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## **Measuring Situational Anxiety Related to Information Retrieval on the Web Among English-Speaking Internet Users**

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**Searching for information on the web is regarded as a complex problem-solving activity involving a range of cognitive and affective processes. Anxiety is a key affective factor. In this article, we describe the construction and initial validation stages of the Information Retrieval on the Web Anxiety Rate (IROWAR) scale. The final structure of this inventory was validated with a sample of 183 English-speaking Internet users. Reliability analyses indicated that the factors were internally consistent (Cronbach's alpha: 0.92). When we checked divergent validity, we found negative correlations with both self-efficacy and positive attitude towards the Internet. There were no effects of either sex or age on the total IROWAR score, but the Internet search anxiety sum score decreased with the length of use. This scale will be useful in several domains, including research on the determinants of web anxiety, individuals' experience of web anxiety and ways of supporting them and Internet learning.**

### RESEARCH HIGHLIGHTS

We report the construction and validation of a web anxiety scale with a good fit.

Physical feelings and negative cognitions of anxiety are both factors for web search anxiety.

Self-efficacy and positive attitude towards the Internet are negatively linked to anxiety.

Anxiety decreases with the length of Internet use.

There is no link between anxiety and self-reported skills.

The Information Retrieval on the Web Anxiety Rate (IROWAR) scale will be useful in research on the determinants of Web anxiety in both educational and work environments.

*Keywords: web searching; information retrieval; retrieval tasks and goals; user characteristics; web anxiety; conative variables*

## INTRODUCTION

Searching for information on the web is viewed as a challenging task in terms of problem solving and self-regulation. Studies have shown that many people experience cognitive difficulties while retrieving information on the web, even though they do not have any problems with other media (Chen et al., 2016; Chevalier et al., 2015; Kammerer and Gerjets, 2014; Monchaux et al., 2015; Sendurur and Yildirim, 2015; White and Drucker, 2007). These difficulties may be related to cognitive processes such as planning, evaluating and controlling, as well as to cognitive flexibility, such that individuals become disoriented when browsing websites and adopt inefficient, lengthy search strategies with a low success rate. Regarding the cognitive variables that may impact information searching on the web, researchers have so far explored the impact of self-efficacy on retrieval activity and performance (Meyer and Rodon, 2004; Rodon, 2008). By contrast, there has been scant research on the affective processes involved in this activity. *Anxiety* is a key affective factor that could be a serious impediment to easy and unlimited access to information. Access to Internet content offers everyone increasingly attractive prospects and opportunities, but these appear to increase anxiety in some people (Chou, 2003; Wang, 2007, cited in Ekizoglu and Ozcinar, 2011). The purpose of the present study was thus to describe the construction and validation stages of the Information Retrieval on the Web Anxiety Rate (IROWAR) scale. This instrument is intended to allow researchers to investigate the impact of this specific form of activity-related anxiety on web search strategies, result expectations, actual performances and coping strategies, with a view to adapting user training and/or interfaces accordingly. We begin by describing the domain-specific usage approach we applied to the development of this new instrument.

### **1.1 From a general approach to a domain-specific one: previous development of computer and Internet anxiety measurement tools**

Ever since computer technology started to expand, researchers have devoted a great deal of attention to the negative impact of anxiety on both usage (avoiding or minimizing computer usage; see Brosnan, 1998, cited in Joiner et al., 2007) and performance (for online learning activities see, for example, Huang and Mayer, 2016). *Computer anxiety* has been defined as a state of heightened tension or a feeling of apprehensive expectation (Howard, 1986) and as an irrational anticipation of fear evoked by the thought of using (or actually using) computers (Cooper and Weaver, 2003). The cognitive expressions of this anxiety are negative thoughts and doubts about one's computer skills and the resulting negative behaviours include distractibility and avoidance of computer use (see Matsumura and George, 2004, cited in Ekizoglu and Ozcinar, 2010, 2011). Computer anxiety has mainly been conceptualized and measured according to general (or global) and multidimensional approaches encompassing equipment anxiety, learning about computers anxiety, computer message anxiety, observing computers anxiety and interactive computer learning anxiety (Brosnan and Thorpe, 2001; Heinszen et al., 1987, Marcoulides, 1989; McInerney and Sinclair, 1994; Sinkovics et al., 2002, cited in Wang, 2007; Thorpe and Brosnan, 2001).

