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Development and validation of the Internet Locus of Control Scale (I-LOC)

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Abstract
No psychological tools have yet been developed to assess the locus of control that people experience when in the Internet environment. In a first study, we developed the Internet Locus of Control (I-LOC) Scale and validated it through a sample of 743 participants. The I-LOC consisted of 18 items revolving around two dimensions, Internal and External I-LOC, and proved to have satisfactory psychometric properties. A second study was conducted on a 219-people sample to externally validate the I-LOC Scale through two Internet-related constructs assessing online self-efficacy, comparing its sensitivity to that of the Rotter's Locus of Control Scale (LCS). The I-LOC Scale was significantly correlated with both the measures of Internet-related self-efficacy, while the LCS correlations with Internet Self-efficacy Scale (ISS) and Social Network Confidence Scale (SNC) were weaker or non-existent. Thus, I-LOC can be considered as characterized by a higher specificity for the online context with respect to LCS.

Keywords
Internet Locus of Control, Internet self-efficacy, locus of control, personality, virtual environment psychology

Introduction

The Internet has become an essential part of our lives, also thanks to its 4.54 billion users worldwide who, whether for work or for pleasure, on a daily basis spend online an average of 6 hours and 42 minutes: more than a quarter of a day (Kemp, 2020). In addition to

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the copious amount of time devoted to online activities, the literature has shown that being on the Web vastly influences people from a psychological standpoint. For example, online they are more uninhibited (Suler, 2004), in control of their self-presentation, and more strategic in adapting their own image (McKenna et al., 2007). Being online seems to significantly alter human behaviour, to the point that many authors have questioned the relationship between one's online and offline Selves. To some, the online and the offline selves can be considered as two distinct identities with the former expressing an idealized and unfaithful version of the latter (Manago et al., 2008). On the other hand, other researchers argue that the Internet offers people a way to express their authentic personality and identity with a freedom that they would have never had in real life (Bargh et al., 2002; McKenna et al., 2005), a theory that Back et al. (2010) named the *extended real-life hypothesis*. Our research does not concern the concept of human personality as a whole, rather it focuses on a specific trait: the locus of control. Although this construct is one of the most used in psychology (Lefcourt, 2013), it looks like no one has ever tried to understand if the perception of one's locus of control is different when the individual is online. The Internet is an increasingly fundamental part of our lives and, as the 2020 pandemic has shown, our world might have to shift to the online arena even more. For this reason, it is important to be able to measure the control people feel in the virtual environment. Our study aims to close this gap in the literature while also presenting a new instrument to assess the online locus of control specifically, named the Internet Locus of Control (I-LOC) Scale. Such instrument was developed by modifying an already existing measure of the construct, inevitably referring to the offline personality trait, in order to refer it to the Internet use. We then proceeded to test the I-LOC Scale specificity to the Internet environment and its higher predictive power towards Internet-related constructs in comparison to another offline locus of control instrument. The locus of control is a personality trait that develops through the interaction with the environment surrounding the individual. For this reason, over the years, several domain-specific measures of locus of control have been developed, such as those concerning health (Ferraro et al., 1987; Wallston et al., 1978), work (Spector, 1988) and education (Trice, 1985). Our I-LOC Scale aims to be another locus of control domain-specific measure for the Internet to be employed in several online contexts.

The locus of control

The construct of locus of control was introduced by Rotter (1966) and can be defined as a personality trait reflecting the extent to which people believe that the events in their life are under their own control. According to the author's early conceptualization, the locus of control of any individual can be placed along a continuum extending from totally internal to totally external, based on the feeling that the events in one's life are determined, respectively, by one's own actions or by external uncontrollable forces, such as luck or powerful others' will. After nearly 60 years since its introduction, this construct has become one of the most ubiquitous in psychology, as its influence extends to a wide range of domains. For instance, it has been shown that people high on internal locus of control tend to have higher self-efficacy (Sherer et al., 1982), self-esteem (Judge et al., 2002) and job satisfaction (Marks, 1998), as well as show better academic achievements (Findley

and Cooper, 1983), social competences (Marks, 1998) and decision-making and leadership abilities (Dumitriu et al., 2014) and a longer life expectancy (Chipperfield, 1993). External locus of control have been found to correlate to many negative outcomes, like obsessive thinking (Ghorbani et al., 2004), a lower Ego development (Adams and Shea, 1979), higher moral disengagement (Detert et al., 2008), an higher risk of Internet addiction (İskender and Akin, 2010) and depression (Benassi et al., 1988) to name a few.

