Bau-Madsen & Lombard, 2012, p. 1).

Conceptualizing Presence

With the increase in mediated communication, researchers questioned if media would be able to convey the richness of face-to-face interactions. While some argued that media inevitably took away the rich social cues of a 'real' experience, others argued that realism was determined by psychological factors, and not the absolute affordances of a medium (Walther & Parks, 2002). Regardless of one's stance regarding the matter, this debate implies that a feeling of realism and physical transportation is considered a significant factor when achieving presence. Presence is typically measured with items that ask the participant how 'real' the interaction seemed (Nowak & Biocca, 2003). Some measures also reflect the belief that each medium has an inherent capacity of delivering a vivid experience and thus employ items questioning one's perception of the medium itself (e.g., Short, Williams, & Christie, 1976).

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Presence can be divided into three subcategories—telepresence (spatial presence), social presence, and self-presence (Lee, 2004)—and researchers have varied on which dimension they consider to be more pertinent to the concept of presence. This dimension of interest is dependent on several factors, including the researcher's subjective interest and the technology being studied. For instance, self-presence recently garnered interest due to the ever-increasing popularity of virtual reality and avatars used therein. One can hypothesize that these nuanced differences are reflected in measures of presence, as "good measurement is tied to how concepts are defined" (Tona, Spagnolli, Bracken, & Rubenking, 2008, p. 280)

Measuring Presence

Since its conception, researchers have measured presence with questionnaire items that tap into how 'real' or 'unmediated' the individual perceives an experience to be. While there has been an increase in researchers who use objective physiological measures to complement subjective reports, presence questionnaires remain the most common method to assess presence (Lombard, Ditton, & Weinstein, 2009). Despite the predominance of this methodology, however, researchers have yet to reach a consensus on which items best measure presence.

While this lack of consensus is understandable when considering the debate over the conceptualization of presence, it often yields the wealth of studies that employ 'presence' as a key variable incomparable to other studies (Lombard et al., 2009). Furthermore, as the present study will show, recent trends suggest the tendency of authors to neglect citing the exact source or items of the presence questionnaire used in their studies, making it all the more difficult to fully understand exactly which definition of presence is being studied and why.

Noting this shortcoming in the literature, we offer a descriptive analysis on how the use of prominent presence questionnaires evolved over time and how these trends differ across publication outlets. Specifically, after extensively coding studies within three major outlets of presence research, we identified SUS (Slater, Usoh, & Steed, 1994), PQ (Witmer & Singer, 1998), IPQ (Schubert, Regenbrecht, & Friedmann, 2001), ITC-SOPI (Lessiter, Freeman, Keogh, & Davidoff, 2001), and the Lombard & Ditton Questionnaire (Lombard et al., 2000; 2009) as five canonical questionnaires. This selection is in line with the prominent presence questionnaires noted by Schuemie, van der Straaten, Krign, & van der Mast (2001).

Five Canonical Questionnaires

Slater-Usoh-Steed Presence Questionnaire (Slater et al., 1994). SUS is the first questionnaire to formally assess the definition of presence in virtual reality. The current version of SUS has six items and is based on three themes that "address a single dimension of presence: presence as transportation" (Lombard, Ditton, & Weinstein, 2009, p. 4).

Presence Questionnaire (Witmer & Singer, 1998). Version 3.0 of the PQ has 32 questions, and is recognized as one of the most widely used presence questionnaires. PQ has been refined to reflect changes in semantics referring to levels of involvement and immersion.

Igroup Presence Questionnaire (Schubert et al., 2001). Schubert and colleagues created IPQ by combining previous questionnaires, including PQ and SUS, with questions that addressed the technical aspects of the interface (Schuemie et al., 2001). IPQ was the first questionnaire to specifically differentiate between spatial presence, immersion and involvement.

ITC-Sense of Presence Inventory (Lessiter et al., 2001). Introduced in 2001, Lessiter and colleagues' ITC-SOPI was well received since the time of its introduction. This 44-item inventory is copyrighted under the UK Independent Television Commission. One of the main goals of the creators of ITC-SOPI was to develop a cross-media presence questionnaire that could be utilized for both VR and other types of interfaces.

Lombard & Ditton Questionnaire (Lombard et al., 2000). Similar to ITC-SOPI, Lombard and colleagues created a questionnaire applicable to cross-media purposes. A more recent questionnaire by Lombard and colleagues (2009) that further refines the ideas presented in Lombard et al. (2000) is the Temple Presence Inventory which is based on 8 subscales: spatial presence, social presence-actor within medium, passive social presence, active social presence, engagement, social richness, social realism, and perceptual realism.

