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Development and validation of a scale to measure internet self-expansion

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Abstract

Self-expansion is a common phenomenon in social life, and it may provide a new and integrated perspective to examine Internet use and its influences. In current information era, Internet has become an indispensable component of our daily lives, but there have been limited attempts to measure its influence from a self-expansion perspective. This study aims to develop and validate a scale measuring Internet self-expansion. Firstly, a semi-structured interview was conducted to generate the initial items. Exploratory factor analysis was then conducted on the initial 23 items using a sample of 565 participants. The results identified three dimensions: the acquisition of new experiences and perspectives; a sense of personal growth and new identities; and raising competence and resources. The three-factor model with 16-item, was then subjected to confirmatory factor analysis using a second sample of 686 participants. The results showed a good model fit. Finally, criterion validity and reliability were examined using a third sample of 351 participants. The results revealed that the score of Internet self-expansion was significantly correlated with that of Inclusion of Other in Self scale and Internet Use Intensity measure, indicating a good criteria validity. The scale of Internet self-expansion also demonstrated good internal consistency and test–retest reliability. Taken together, the findings suggest that the proposed scale is a reliable and valid measure which can be used to assess Internet self-expansion.

Keywords Self-expansion · Internet scale development · Scale validation

Introduction

Self-expansion is a common phenomenon in social life. The self-expansion model explains that individuals are fundamentally motivated to enhance their ability to achieve goals by the acquisition of new knowledge, abilities, perspectives, identities, and resources; this process has been defined as self-expansion (Aron et al., 1998; Mattingly & Lewandowski, 2013a; b). As close relationships offer direct opportunities for self-expansion by taking on a partner's resources, perspectives, capabilities, and identities (Aron et al., 2001; Lewandowski et al., 2006; Mattingly et al., 2012), early studies focused mainly on self-expansion in close or romantic relationships. However, there are other sources or routes for self-expansion. For example, self-expansion can be experienced through a relationship with brands (Reimann & Aron, 2011), or participating in novel, interesting, or challenging activities (Graham & Harf, 2015; Mashek et al., 2010). School, work, and fictional characters can also act as sources for self-expansion (Mattingly & Lewandowski, 2014; McIntyre et al., 2014; Shedloskyshoemaker et al., 2014). Individuals can even incorporate new perspectives and identities into the self from communities (Branand et al., 2015) and nature and the environment (Davis et al., 2009; Tang et al., 2017).

Self-expansion may provide a new and integrated perspective to examine Internet use and its influences (Aron et al., 2001). According to relevant statistics, the total number of Internet users across the globe has reached 4.38 billion,

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accounting for 56.8% of the world's population (Internet World Stats, 2019). In China, the number of Internet users has reached 829 million, accounting for 59.6% of the total population of China (CNNIC, 2019). For a large number of people, Internet and its various applications have become an indispensable part of their daily lives, utilized in many situations for a wide range of purposes and convenience (Borca et al., 2015; Özkan, 2016).

Against this background, research has focused on the influences of Internet use on the individual, and the results indicate that Internet use is associated with various aspects of an individual's development and adaptation, including physical health, cognition, depression, well-being, and brain structure (Nam, 2019; Özkan, 2016; Park & Kim, 2016; Sparrow & Wegner, 2011; Qi et al., 2015). However, an integrated perspective on the relationship between Internet use and the individual is largely lacking. The current study examines whether the concept of self-expansion can fill this void.

Researchers have suggested that there are two primary modes of self-expansion: acquiring new perspectives, resources, and identities directly, or engaging in novel and challenging experiences (Aron et al., 2013). Notably, the two primary routes of self-expansion are both available online. On the one hand, individuals can achieve new perspectives, resources, and identities directly. Firstly, Internet provides various conveniences and benefits, which enhance our ability and resources to cope with the external environment; for example, by searching and obtaining information and acquiring knowledge (Kaspar & Müller-Jensen, 2019; Özkan, 2016; Shenton & Dixon, 2014). Secondly, Internet can serve as a primary form of external or transactive memory (Sparrow & Wegner, 2011). Thirdly, Internet can broaden people's horizons and encourage them to see the world from new perspectives (Tommy et al., 2015; Way & Beardon, 2018). Lastly, individuals can explore and construct new identities and roles through online avatars, and even construct avatars whose gender or personality is opposite to their actual situation (Subrahmanyam et al., 2006; Subrahmanyam & Šmahel, 2011). On the other hand, activities such as playing games or communicating with strangers online offer novelty and challenges for individual engagement (Rettie, 2001).