The locus of control and virtual environments

The relationship between locus of control and virtual environments, like the Internet, did not receive much attention in the scientific literature. There are many articles about the locus of control and many other constructs concerning virtual environments, such as online well-being (Chak and Leung, 2004; Ye and Lin, 2015), telepresence (Murray et al., 2007; Wallach et al., 2010) or social media usage (Hou et al., 2018; Kuo et al., 2019). It has been shown that people high in internal locus of control tend to make use of the computer in a more goal-oriented way, as they consider it a means to achieve their goals. Instead, those who display higher levels of external locus of control have the tendency to use the Internet in a less instrumental and more hedonistic way: mostly the activity serves them as a distraction and source of entertainment (Hoffman et al., 2003). Several studies have also revealed how having an external locus of control in the real world heightens the risk of developing Internet addiction (İskender and Akin, 2010; Rotsztein, 2003). The locus of control does not predict the amount of time spent online, probably because of the fact that Internet is so widespread and essential in daily life: people are used to making use of it in spite of their beliefs about their control on it (Chak and Leung, 2004). In other words, those who are high on internal locus of control are not less motivated to go online than those who are externally oriented, and there is no guarantee that they would spend many hours on the Web. The difference is that the former have more control on their behaviour than the latter and thus they manage not to let their use, even if substantial, get out of hand and become problematic. People exhibiting a high level of external locus of control, on the other hand, find more difficult to do the same and, as a result, they are more likely to stay online longer than first intended, potentially jeopardizing their social relationships, job and academic achievements. The locus of control also influences the way the Internet is used to communicate. According to (Flaherty et al., 1998) an external locus of control is associated to a higher need for affiliation as well as to a higher degree of anxiety experienced during social interactions with other people. Ye and Lin (2015) observed that externality is positively correlated with the preference for online social interactions, with loneliness and to a lower subjective well-being. Those who have an external locus of control reported feeling more lonely and unhappy despite having more online social interactions. These are just some examples. The locus of control has also been studied in relation to social network confidence (Haridakis and Hanson, 2009), online courses learning competency (Aldalalah and Gasaymeh, 2014) and degree of presence in immersive virtual environments (Murray et al., 2007; Wallach et al., 2010) finding many statistically significant differences. In particular, people high on internal locus of control tend to have a higher social network confidence and to acquire higher competency in online learning scenarios (Aldalalah and Gasaymeh, 2014; Haridakis and Hanson, 2009). As regards the

degree of immersiveness in virtual environments, the results are mixed, but there is evidence that people high on internal locus of control could experience a higher level immersion in virtual environments (Wallach et al., 2010). Nonetheless, also in these cases, an offline personality trait has been used to model an online behaviour without investigating if locus of control was different in the virtual environment. Usually, if locus of control is studied in relation to the Web or virtual reality, the goal is to understand how it might influence the way people interact with such environments. Thus, it has always been conceptualized and operationalized as a trait characterizing offline (or real-world) personality exclusively, hardly ever considering how it may change within the cyberspace or a virtual environment. Lloyd et al. (2019) got rather close to doing so, through a study on videogames. They took into consideration the locus of control people feel in the game and found that it can diverge from that experienced in the real world. Moreover, they found that the degree of divergence could predict gaming frequency and problematic nature. Despite being a rare exception, this study provided precious evidence about the fact that one's locus of control can vary inside a virtual environment, in this case videogames. However, no one to our knowledge seems to have investigated how locus of control changes within the specific context of the Internet.

Purpose of the study

Several studies have evaluated how the 'real world' locus of control can affect the way individuals behave online. For this reason, our study aims to comprehend whether an online locus of control conceptualization is more predictive of online dynamics than the traditional offline one. We expect it to be different in terms of predictive power, for several reasons. Locus of control is dependent on the environment, in particular as regards the connection it makes people perceive between their behaviours and their consequences (Rotter, 1966). On one hand, an individual with an internal locus of control will feel in control because any reward or punishment will be perceived as a direct result of certain actions. On the other hand, individuals with an external locus of control would be more likely to believe that such reactions are not tied to their actions but, instead, perpetuated by external, uncontrollable, forces, such as luck or other, more powerful, people (Rotter, 1966). In the Internet environment, users are offered a different degree of control. For instance, they can always choose freely when to log in or to log out, and which websites to visit. People on the Internet are physically disconnected from other users and anonymous. This particular setting may lead to a reduced risk perception and comprehension of the negative consequences of one's actions, hence causing people to feel less accountable (McKenna et al., 2005). As McKenna et al. (2007) explains, interacting via computer removes any discomfort or apprehension that may arise due to the physical presence of the other and strips the communication of most of its non-verbal elements. Text-based interactions (i.e. via chat or over Internet forums) only revolve around what is typed on the keyboard, but even audiovisual settings, such as webcam calls, lack many of the non-verbal cues people are used to counting on when interacting in real person. Moreover, because of the peculiar psychological processes characterizing the online experience (e.g. deindividuation), beyond the visual anonymity, several additional features such as the increased local self-awareness induced by the physical isolation have been demonstrated

to play a role (Joinson, 2001; Perfumi et al., 2019). Besides, communications exchange is somewhat asynchronous, and whether via chat or any messaging services, there is always the possibility to stall the conversation and take some time before replying (McKenna et al., 2007). Features like these mean that on the Internet individuals have more control over the interaction than they could ever count on in person, being able to carefully select what to say and how to say it, as well as not having to worry about communicating anything else other than what is typed on the keyboard. Cyberspace offers thus an extremely personalized experience, tailored on its users' abilities, needs and preferences, that is therefore capable of increasing in certain situations a person's feeling of environment control. As a result of the above considerations, we expect the locus of control set in a virtual environment to be different than the one set in an offline and traditional setting. To analyse our hypothesis, we developed the I-LOC Scale tool. Two separate studies have then further explored the scale's factorial structure as well as its specificity to the online environment.

First study: I-LOC Scale creation and evaluation

Study 1 had the objective of developing the instrument needed to assess the I-LOC. This was achieved by modifying an already existing measure for real-world locus of control, so that its items would be referred to the online environment. The two measures considered for the adaptation were Levenson's (1973) IPC Scale and Craig et al.'s (1984) LCB. The whole process of the scale development was carried out in two phases: first we scrutinized several instruments in order to choose those which were suitable for our purpose in terms of clarity and face validity; then we adapted those tools, submitting the drafts to an expert group composed of 10 psychologists, two computer scientists and two physicists of complex systems, all belonging to the Centre for the Study of Complex Dynamics (CSDC) of the University of Florence. The scale thus developed underwent confirmatory factor analysis (CFA) and its psychometric properties were evaluated.