The emergence of the World Wide Web gave rise to a more domain-specific approach and a new focus on *Internet anxiety*. This has been defined as a feeling that is triggered by the use of web technologies and more specifically as the fear or anxiety that may be experienced while using the Internet (Thatcher et al., 2007, cited in Ekizoglu and Ozcinar, 2010). Chou developed the Internet Anxiety Scale to complement the widely used Computer Anxiety Rating Scale (Heinszen et al., 1987; Lankford et al., 1994). For their part, Ekizoglu and Ozcinar (2011) developed a scale measuring student teachers' anxiety towards the Internet in terms of security anxiety, anxiety of using the Internet and following the latest trend and anxiety of Internet addiction. More recently, other dimensional or specific considerations regarding Internet anxiety have been addressed. Elhai and Hall (2016), for instance, tackled hacking anxiety (or electronic data breach anxiety), reflecting the emotional consequences of feared breaches of electronic data security. The authors referred to Chai and colleagues, who had earlier defined a similar construct they named *information privacy anxiety*, reflecting 'an individual's

cognitive assessment of his/her vulnerability and the possibility that an information privacy breach might occur' (Chai et al., 2009, p. 170).

Some authors have raised the question of whether Internet anxiety is the same as computer anxiety (Chou, 2003; Joiner et al., 2007; Presno, 1998). Although Internet anxiety shares some conceptual commonalities with computer anxiety, there is nonetheless a point at which the two types of anxiety diverge, with Internet anxiety having its own processes. In this regard, Ekizoglu and Ozcinar (2010) showed that there is a weak positive relationship between computer anxiety and Internet anxiety. Similarly, we can assume that there are degrees of conceptual commonality and divergence between Internet anxiety and anxiety relating to a specific usage of the Internet. In this regard, Wang (2007) validated a multidimensional (7-factor, 38-item) Mobile Computer Anxiety Scale, arguing that Palm-size mobile equipment (cellphones, personal digital assistants and smartphones) have ergonomic drawbacks that generate end-user anxiety. As for as Cowan and Jack (2010, 2011, 2014a, 2014b), they created a specific measure of user anxiety towards Wiki editing.

Regarding information retrieval on the web, this specific online activity consists in retrieving relevant information from the Internet's World Wide Web across all domains (leisure, health, work, etc.) whenever it is needed and from almost anywhere (via our fixed or mobile devices). This has been described as a challenging problem-solving task (Chen et al., 2016; Chevalier et al., 2015; Kammerer and Gerjets, 2014; Monchaux et al., 2015; S, endurur and Yildirim, 2015; White and Drucker, 2007). It involves specific operating and/or cognitive skills irrespective of the topics being searched, such as typing several keywords, trying several formulations on the search engines, using Boolean operators, using an advanced search mode and keeping to the initial goal search (Rodon et al., 2008; Monoi et al., 2005). Searching for information on the web also exposes users to a dynamic environment, where the system sometimes changes independently of their actions. Much information is easily accessible, but some may temporarily be unavailable. This lack of predictability and controllability may trigger anxiety specifically related to information retrieval on the web. Based on a case study by Presno (1998), searching for information in a maze-like cyberspace has been identified as one of the four sources of anxiety people have about the Internet in terms of not being at ease with limiting and narrowing searches, documents that are no longer accessible and various technical obstacles to find the desired website and feelings of frustration. The other three sources of anxiety identified by the author are Internet terminology anxiety, Internet time delay anxiety and general fear of Internet failure. Despite this, no instrument is yet available to measure and inform us about this type of anxiety related to information retrieval on the web. Therefore, in contrast to all existing computer and Internet anxiety measurement tools, we aimed to develop a short self-report measure that would allow anxiety related to the use of the Internet for information retrieval (or web searches) to be captured during actual use and/or the anticipation of having to use it, whatever the topic (e.g. football league, rheumatism or other diseases) and beyond actual personal procedural skills. The resulting instrument allows anxiety towards computers to be explored in a more up-to-date fashion, by identifying two major dimensions that are particularly closely linked to information searching on the web: somatic and cognitive. It also allows this anxiety to be probed for different websites, such that any given website can be remedied. This instrument will extend current research on anxiety on the web and its links to other variables of interest for the development of search engines and sites.