Method

Selecting the Five Canonical Questionnaires

We focused on three major outlets of presence research: *Presence: Teleoperators and Virtual Environments*, the *International Society for Presence Research Conference Proceedings*, and *Cyberpsychology, Behavior, and Social Networking* (*Presence*, *ISPR*, and *Cyberpscyhology* from here). We concluded that the specialized nature of these venues would render them indicative of questionnaire use trends. Five questionnaires (SUS, PQ, IPQ, ITC-SOPI, and Lombard & Ditton) were the most prevalent; the most recent versions are in Appendix A[1][2].

Coding the Articles

Three coders rated each article in the three sources from 1998 to 2012 for (a) whether a questionnaire was used to measure presence and, if so, (b) the canonical questionnaire that was used. Questionnaires that were not among the five canonical questionnaires or did not cite a specific source were coded as 'other.' Three years were double-coded to determine inter-coder reliability. PRAM (Program for Reliability Assessment with Multiple Coders, Skymeg) was used to determine inter-coder percent agreement. The average percent agreement for whether or not an article contained a presence questionnaire was .98 and .97 for the type of questionnaire, indicating a robust inter-coder agreement. Overall, the coders found 350 cases wherein some form of presence questionnaire was used. When two or more of the canonical questionnaires were used, the study was listed multiple times to accommodate the purpose of our study. That is, the unit of analysis for the present study was the questionnaire that was used in presence studies.

Results

Canon popularity over the years

To assess how the popularity of canonic questionnaires changed over the years, we calculated the percentage of studies that used a specific canon among those that used one of the five canons across three-year periods (i.e., 1998-2000, 2001-2003, 2004-2006, 2007-2009, 2010-2012). We found that the initial popularity of SUS (M=32.75%, SD=8.53%) and PQ (M=28.93%, SD=7.41%) in the earlier years of presence research (1998-2000) decreased with the introduction of IPQ (M=11.08%, SD=2.75%), ITC-SOPI (M=19.76%, SD=11.58%), and Lombard & Ditton (M=7.48%, SD=2.75%). As a result, although there were still obvious key players (SUS, PQ, ITC-SOPI), the use of the canonic questionnaires became more evenly distributed.

[1] Appendix A is available online at https://docs.google.com/document/d/1EGzifUQ7IwrB2QXSdIZR9oseRKB2naADYat2L2uEQrI/edit

[2] ITC-SOPI is not included in the Appendix as it is under the copyright of the UK Independent Television Commission. However, free use of the questionnaire is provided to laboratories that agree to the conditions of use (Lessiter et al., 2001).

Canon popularity by source and year

We then examined if the use of a specific questionnaire differed across outlets. The overall popularity trends of questionnaire use were similar for *Presence* and *Cyberpscyhology*, with PQ in the lead, followed by SUS and ITC-SOPI, while the use of IPQ and Lombard & Ditton was less common. In contrast, ITC-SOPI and SUS were the two predominantly used questionnaires for *ISPR* while the remaining questionnaires were relatively evenly distributed.

Specifically, when examining the change in questionnaire popularity over the years by source, we divided the data into 5-year segments. We did not use the original 3-year segments, as the number of studies for each period was too small to derive meaningful conclusions. In so doing, we found that PQ (M=44.75%, SD=13.74%) and SUS (M=33.23%, SD=3.18%) were the two most commonly used questionnaires for *Presence*. In the case of *ISPR*, there was a downward trend in the popularity of SUS (M=30.01%, M=12.76%), PQ (M=12.44%, SD=2.92%), and IPQ (M=13.13%, SD=2.40%), while there was a clear upward trend for ITC-SOPI (M=31.79%, SD=9.46%) and Lombard & Ditton (M=12.63%, SD=8.69%). Finally, for *Cyberpsychology*, the distribution of questionnaires became increasingly even over the years, although PQ (M=42.11%, SD=13.67%) and SUS (M=28.22%, SD=20.90%) remained the leaders [*Figure 1*].

Practice of Reporting Items

Finally, we assessed how common the practice of reporting items was by examining the percentage of studies among those that used a subjective questionnaire (not exclusive to the five canonic questionnaires) that reported *all* of the items used. Inclusion of these measures is perceived as helpful to others researchers, but not necessary for the comprehension of the results by the reader. The percentage of studies that reported all of the items used (M=31.03%, SD=5.77%) show a surge in 2001-2003 but it is followed by a decrease between 2004-2009 and a slight increase for 2010-2012. When we examined how common the practice was across sources, we found that *Presence* had the highest percentage of studies that reported all of their items (M=49.07%, SD=7.12%). The practice of reporting questionnaire items was less common for *ISPR* (M=21.79%, SD=4.13%). However, the interpretation of these results must be treated with caution, as the advised article format, length restrictions, and main purposes tend to vary between the outlets [*Figure 2*].

Discussion

By analyzing the prevalence of the most widely used presence questionnaires, this study sought to uncover a possible trend in presence questionnaire use over time. We also examined how often researchers exhaustively noted the items they used to measure presence.