Study 1 method

Items development

First phase: tool choice. Initially, various locus of control assessment measures have been taken into consideration to carefully pick the one better suited for the context of our study. More precisely, the ideal scale's items ought to be general enough that just adding expressions like 'on the Internet' or 'online' would be enough to refer them to the Internet without altering their meaning in any other way. Rotter's Internal–External (IE) Scale is certainly the most used tool in scientific literature (Rossier, 2005; Twenge et al., 2004), however it did not fit our requirements. Many of its items are in fact too related to everyday, real-world activities. The next best candidates were then: the IPC Scale (1973) and the LCB Scale (1984). The first scale revolves around 24 items, organized in three dimensions: Internal, Powerful Others and Chance. The IPC Scale's locus of control is significantly different with respect to Rotter's. The latter portrays locus of control as a unidimensional construct, fundamentally based on an internal to external continuum. Levenson, on the

other hand, believes it to be better defined by three, non-mutually exclusive dimensions which could very well be present in an individual at the same time. Compared to the IPC Scale, the LCB has not been adopted as often by the scientific community. However, it has been translated and validated by Farma and Cortivonis (2000) on an Italian sample, thus allowing us to take it into consideration. The scale is constituted of 17 items and retains the original internal and external locus of control definitions.

Second phase: items adjustments. Following the initial scale candidates choice, the next step was to modify their items, by adding new concepts (e.g. 'online') while still retaining the original meaning. IPC Scale's 4, 12 and 20 items, however, specifically refer to car incidents and were therefore not retained, as they would not be appropriate in a virtual environment. They were thus changed into the broader definition of 'being in trouble'. This initial work resulted in two different drafts which were subsequently analysed by an expert group, which was tasked with choosing the best tool. Following an evaluation, a majority vote decreed that the modified IPC Scale draft was more comprehensible, easy to understand and pertinent than its LCB counterpart, which led us to its employment in the definitive I-LOC Scale definition. The I-LOC Scale items are presented in the document's Appendix 1, both in their Italian form, which we used for our studies, and in their English translation, which we are planning to validate in a subsequent study.

Study 1 participants

The tool we developed through the aforementioned process was administered to a sample of 743 participants, selected for this objective on a voluntary basis. Participation was in fact completely non-mandatory and exclusively Internet based. The recruitment was carried out by advertising the study through free open calls to action on social media platforms and online word of mouth, ensuring the anonymity of any respondent. Users were provided with Google Forms that have been used to gather our data. Every participant was provided with a privacy consent document which assured anonymity as well as fair data use on the researcher's behalf in line with Italian law's requirements of privacy and informed consent (Law Decree DL-101/2018) and European Union (EU) regulation (2016/699). The sample for the first study was predominantly female (80.5%) with an average age of 30.21 years (standard deviation = 10.75).

Study 1 data analysis

We proceeded checking the assumptions for CFA. Multivariate normality was assessed through the test for normality and outliers. As for the sample size, according to literature, there should be at least 10 participants for each scale item (Comrey, 1988), and because the total number of items is 24 (and 18 in the final version), the final sample size was deemed to be acceptable for study one. Consequently, CFA was carried out to define the I-LOC dimensionality. For CFA, we relied on AMOS (Arbuckle, 2014). Finally, internal consistency was assessed through Cronbach's α and item-total correlation was computed.

Table 1. Unidimensionality analysis.

Model	χ^2 / df	TLI	CFI	RMSEA	SRMR
PRE: Internal	13.90	.73	.81	.132	.085
POST[a]: Internal	5.88	.94	.97	.080	.035
PRE: Powerful Others	9.33	.89	.92	.106	.049
POST[b]: Powerful Others	5.71	.95	.97	.080	.036
Chance	4.12	.95	.97	.065	.034

TLI: Tucker–Lewis index; CFI: comparative fit index; RMSEA: root mean square error of approximation; SRMR: standardized root mean square residual.
In the table are reported the fit indexes for each model before and after modifications.
[a]Removal of items 9 and 18.
[b]Removal of item 8.

Study 1 results

Construct validity phase. The construct validity of I-LOC was preliminary judged by means of CFA on a sample of 743 participants. First, we performed a CFA, testing the original structure foreseen by the Levenson Multidimensional Locus of Control Scales (Model 1). Maximum Likelihood Estimation (MLE) was employed for estimating the model's parameters. Model fit was assessed through several goodness-of-fit indices: the Chi-square to the degree of freedom ratio (χ^2 / df; Jöreskog, 1969), the Tucker–Lewis index (TLI; Tucker and Lewis, 1973), the comparative fit index (CFI; Bentler, 1990), the standardized root mean square residual (SRMR; Bentler, 1995), and the root mean square error of approximation (RMSEA; Browne and Cudeck, 1993). The model structure is supported by a TLI value higher than .95, a CFI value close to .95 (.90 to .95 for a reasonable fit), a SRMR value less than .08, and a RMSEA less than .06 (.06 to .08 for a reasonable fit; Hu and Bentler, 1999). The three-factor structure did not show a satisfactory fit ($\chi^2 / df = 7.18$; TLI = .76; CFI = .78; RMSEA = .091; SRMR = .122), and for this reason, we analysed the unidimensionality of each of the three dimensions since the unidimensionality of item response data is an essential component of construct validity (Slocum-Gori and Zumbo, 2011).