## **1.2 Conceptual reference for items describing anxiety related to information retrieval on the web**

We took items from the Burns Anxiety Inventory (Burns-A) to probe the specific activity of Internet searching. This general (i.e. non-specific) anxiety measure is one of the most widely used and well established instruments, both for research purposes and for the assessment of treatment outcomes (Brittain, 2004; Burns, 1993; Rabenhorst, 2000). Its general conceptualization of anxiety beyond a specific domain such as technology, computers or the Internet renders the items more transferable to particular activities (here, retrieving information from the web). Originally developed in English, it has since been translated into different languages and has been confirmed as having an internal consistency of 0.95 and a high correlation with the Anxiety subscale of the Symptom Checklist-90-Revised (Derogatis, 1975, cited in Ortuño-Sierra et al., 2015). Finally, the Burns-A classically considers different facets or manifestations of anxiety (Borkovek, 1976). It features 33

anxiety symptom items probing anxious feelings (6 items) such as 'anxiety, nervousness, fear or worry', anxious thoughts (11 items) including 'difficulty focusing or fear of being alone, being isolated from others or being abandoned' and physical symptoms (16 items) including 'pain, oppression or thoracic constriction', among others.

### 1.3 Links between web search anxiety and selected variables: hypothesis

For validation purposes, we examined several classic factors that have been investigated alongside computer and Internet anxiety.

#### 1.3.1 Self-efficacy

Eastin and La Rose (2000) defined *Internet self-efficacy* as the feeling of being able to successfully complete Internet actions and searches. The development of self-efficacy changes attitudes towards Internet searching and therefore levels of anxiety. According to sociocognitive theory, individuals who are able to search the Internet on their own, without the need for other-regulation seem less afraid and more engaged in action than people with lower self-efficacy (Bandura, 1986). Several studies have found that computer and Internet self-efficacy is negatively correlated (albeit weakly) with computer and Internet anxiety (Achima and Al Kassim, 2015; Brosnan, 1999; Durndell and Haag, 2002; Ekizoglu and Ozcinar, 2010). By contrast, Cazan et al. (2016) failed to observe a significant correlation between computer self-efficacy and Internet anxiety (Thatcher et al., 2007).

#### 1.3.2 Self-reported skills

Good computer skills bring about a reduction in computer anxiety and very positive attitudes towards the Internet, associated with longer periods spent on it (Durndella and Haag, 2002; Ozdamli and Uzunboylu, 2008, cited in Ekizoglu and Ozcinar, 2011). Cazan et al. (2016) showed that levels of anxiety towards computers and the Internet are lower among individuals who studied computer science at school.

#### 1.3.3 Attitudes

Anxiety should not be confused with negative attitudes. For example, computer anxiety is characterized as an effective response (Barbeite and Weiss, 2004, cited in Wang, 2007) alongside beliefs and feelings about computers that shape attitudes towards this technology (Heinssen et al., 1987). Despite their conceptual distinction, we expected our scale to reveal an inverse relationship between anxiety and attitude, as studies have shown just such a relationship between positive attitudes towards computers and the Internet and computer and Internet anxiety levels (Ekizoglu and Ozcinar, 2010).

#### 1.3.4 Practice level or Internet experience

Different levels of experience with computers and the Internet have been gauged in terms of the overall amount of time spent online, frequency, specific usages and training.

Studies with different samples have shown that computer anxiety is associated with lower Internet use and less time spent online (Barbiete and Weiss, 2004, cited in Joiner et al., 2007; Chou, 2003; Durndell and Haag, 2002; Jackson et al., 2001). More specifically, computer anxiety is negatively linked to computer use ( $r = -0.39$ ), intention to use computers ( $r = -0.26$ ) and weekly computer and Internet usage time (Chou, 2003; Joiner et al., 2007). If the source of anxiety is external,

an inverse relation may be observed. For instance, in the case of *cyberchondria*, Muse et al. (2012) showed that individuals with the highest level of health anxiety most frequently search for health information and spend more time on the Internet.