Given these experiences and the primary modes of self-expansion, Internet may serve as a source of self-expansion. Namely, individuals may experience self-expansion in online activities (online self-expansion). Though Relevant studies provide some empirical evidence: for instance, leisure activities, including media use, have the potential for self-expansion (Stenseng et al., 2012), and the mobile phone, a popular application of modern technology, can also be used for self-expansion (Hoffner et al., 2015). In addition, research has examined online self-relevance by comparing the cognitive advantages of one's real name and screen name, which directly supports the phenomenon and experience of self-expansion in online space (Niu et al., 2020; Yang et al., 2015). However, little attention has been paid to how we might measure Internet self-expansion (the experience of self-expansion in online space), which could advance and deepen studies on this theme with a quantitative approach. Based on these observations and the main points of self-expansion, this study aims to develop and validate a scale of Internet self-expansion.

Material and Methods

Participants

Four groups of participants were randomly selected from three universities located in northeast, central, and southwest China. The 30 participants (skilled internet users) in group1 (15 female and 15 male participants; $M_{age} = 20.37 \pm 2.25$ years) were used to conduct the semi-structured interview. The 565 participants in Group 2 (285 female and 280 male participants; $M_{age} = 20.05 \pm 2.87$ years) were used to conduct exploratory factor analysis. The 686 participants in Group 3 (348 female and 338 male participants; $M_{age} = 20.35 \pm 2.46$ years) were used to conduct confirmatory factor analysis. The 351 participants in Group 4 (174 female and 177 male participants; $M_{age} = 20.11 \pm 2.95$ years) were used to test the validity and reliability of the scale; and a subset of 109 participants in Group 4 (57 female and 52 male participants; $M_{age} = 20.09 \pm 2.91$ years) was asked to complete a retest survey 4 weeks later.

Item Generation

To generate the items for a questionnaire, first, a semi-structured interview was conducted to investigate their experiences of self-expansion in online activities. For example, the users were asked whether they had had some experiences or feelings relevant to self-expansion when using Internet and, if so, to explain such experiences in detail (the interview questions were attached in the appendix). Using the relevant responses, the interview results were streamlined, refined, and integrated to generate the initial potential items (a total of 31 items). Subsequently, the authors discussed and modified the potential items based on the principle of self-expansion; repetitive and redundant items were revised or deleted. Finally, 23 potential items were developed through this process, and each item was rated on a 7-point Likert-type scale to capture sensitively the differences in responses received (1 "strongly disagree" to 7 "strongly agree").

Validity Indicators and Measures

To test the validity of the scale, two variables (inclusion of other in self and Internet use intensity) were selected as the criteria indicators. Regarding inclusion of other in self, it is a

simple indicator for self-expansion and widely adopted to measure the experience of self-expansion in various situations, which reflect the extent that one experience self-expansion from the specific target (e.g., brand, close friend, partner, or job) (Branand et al., 2015; Hoffner et al., 2015); as to Internet use intensity, relevant studies revealed that, as a positive experience, the activities or things providing self-expansion experience would be fascinating, and make individuals more engaged into them (McIntyre et al., 2014; Reimann & Aron, 2011; Shedloskyshoemaker et al., 2014); especially self-expansion is valuable and could boast individuals' self-worth and self-concept, promoting people to continue self-expansion in the same way (Lewandowski & Ackerman, 2006; Reimann & Aron, 2011). Regarding Internet use, the self-expansion experience online would make individuals more engaged in Internet use, and thus be positively associated with Internet use intensity (McIntyre et al., 2014; Reimann & Aron, 2011; Shedloskyshoemaker et al., 2014). Thus, inclusion of other in self and Internet use intensity were selected as the criteria indicators.

Inclusion of Other in Self (IOS) The scale was developed by Aron et al. (1992) and has been widely used as a simple and general indicator of various self-expansions (Branand et al., 2015; Hoffner et al., 2015). It aims to measure the overlap between oneself and other people or things by displaying seven pictures of two overlapping circles; the seven pictures vary in the extent of the overlap. Participants are asked to imagine that one circle represents themselves and the other circle represents the specified target (e.g., a specific brand, close friend, partner, or job), and to choose the picture that best represents their relationship with the specific target, which reflect the extent that one experience expansion from the target. In this study, the scale was adopted to measure participants' inclusion of Internet in themselves, which means the extent one experience expansion from Internet or the activities online.