As we can gather from Table 1, neither the Internal nor Powerful Others dimensions achieved an acceptable fit. From the internal dimension, items 9 and 18 were eliminated due to their low factor loading (respectively, .22 and .23) and factor weight (respectively, .027 and .03). Moreover, the modification indices (MI) analysis further supported the removal of these two items. Excluding items 9 and 18 led to an acceptable fit for the internal dimension together with the addition of a covariance link between items 4 and 21. For the sake of clarity, we specify that covariated errors may arise from items that are similarly worded, reverse-worded, differentially prone to social desirability, or the like (Brown, 2015). As for the Powerful Others dimension, item 8 showed a factor loading less than .50 and the lowest factor weight value across the Powerful Others item pool. After the removal of this item, all indices were satisfactory. Finally, the Chance dimension did show immediately an acceptable fit and thus did not incur in any modification of its item pool.

Table 2. Unidimensionality analysis.

Model	χ^2 / *df*	TLI	CFI	RMSEA	SRMR
PRE: External	4.81	.92	.93	.072	.041
POST [a]: External	5.12	.91	.93	.075	.042

TLI: Tucker–Lewis index; CFI: comparative fit index; RMSEA: root mean square error of approximation; SRMR: standardized root mean square residual.
In the table are reported the fit indexes for each model before and after modifications.
[a]: Removal of item 3.

From Model 1 to Model 2

Using the indications from the unidimensionality analysis, we narrowed the item pool from 24 to 21. A new three-factor model was tested (Model 2). However, Model 2 did not achieve a satisfactory fit ($\chi^2 / df = 4.85$; TLI = .87; CFI = .89; RMSEA = .072; SRMR = .065). Neither factor loading nor factor weights analysis was able to identify underperforming or unsuitable items. Nonetheless, the correlation between Powerful Others and Chance dimensions (.95) suggested a different possible structure to test against (i.e. two-factor). Indeed, a strong correlation value may entail the existence of a single dimension formed by Powerful Others and Chance.

From Model 2 to Model 3

The two-factor structure (Model 3) was tested first using the same item pool of Model 2 (i.e. 21 items). The fit slightly increased, reaching the CFI cut-off value for acceptability. Nonetheless, the other fit indices were still not satisfactory ($\chi^2 / df = 4.81$; TLI = .82; CFI = .93; RMSEA = .072; SRMR = .041). As for Model 1 , we proceeded to investigate the unidimensionality of this new factor called 'external'. The results are presented in Table 2.

Item 3 was removed during this procedure due to the very low factor weight (.005). Despite item 3 removal, the model did not notably change.

From Model 3 to Model 4

Based on the unidimensionality results, the 20 items were used to test our first version Model 4 (two-factor structure). The fit was still not completely satisfactory ($\chi^2 / df = 4.65$; TLI = .88; CFI = .90; RMSEA = .070; SRMR = .065). From this point over, we proceeded to refine the two-factor structure using the MI analysis. Since internal and external latent variables appeared poorly correlated with one another (estimate = .12) and thus mostly independent, we decided to remove those external items whose errors were found to covary with other error terms that were not part of the same factor. Item 10 was the first to be removed in this procedure due to the modification index values. In particular, item 10 error term appeared related to the internal latent factor (MI = 42.79) and item 5 (MI = 28.42), 23 (MI = 5.88) and 19 (MI = 5.21) error terms. After the item 10 removal, the Model 4 fit increased and was adequate for mostly fit indexes apart

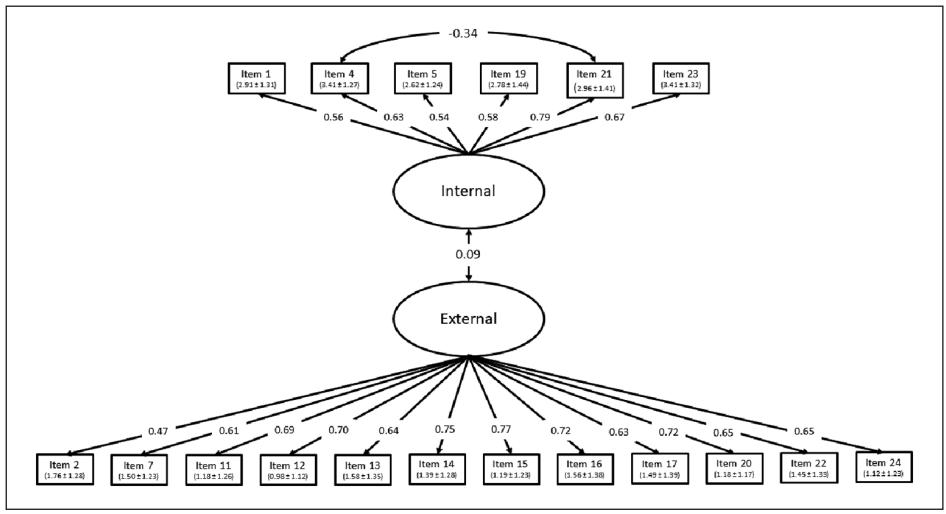

Figure 1. Results of confirmatory factor analysis of the two-factor model (Model 4) of Internet Locus of Control (I-LOC). The numbers in parentheses represent item mean scores and standard deviations (mean ± *SD*).

from the TLI ($\chi^2 / df = 4.65$; TLI = .88; CFI = .90; RMSEA = .070; SRMR = .065). To increase the model fit and thus satisfy all the fit thresholds, we proceeded following the MI analysis and thus deleted item 6. As for item 10, item 6 error term entertained relationships with error terms related to the internal dimension (internal latent factor: MI = 24.61; item 5 error: MI = 34.83; item 1 error: MI = 16.49). At this point, we obtained an adequate fit for all the fit metrics ($\chi^2 / df = 4.31$; TLI = .90; CFI = .92; RMSEA = .067; SRMR = .055). The final version of Model 4 encompasses 18 items as shown in Figure 1. The internal dimension is defined by items 1, 4, 5, 19, 21, 23, while the external, by items 2, 7, 11, 12, 13, 14, 15, 16, 17, 20, 22, 24.