We found that questionnaire use trends not only fluctuated over the years, but also became more diversified, reflected in the increasingly even usage distribution, instead of converging. Such a trend suggests that using the same umbrella term, presence, without clarifying why a specific questionnaire was used can be misleading. Furthermore, we found that questionnaire use trends varied across outlets. Considering the fact that questionnaires often have different levels of applicability across different media, this may imply subtle differences in the technologies that are most commonly examined, in addition to the audience for each outlet.

The present study also found that researchers often fail to report the exact items used. While this trend is not problematic for comprehension of the study effects, it is helpful to include the measures, especially when slight modifications to the wording of a question leads to an evolution of the questionnaire. An online database can be highly beneficial in ameliorating this issue. Efforts to create a cooperative database have already been made for presence studies (e.g., Lombard & Jones, 2007), but we have yet to create such a database on presence questionnaires.

While there have been admirable works that accumulated presence questionnaires such as the Omnipres Compendium (van Baren & IJsselsteijn, 2004), the present study is unique as it directly examine all of the articles published in selected major outlets and describes the use of specific questionnaires during the past fifteen years. We hope that the study will encourage communication among members of the presence community and help researchers achieve a more profound consensus on the measurement of presence.

Future Directions

With the initial data collected, many opportunities for future work become evident. During data collection, we found that presence questionnaires were used primarily for recording presence as a dependent variable. Only twice was social presence the manipulated variable in the experiment. However, to further explicate the usage trends of these questionnaires, it is also important to record whether presence was measured and analyzed as a moderator or mediator affecting some other psychological process. Similar to other psychological constructs, presence may have great power as an explanatory variable.

In addition to the more fine-grained analyses, one of the most intriguing directions for future research is in determining the popularity of these presence questionnaires by technology studied. This may prove helpful in predicting future trends in usage as certain technologies become obsolete while others become well-integrated into everyday life.

Future research should also seek to place social presence questionnaires within the larger context of research methodologies by assessing convergent validity and commensurability between these self-report measures, behavioral measures and psychophysiological measures. Determining convergent validity starts with further analysis regarding those research studies that have measured presence using multiple tools. This comparison can also include those studies that have utilized more than one presence questionnaire, comparing validity across all presence measures. Inter-item correlations will further deconstruct each presence measure to help with possible dimension reduction in each analysis.

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Figure 1. Questionnaire popularity over the years by source (0=0%, 1=100%)

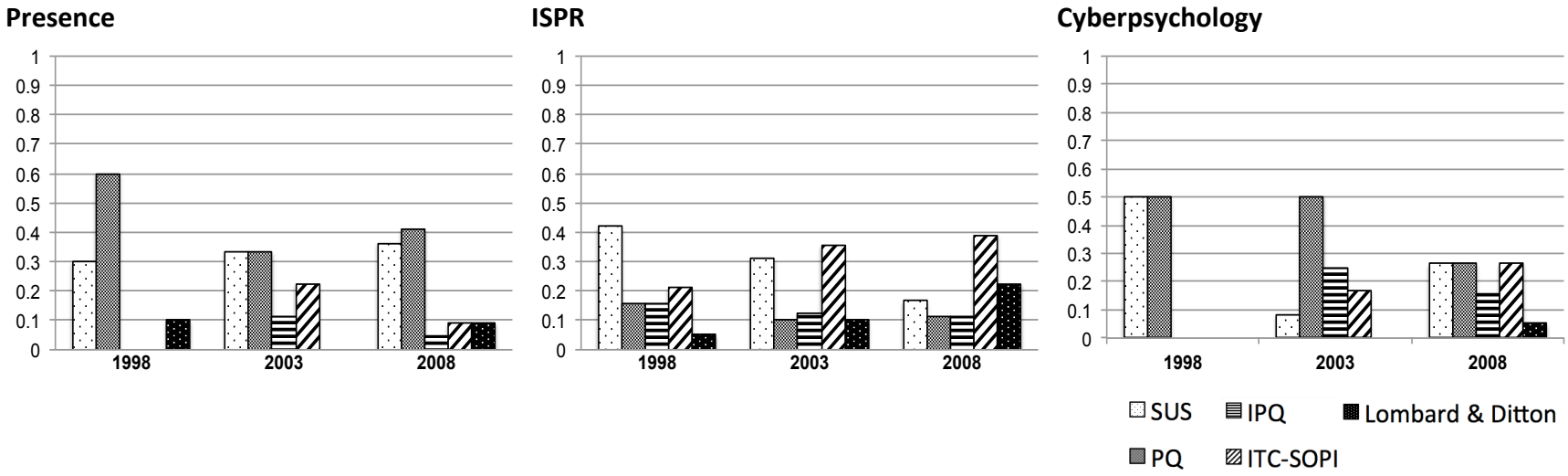

Figure 2. Percentage of studies that report items by source (0=0%, 1=100%)