Internet Use Intensity Luo et al.'s (2017) scale was used to measure Internet use intensity; this was adapted from a scale first developed by Valkenburg and Peter (2007). It contains four items (e.g., "On weekdays, how long do you spend online on average during a day?"). Participants are asked to respond on a scale ranging from 1 ("about 15 min") to 7 ("three hours or more"); higher scores indicate a higher intensity of Internet use. In this study, Cronbach's alpha for the scale was 0.75.

Data Analysis and Validation

Firstly, item–total correlation and item discrimination were calculated to test whether all of the items were consistent with the scale. Secondly, using SPSS 20.0, the suitability of factor analysis was examined by the KMO test and Bartlett's test of sphericity. A series of exploratory factor analyses was then conducted using principal axis factoring with direct oblimin rotation to determine the items and latent structure. Thirdly, confirmatory factor analysis using the maximum likelihood estimation method was conducted via AMOS 20.0 to confirm the structural model. Finally, to test the criteria validity, Pearson correlation analysis was conducted to explore the associations between the developed scale and two criteria measures (Inclusion of Other in Self and Internet Use Intensity). The internal consistency (Cronbach's alpha) and test–retest reliability were also calculated to examine the reliability of the scale.

Results

The item–total correlation analysis showed that all the scores on the 23 items were significantly correlated with the total score of the items (all $rs \geq 0.4$; all $ps < 0.001$). The item discrimination analysis contrasted the scores of individuals with the highest and lowest 27% total score. The analysis revealed significant differences in each item (all $ps < 0.001$). Both analyses indicated that all the items could enter into further analysis.

The KMO test (KMO = 0.93) and Bartlett's test of sphericity ($\chi^2 = 4564.31$, $p < 0.001$) showed that the correlation matrix of this sample was appropriate for factor analysis. In the exploratory factor analysis, several indexes, such as eigenvalue (> 1) and the scree plot, were adopted to determine the factors; items with low factor loadings (< 0.35) or multiple cross-loadings were removed. After three rounds of analyses, 16 items were identified with a three-factor solution, which accounted for 57.07% of the total variance to be explained. The three factors were positively and moderately correlated with each other, and defined as follows. 1) The acquisition of new experiences and perspectives (e.g., "Internet provides a source of new and exciting experiences," and "Internet provides me with a larger perspective on things"). 2) A sense of personal growth and new identities (e.g., "I find different aspects of myself on Internet," and "Internet helps me find my potential"). 3) Raising competence and resources (e.g., "Internet increases my ability to accomplish new things").

Following this process, confirmatory factor analysis was conducted to test the three correlated factors with 16 items (see Table 1). In addition, a single-factor structure and also a three uncorrelated factors structure were then tested to further verify the factor structure. The results revealed an acceptable model fit for the three correlated factors structure: $\chi^2 = 336.85$, $df = 101$, $\chi^2/df = 3.34$, RMSEA = 0.04, CFI = 0.95, NFI = 0.93, IFI = 0.93. The other two structure yielded poor fits: for the single-factor: $\chi^2/df = 10.42$, RMSEA = 0.32, CFI = 0.58, NFI = 0.53, IFI = 0.52; for three uncorrelated factors structure: $\chi^2/df = 7.34$, RMSEA = 0.17, CFI = 0.70, NFI = 0.65, IFI = 0.63. These results supported the proposed model, and the loading of each item was greater than 0.51 (see Fig. 1).