Construct reliability phase and item analysis phase

Internal consistency across the four models. The reliability analysis of the I-LOC two-factor final model was carried out by calculating Cronbach's alpha internal consistency coefficients on the whole sample. Cronbach's alpha values can be classified as minimally acceptable ($\alpha = .65$), acceptable ($\alpha = .70$) and optimal ($\alpha = .80$) (DeVellis, 1991; Nunnally and Bernstein, 1994). The α coefficient value for the internal factor was .78, while the α for the external factor was found to be .875. We also performed the same analysis with the previous models' dimensions to highlight whether or not the I-LOC reliability changed by removing items. The internal factor remained the same (i.e. no item were further excluded) from Model 2 and thus we could only compare its reliability against Model 1. Model 1 showed a reliability coefficient of .757 for the internal factor. Overall, the removal of items 9 and 18 appeared to increase the internal factor's

reliability. The first time the external dimension was accounted for is in Model 3. Considering the Model 3 item pool the reliability was of .878 , which is pretty the same as Model 4 . Comparing Model 4 external factor reliability with Powerful Others (α = .85 in Model 1 and α = .80 in Model 2) and Chance (α = .84 in both Models 1 and 2) alpha coefficients, we could observe that external reliability in Model 4 resulted higher. In general, the transition from Model 1 to Model 4 increased or maintained the internal consistency of the I-LOC measure.

Item-total correlations. As an important phase of item analysis, the corrected item-factor total correlations were also investigated to determine the coherency of items within the same factor. All item-factor total correlations were much greater than the threshold value of .30 (Cohen (1988)), ranging from .46 to .63 for the internal factor, and from .46 to .66 for the external factor. These results suggested that I-LOC has significant item-factor relationships.

Second study: external and convergent validation phase

Study 2 aimed to gather data for convergent and external validation of I-LOC Scale. To do so, it was compared against Rotter's (1966) Locus of Control Scale (LCS). Although there are more recent and updated measures, our choice fell onto Rotter's, due to both the existence of an Italian validated version (Nigro, 1983) and the fact that it is the most used scale for the assessment of locus of control (Rossier, 2005; Twenge et al., 2004). Since the I-LOC was hypothesized to be a different construct from its offline counterpart, the measures of both should have been mostly uncorrelated with one another, or lightly correlated at the most. Furthermore, our instrument was meant to be an Internet-specific scale for locus of control, thus it should have displayed better predictive power for Internet-related constructs than a general LCS. To test this hypothesis, our instrument and Rotter's were compared against measures of Internet self-efficacy and social network confidence. The locus of control correlation with self-efficacy and confidence is well established in the literature (Ashagi and Beheshtifar, 2015; Cramer et al., 2009; Judge et al., 2002; Peterson and Stunkard, 1992; Stewart and De George-Walker, 2014). As we have taken into consideration two online-based versions of those constructs, we expected their measures to display stronger correlations with our I-LOC Scale than with Rotter's LCS.

Study 2 method

Study 2 participants and procedure. The tool was administered in its final form (18 items), adjusted based on results of the previous study, alongside other locus of control real-world measures as well as self-efficacy Internet and social network usage measures. The sample for this study was constituted of 219 subjects. Participants recruitment followed the same rules employed in the previous one, obtaining a fairly similar sample with respect to the previous one: mainly composed of female (79.9%) of average age 25.46 years (SD = 4.08).

Study 2 measures

Internal–External LCS. The most popularly employed among locus of control tools, the IE Scale, was used as a real-world locus of control measure for this research (Rotter, 1966). The scale is composed of 29 items, 6 of which forced choice fillers. The latter essentially are two considerations around the same concept, defined in such a way to express an internal and external locus of control, respectively. Participants would then choose the one better representing their own points of view, resulting in a different score for each choice. In particular, every answer concerning an external locus of control would increase the score by one, while each internal locus of control choice would not increase the final score, thus defined the final score's range between 0 (maximum internal locus of control degree) and 23 (maximum external locus of control degree). Rotter assessed the measure confidence as .70 (Kuder–Richardson Formula 20).

Internet Self-efficacy Scale (ISS). A 17-item, 7-point Likert-type scale ranging from 1 ('Not sure') to 7 ('Totally Sure'), meaning to measure a participant's self-efficacy while performing several online activities of different complexity (Kim and Glassman, 2013). This scale revolves around five factors ('reactive/generative self-efficacy', 'differentiating self-efficacy', 'organization self-efficacy', 'communication self-efficacy', 'research self-efficacy') with a Cronbach's $\alpha = .91$.

Social Network Confidence Scale (SNC). An ad hoc tool to measure one's personal trust over social network usage. It is composed of 8 items, 5-point Likert-type scale ranging between 'Very Little' to 'A lot', and some examples are 'I feel confident in my ability to use social network sites' (item 2) and 'I find social network sites to be easy to use' (item 4). The instrument displayed a good internal consistency, with a Cronbach's $\alpha = .88$.

Study 2 data analysis. Study 2 sample size was defined through power analysis. Power analysis is an essential aspect of experimental design. Indeed, it allows researchers to define the recommended sample size to observe an effect of a given size with a given degree of confidence. Power analysis was carried out relying on G*Power (Faul et al., 2009). The analysis showed that in our case (i.e. Pearson correlation) a sample size of 193 individuals would be enough to ensure a statistical power of .80, assuming a small-medium effect size ($\rho = .2$) and a significance level of .05. Statistical procedures for Study 2 were performed using the SPSS software (25.0, IBM Inc., New York, NY, USA). We assessed normality through the asymmetry and kurtosis values for each measure involved in the external/convergent validity procedure. Finally, Pearson's correlation was used to investigate the relationship between the I-LOC and validity measures.

Study 2 results

Descriptive statistics on these measures are reported in Table 3.

After checking for Pearson's assumptions through the asymmetry and kurtosis values, the correlation between the two I-LOC factors and Rotter's LCS (as an indicator of the participants' offline locus of control) was assessed. Rotter's LCS was significantly correlated with both internal ($r = -.31$, $p = .001$) and external ($r = .24$, $p = .001$) factors,

Table 3. Descriptive statistics.

Variable	Mean	*SE*	*SD*	Skeweness	Kurtosis
Internal I-LOC	10.45	0.35	5.18	–0.54	1.06
External I-LOC	16.30	0.63	9.39	–0.48	0.61
Rotter's LCS	11.07	0.28	4.13	–0.05	–0.15
ISS: Reactive/generative self-efficacy	15.26	0.54	7.98	0.21	–0.60
ISS: Differentiation self-efficacy	17.00	0.30	4.47	–0.77	0.91
ISS: Organization self-efficacy	13.34	0.24	3.60	–1.01	1.53
ISS: Communication self-efficacy	7.42	0.21	3.14	–0.60	–0.43
ISS: Search self-efficacy	9.02	0.15	2.23	–1.15	2.08
ISS: Total score	62.04	1.20	17.74	–0.39	0.26
Social network confidence	17.01	0.42	6.20	0.04	–0.36

N = 219. *SE*: standard error; *SD*: standard deviation; I-LOC: Internet Locus of Control; LCS = Locus of Control Scale; ISS = Internet Self-efficacy Scale.
In the table are reported mean and standard deviation values for each variable involved in the external and convergent validation phase.

although mildly as we expected. Pearson's *r* can be interpreted referring to these thresholds (Hinkle et al., 2003): we have a negligible correlation for coefficient lower than $|.30|$, a low correlation for values between $|.30|$ and $|.50|$, a moderate correlation for *r* values ranging from $|.50|$ to $|.70|$, a high correlation for coefficients between $|.70|$ and $|.90|$ and a very high correlation for values ranging from $|.90|$ to $|1.00|$. Notably, as we can gather from Table 4, Internal and External I-LOC appeared independent dimensions ($r = .01$, $p = .91$) in line with the CFA results in Study 1 .

As we can gather from Tables 4 and 5, the I-LOC's internal factor appeared to be positively correlated with all the Internet self-efficacy dimensions, as well as with its total score. All the correlation coefficients were statistically significant and higher than .30. Participants that reported higher levels of online locus of control also experienced a higher positive Internet-related self-efficacy. As for the external factor, no statistically significant relationship was found with ISS. Participants' Social Network Confidence result associated positively with both the internal and the external factors. Nonetheless, the relationship between SNC and the I-LOC external factor appeared negligible in size. Participants' Social Network Confidence was also moderately associated with the ISS dimensions and total score with correlation coefficients ranging from .47 to .66. Finally, all ISS components appeared correlated with one another with Pearson *r* values higher than .50 except for the relationship between Communication and Search self-efficacy dimensions ($r = .48$, $p = .001$).

Subsequently, we compared the I-LOC internal factor's predictive power on ISS against the Rotter's LCS, which was selected to measure the 'offline' component of the locus of control construct. Since we aimed to develop a new locus of control measure specifically designed for online and virtual interactions, it was essential to test whether our measure could explain more Internet-related variables' variance than the traditional locus of control measure meant for 'real-world' dynamics. As reported in Table 5, I-LOC internal factor appeared able for all ISS variables to explain more variance (average $\Delta r = .21$). Moreover, internal I-LOC was able to predict participants' social network confidence, while Rotter's LCS failed.

Table 4. Correlations between total scores for I-LOC and Rotter's locus of control and measures of convergent and divergent validity.

Variable	ISS	SNC	Internal I-LOC	Rotter's LCS	External I-LOC
ISS	1				
SNC	0.66***	1			
Convergent validity					
Internal I-LOC	0.48***	0.48***	1		
Divergent validity					
Rotter's LCS	–0.23***	–0.13^{ns}	–0.31***	1	
External I-LOC	–0.03^{ns}	0.13*	0.01^{ns}	0.24***	1

$N = 219$. *ns* = not significant; LCS = Locus of Control Scale; ISS = Internet Self-efficacy Scale; SNC: Social Network Confidence Scale; I-LOC: Internet Locus of Control.
*$p < .05$, ** $p < .01$, ***$p < .001$.

Table 5. Correlation matrix.

Variable	Rotter's LCS	Internal I-LOC	External I-LOC
ISS: Reactive/generative self-efficacy	–.16*	.37***	.10^{ns}
ISS: Differentiation self-efficacy	–.24***	.44***	–.02^{ns}
ISS: Organization self-efficacy	–.25***	.39***	–.10^{ns}
ISS: Communication self-efficacy	–.09^{ns}	.40***	–.03^{ns}
ISS: Search self-efficacy	–.20**	.37***	–.06^{ns}
ISS: Total score	–.23**	.48***	–.03^{ns}
Social network confidence	–.13^{ns}	.48***	.13*

$N = 219$. *ns* = not significant; LCS = Locus of Control Scale; ISS = Internet Self-efficacy Scale; I-LOC: Internet Locus of Control.
In the table are reported the Pearson correlation values with validity measures for both Rotter's LCS and I-LOC.
*$p < .05$, ** $p < .01$, ***$p < .001$.