Table 1 Three factor model of Internet self-expansion and item factor loading

Items	Factor 1	Factor 2	Factor 3
Item 1: Internet provides a source of new and exciting experiences	0.80		
Item 2: I get a clearer and deeper understanding of things because of using Internet	0. 67		
Item 10: Internet provides me with a larger perspective on things	0.73		
Item 14: Internet expands my understanding of external things	0.75		
Item 23: Internet provides me with many novel and challenging experiences	0.63		
Item 4: Internet helps me to expand my sense of the kind of person I am		0.73	
Item 5: Internet helps me to find my potential		0.71	
Item 6: Internet increases my focus on myself		0.55	
Item 11: To some extent, Internet makes me rediscover myself		0.64	
Item 15: I have different identities and roles online, which are different from those in real life		0.55	
Item 22: I find different aspects of myself online		0.64	
Item 3: Internet increases my ability to accomplish new things			0.65
Item 8: I have learned new things through using Internet			0.76
Item 12: Internet increases my knowledge			0.72
Item 16: I have more resources online			0.63
Item 20: Internet increases my competitiveness in life			0.59

Note: Factor 1: Acquisition of new experiences and perspectives, Factor 2: Personal growth and new identities, Factor 3: Raising competence and resources

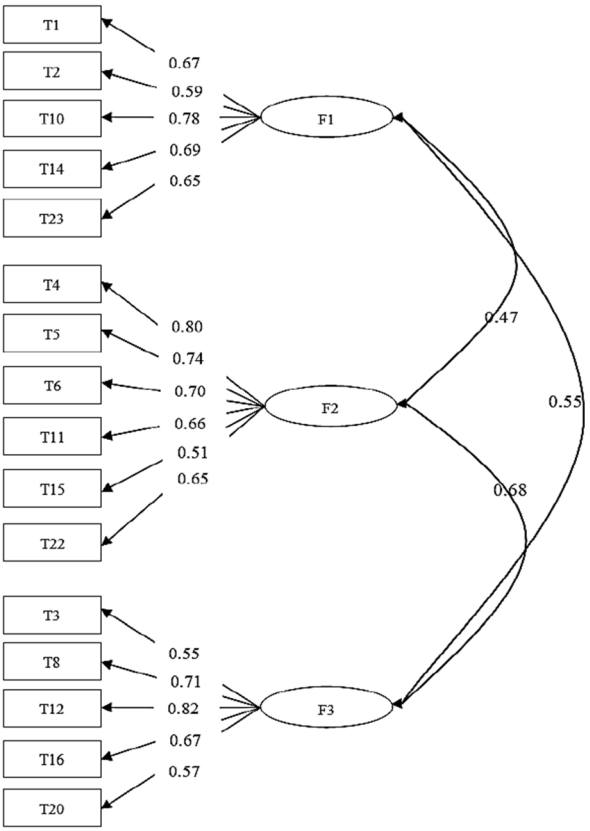

Fig. 1 Confirmatory Factor Analysis of the three-factor model and standardized factor loadings. *Note*: F1 = "the acquisition of new experiences and perspectives"; F2 = "a sense of personal growth and new identities"; F3 = "raising competence and resources." The numbers of the items are their numbers in the original scale

Finally, we tested the validity of the criteria indicators; i.e., the Inclusion of Other in Self (IOS) scale and the Internet Use Intensity (IUI) measure. Pearson correlation analysis was conducted to examine the associations between those measures and the Internet self-expansion. The results showed that both the IOS and IUI were significantly positively associated with the developed scale ($r = 0.67/0.54$, $p < 0.001$) and its three dimensions: the acquisition of new experiences and perspectives ($r = 0.63/0.65$, $p < 0.001$); a sense of personal growth and new identities ($r = 0.58/0.53$, $p < 0.001$); and raising competence and resources ($r = 0.71/0.49$, $p < 0.001$). This indicates that the developed scale has good criteria validity. Additionally, Cronbach's alpha for the whole scale and the three dimensions were 0.90, 0.85, 0.87, and 0.82 respectively. The Pearson correlations between the scores at two points in time were significant and strong ($r = 0.80$, $p < 0.001$), which further indicates that the scale has good reliability.

Discussion

This study focused on the development and validation of a scale to measure Internet self-expansion. Through a systematic process, a three-factor model with 16 items was developed and tested. The results indicate that the scale has good psychometric properties, which is of great significance and value for future studies on Internet use from the perspective of self-expansion.