Discussion

The main goal of our research was to evaluate whether online locus of control was different from its offline counterpart, and to present and validate a new instrument to assess it. Such instrument was named the I-LOC Scale and was created by adapting the Levenson's IPC Scale. Nonetheless, simply modifying the IPC Scale items was not enough to yield to a psychometrically sound instrument. Thus, we adjusted the item pool as well as the factorial structure. We tested four different CFA models before reaching the goodness-of-fit indices' cut-off values for acceptability. The results of our first study suggested that the I-LOC Scale was an internally valid measure. The final version of the scale differs from the original one for the removal of six items (namely the number 3, 6, 8, 9, 10 and 18) and, more importantly, for the adoption of a different factorial structure, encompassing two dimensions: Internal and External. Although these two dimensions are not mutually exclusive, this solution is more

consistent with the classic conception of locus of control (Rotter, 1966) than with Levenson's (1973) definition, which instead identifies three dimensions: Internal, Powerful Others and Chance. At first, we tried to preserve Levenson's original three-factor structure of the CFA, but we soon found that the Powerful Others and the Chance dimensions were strongly correlated. Thus, merging these two dimensions into a single factor representing the external locus of control became necessary in order to increase model fit. Such a result suggested that even though the IPC Scale factorial structure describes well individual control perception during real-world events, it probably does not apply to what happens within the confines of cyberspace, where chance or other people's will might not be felt like exerting that big of an influence. In particular, the Externality factor appears to be less discernible along the classical dimensions of Powerful Others and Chance, and probably more related to specific features of online environments. The removal of the items can be understood considering the different information that these items bring when referring to real and Internet environments. Technically speaking, the CFA assessed that the removed items strongly covariated (i.e. shared a great portion of variance) with others, suggesting that these items perform differently depending on the environment. In particular, the nuances that these items bring in characterizing the offline locus of control might get lost when referred to the online context. Further research should investigate the external factors affecting I-LOC in order to provide a clear dimensionality of this construct.

The I-LOC Scale showed to have a good internal consistency as the value for Cronbach's alpha turned out to be .78 for the Internal factor and .875 for the External one, both dimensions scored above what can be considered acceptable (DeVellis, 1991; Nunnally and Bernstein, 1994). The item–factor correlations analysis gave satisfactory results as well. In our second study, we analysed the I-LOC Scale external and convergent validity by comparing it against a golden standard represented by the Rotter's LCS. According to Back et al.'s (2010) *extended real-life hypothesis* the digital Self should be considered as an extension of one's real Self, meaning that on the Internet people communicate their authentic personality. As far as the locus of control is concerned, we could not confirm this theory. Rotter's instrument showed significant but mild correlations with both the Internal ($r = -.31$, $p = .001$) and the External ($r = .24$, $p = .001$) factors of the I-LOC Scale. Thus, despite a partial overlap between the two constructs, they appear to be mostly independent from one another, as the offline locus of control accounted for an exiguous part of the I-LOC variance (9.61% of the Internal factor and 5.76% of the External), which consequently seemed to be predominantly determined by other factors. This supports the idea that our instrument should be considered specific measures of online locus of control. The I-LOC Scale only concerns the online environment, whereas Rotter's LCS assesses an individual's general beliefs of control. Therefore, we should expect the two measures to be mainly independent one from the other, which seems to be the case. Moreover, the I-LOC Scale should also be a better predictor of Internet-related variables, and to verify this, we used the ISS and the ad-hoc created SNC. These instruments were chosen because of the well-documented positive correlation between internal locus of control and higher self-efficacy (Ashagi and Beheshtifar, 2015; Judge et al., 2002; Peterson and Stunkard, 1992; Sherer et al., 1982; Stewart and De George-Walker, 2014). Confidence

is a construct that is closely related to self-efficacy, though the two are not the same: the latter refers to the perception of one's own ability to conduct a particular behaviour, while the former reflects a degree of certainty about a perception, event or outcome (Cramer et al., 2009). Real-world locus of control (as measured by Rotter's LCS) should not be completely disjointed from Internet-related self-efficacy and confidence, but being the I-LOC Scale specific to the online context, it should display stronger correlation with the ISS and the SNC and explain a wider portion of their variance. This was confirmed by our results, as the Internal I-LOC factor showed significant correlations with the SNC and all of the ISS dimensions, while Rotter's LCS correlation with ISS and SNC was either weaker or non-existent. We could interpret this as an evidence in favour of the I-LOC Scale's higher specificity towards the online context and the variables that pertain to it. The lack of correlation between the External I-LOC score and both SNC and ISS was unexpected. These results might highlight a different dimensionality regarding the online and offline external dimensions of locus of control, maybe due to the different individuals' control degree that is possible within virtual environments. For instance, the concepts of Chance and Powerful Others in online interactions may be less salient, given the reduction of uncertainty due to the design of these environments (Chun and Hahn, 2007). On the contrary, it appears that offline external locus of control may affect both real-life and online behaviours in the expected direction.