The three dimensions of Internet self-expansion were identified as: the acquisition of new experiences and perspectives; a sense of personal growth and new identities; and raising competence and resources. These three dimensions are consistent with the common aspects of self-expansion in real life: the resources, perspectives, capabilities, and identities, as well as the accompanying sense of personal growth (Aron et al., 2001; Lewandowski et al., 2006; Mattingly and Lewandowski, 2013a; Mattingly et al., 2012). However, compared with other modes of self-expansion (e.g., by fictional characters, mobile phones, or brands), the acquisition of new identities and perspectives is more prominent in Internet self-expansion. Because Internet provides a new space for individual psychology and behavior (Pervushin, 2015), there are many self-expansion experiences available via online activities. In particular, the two primary routes of self-expansion both exist on Internet; i.e., achieving new perspectives and so on, and engaging in novel and challenging activities (for example, constructing new identities and roles through online avatars, playing Massive multiplayer online games or and communicating with strangers online). Internet not only makes it convenient for users to explore and construct new identities and roles (Subrahmanyam et al., 2006; Subrahmanyam & Šmahel, 2011), but also provides users with rich thoughts and diversified perspectives (Tommy et al., 2015; Way & Beardon, 2018). Thus, Internet could act as a new and ideal source of self-expansion, and all aspects of self-expansion could be gained through Internet usage. At the same time, the experience of new identities and self-perspectives is more prominent in this source than in other sources of self-expansion.

The IOS scale is a widely used and simple measurement of self-expansion in many situations, and can also serve as an indicator of validity (Aron et al., 1992; Branand et al., 2015; Hoffner et al., 2015). Studies have found that individuals feel strongly associated with the things through which their selves can be expanded, and frequently use them or more engaged in them (McIntyre et al., 2014; Reimann & Aron, 2011; Shedloskyshoemaker et al., 2014). Hence, the IOS measure and Internet Use Intensity measure were adopted as criteria indicators in this study. The results revealed the validity of the Internet self-expansion scale. In addition, the internal consistency and test–retest reliability analysis indicated the scale's reliability. Taken together, these results suggest that the Internet self-expansion scale proposed in this study is a reliable and valid scale to measure an individual's Internet self-expansion.

Implication and Limitation

The development of a well-validated measure of Internet self-expansion not only further examine the experience of self-expansion in online space, but also lays the foundation for further studies on this theme, which could further improve our understanding of the influences of Internet use on individuals from a self-expansion perspective. In addition, there are some possible implications of the measurement tool: firstly, as self-expansion is a common and fundamental motivation (Aron et al., 1998; Mattingly & Lewandowski, 2013b), it may be suitable to measure the online self-expansion experience of various groups; secondly, since self-expansion is a fantastic experience and closely associated with use intensity (McIntyre et al., 2014; Reimann & Aron, 2011; Shedloskyshoemaker et al., 2014), Internet self-expansion could be adopted to evaluate the usability and user experience for various online applications.

The present study does however have certain limitations. Firstly, a convenience sample of undergraduate students in China participated in this study, which may limit the generalization of the findings. As this is the first attempt to examine empirically a measurement of Internet self-expansion, it is of great importance to replicate the findings in larger and more diverse samples. Secondly, this study focused only on the development and validity of the self-expansion scale. Future studies should examine the factors that influence Internet self-expansion, and the outcomes of self-expansion online.

Conclusion

In conclusion, this study is the first attempt to measure the phenomenon of Internet self-expansion. Using exploratory and confirmatory factor analyses, a 16-item scale was developed using a three-factor model of self-expansion: the acquisition of new experiences and perspectives; a sense of personal growth and new identities; and raising competence and resources. Having tested the validity of the criteria and reliability of the scale, we propose that the scale developed in this study is a valid, reliable measure that is of great significance for the study of Internet self-expansion.

Appendix

The outline of the semi-structured interview

(1) Personal information; basic information on internet usage (length of internet use, the time when he/she first use internet, frequency and duration of daily Internet use, and the common functions used online).
(2) Have you heard of the term of self-expansion or do you know the definition of it? (Presenting the definition and specific example of self-expansion) Could you tell some examples or experience of self-expansion in your daily lives.

(3) Do you have some experience of self-expansion online or in online activities? When and how you feel the sense of self-expansion in online space or activities? Could you please tell these experience in detail?

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Data Availability The data that support the findings of this study are available from the Key Laboratory of Adolescent Cyberpsychology and Behavior (CCNU), but restrictions apply to the availability of these data, which were used under licence for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of the Key Laboratory of Adolescent Cyberpsychology and Behavior (CCNU).

Declarations

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Conflict of Interest The authors declare that they have no conflict of interest.

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