Studies' limitations and future perspectives

Our study research had some limitations. As regards the I-LOC Scale, it is the first instrument to assess people's perception of control within the Internet environment, but despite displaying satisfactory psychometric properties, it is far from perfection. It was developed by adapting an already existing scale and it inevitably suffered from the lack of knowledge regarding the online locus of control, as the CFA could confirm the existence of just the two classic dimensions of Internal and External control. Future research should deepen our knowledge about the I-LOC to better understand its characteristics and properties. An increased comprehension of the subject could help improve the I-LOC Scale, for example, by identifying a factorial structure that describes the new construct more specifically, instead of resorting to Rotter's concept of internality versus externality that he himself already considered too generic (Rotter, 1966, 1975). Another limitation is the reliance in both studies on a convenience sample disproportionally consisting of female (80.5% in Study 1 and 79.9% in Study 2) students. This limits the generalizability of our results; thus, future research should aim to involve more heterogeneous arrays of participants, better suited to represent the general population, given how locus of control is known to be influenced by aspects like gender (Chubb et al., 1997; Sherman et al., 1997) and socioeconomic status (Marks, 1998). As far as our second study is concerned, it shed light on the relation between offline and online locus of control, but much more needs to be understood. For instance, future research should definitely delve into the way they can be different for the same individual. Lloyd et al. (2019) have shown that, as far as video games are concerned, feeling less under the control of Powerful Others within

the in-game environment than in the real world significantly predicted gaming frequency, while feeling comparatively more internal control in-game than in real life significantly predicted problematic gaming. It can be hypothesized that the same applies to the online environment, in the sense that feeling a more internal locus of control online than offline could theoretically lead a person to develop a preference for online social interactions and thus more prone to make a problematic use of the Internet. Finally, our second study is cross-sectional and therefore it suffers from all the limitations implicit in such a design; first of all, the lack of ability to infer causality relationships between the variables we took into consideration. For instance, we could observe that an internal I-LOC was positively correlated to both ISS and SNC, but we could not tell if one was the consequence of the other: it is logical to assume that people could feel more in control over what goes on within the cyberspace as a result of their perceived confidence in the use of the Internet and social media, but the opposite might be true as well. Besides, an internal I-LOC and higher scores on the ISS and the SNC could be the results of some people being more competent with the Internet and accustomed to being online. For these reasons, future studies could try to isolate all these variables. One way would be to focus on those users who report a divergence between their I-LOC on one side and their ISS and SNC on the other (i.e. those who have an internal I-LOC but do not feel confident in using the Internet and social media, or, vice versa, those who show to have high confidence and self-efficacy despite an external I-LOC). Knowing what may cause such a discrepancy would help understand what differentiates those variables and how they are related. To factor in the role of competence and acquaintance with the Web on one's I-LOC, it could use conducting a longitudinal study on a sample of people that do not know how to use the Internet and, while teaching them how, monitoring overtime any potential change in their I-LOC as they gain ability and familiarity with the new technology.

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Appendix 1

1. ITEM 1 Whether or not I get to be a leader online, it mostly depends on my skills. (Se online divento o meno un leader, dipende soprattutto dalle mie abilità) [I].
2. ITEM 2 To a great extent, my life on the Internet is controlled by random events. (In larga misura la mia vita su internet è controllata da avvenimenti casuali) [E].
3. ITEM 4 Whether or not I get into trouble online, it mostly depends on me. (Se mi trovo o meno nei guai su internet dipende da me) [I].
4. ITEM 5 When I make plans online, I am almost certain to make them work. (Su internet, se faccio dei piani sono quasi del tutto certo di riuscire a farli funzionare) [I].
5. ITEM 7 Online, if I get what I want, it's usually because I'm lucky. (Quando online ottengo qualcosa che voglio, solitamente accade perché sono fortunato) [E].
6. ITEM 11 My online life is mainly controlled by powerful others. (La mia vita online é principalmente controllata da altre persone che hanno potere) [E].
7. ITEM 12 Whether or not I get into trouble on the Internet, it is mostly a matter of luck. (Se online mi trovo nei guai o meno è più una questione di fortuna) [E].
8. ITEM 13 When online, people like me have very little chance of protecting their personal interests, when they conflict with those of strong pressure groups. (Su

internet, quelli come me hanno poca speranza di poter proteggere i propri interessi personali quando entrano in conflitto con chi appartiene a forti gruppi di pressione) [E].

9. ITEM 14 Online, it's not always wise for me to plan too far ahead, because many things turn out to be a matter of good or bad fortune. (Non è sempre saggio per me fare piani online troppo in anticipo perché molte cose finiscono per essere una questione di buona o cattiva sorte) [E].
10. ITEM 15 Getting what I want online requires pleasing people that are more powerful than me. (Su internet, ottenere ciò che voglio richiede di dover compiacere i miei superiori) [E].
11. ITEM 16 Whether or not I get to be a leader online, it depends on me being lucky enough to be in the right place at the right time. (In rete, se divento o meno un leader dipende dal fatto che io sia abbastanza fortunato da essere al posto giusto al momento giusto) [E].
12. ITEM 17 If important people online were to decide they didn't like me, I probably wouldn't make many friends. (Se persone importanti in rete decidessero che a loro non piaccio, probabilmente non mi farei molti amici) [E].
13. ITEM 19 Online I am usually able to protect my personal interests. (Su internet sono solitamente capace di proteggere i miei interessi personali) [I].
14. ITEM 20 Whether or not I get into trouble on the Internet, it mostly depends on somebody else. (Se online mi trovo nei guai o meno dipende soprattutto da qualcun altro) [E].
15. ITEM 21 When I get what I want online, it's usually because I worked hard for it. (Se ottengo ciò che voglio online è solitamente perché ho lavorato sodo) [I].
16. ITEM 22 In order to make my plans work, I make sure that they fit in with the desires of people who have power over me on the Internet. (Affinché i miei piani funzionino, mi assicuro che siano in linea con I desideri delle persone che hanno potere su di me in rete) [E].
17. ITEM 23 My life online is determined by my own actions. (La mia vita online è determinata dalle mie stesse azioni) [I].
18. ITEM 24 It's mainly a matter of luck, whether or not on the Internet I have a few friends or many. (È principalmente una questione di fortuna se su internet ho pochi amici o molti) [E].

I = Internal, E = External. There are no reverse-scored items.