Research has also highlighted a negative relationship between computer experience and anxiety, with less Internet experience correlating with more anxiety during Internet searching. Moreover, computer expertise appears to be associated with low levels of anxiety (for a meta-analysis, see Chua et al., 1999). The meta-analysis by Maricutoiu (2014) suggested that computer anxiety can be reduced by training. Learning how to use a computer has direct positive effects on computer anxiety and negative attitudes towards the Internet (Cazan et

al., 2016). These authors showed that studying computer science at university is associated with a lower level of computer anxiety. There is a positive relationship between computer skills and Internet proficiency (Schumacher and Morahan-Martin, 2001).

### 1.3.5 Gender differences

Gender is another demographic variable that is frequently studied in relation to computer anxiety, although results are inconsistent (Chou, 2003). Meta-analyses on gender differences indicate that women have higher anxiety, including computer anxiety (Cowan and Jack, 2014a,b). Some studies have reported that women's Internet anxiety is significantly higher than men's (Chou, 2003; Joiner et al., 2005, 2007; Sun, 2008), but many others have observed no such difference (e.g. Jones and Wall, 1989, cited in Chou, 2003). This difference has been found to be based on Internet experience and frequency of use (Ekizoglu and Ozcinar, 2010), with men having much more experience than women, insofar as they spend much more time on the Internet (Joiner et al., 2005). Schumacher and Martin (2001) concluded that because men spend more time on the Internet than women, they are more relaxed about using computers.

### 1.3.6 Age

Age is a variable that is frequently studied with regard to computer anxiety (Chou, 2003).

There may be a non-linear relationship between the two. Studies on a broad age range have found that younger individuals feel much more anxiety than older ones (Rosen and Weil, 1995a, cited in Chou, 2003). Youth anxiety is affected by their low level of experience and that of older individuals by diminished cognitive skills, familiarity with computer skills and the ability to adapt to change (Chua et al., 1999; Kubiak et al., 2011; Parasuraman and Iqbaria, 1990, cited in Cazan et al., 2016). Nonetheless, caution should be exercised regarding inferences drawn from studies conducted in the 1990s, as computers were very different back then and the Internet was still in its infancy.

## 1.4 Aims of study

In the present study, we developed the IROWAR and tested its construct validity among English-speaking Internet users. One goal was to ensure its reliability and explore its factorial structure. We also assessed the relationships between the IROWAR's latent factor (situational anxiety regarding the use of the web to look for information or search for documents) and relevant external (criterion-related) variables.

## 2. METHOD

### 2.1 Item development

As we mentioned in the Introduction, the Burns-A served as the conceptual basis for developing our new tool to measure anxiety related to information retrieval on the web. We ensured that each new item took the form of a complete sentence (unlike the original Burns-A items), as we wanted all the research questionnaire measures to have a homogeneous appearance (see 'Measures' subsection). In this regard, when we reviewed existing anxiety scales, both general and specific, including the Internet Anxiety Scale (Chou, 2003), we noticed that the terms *concerned*, *worried*, *afraid* and *fear* were commonly and consistently used to describe the experience of anxiety. We therefore used these in our sentence starters, ensuring that they were evenly balanced across the cognitive items of the IROWAR scale (see Table 1). Some Burns-A items (e.g. 'sense of impending doom', 'sudden, unexpected panic spells' and 'frightening fantasies or daydreams') were omitted because they were either inappropriate or too extreme, given that we wanted to measure regular and non-pathological Internet search activity. Additionally, Burns-A Items 1 and 2, which refer to concentration skills, were adapted to Internet search activity (IROWAR Items 1 and 2), in view of the massive amount of content and its dynamic nature on the web (see reference to a *maze-like cyberspace* by Presno, 1998). Burns-A Items 10 and 11 relating to the anxiety of

losing control were conflated and transformed in terms of Internet addiction (IROWAR Item 3; see Ekizoglu and Ozcinar, 2011). Other Burns-A items linked to the social dimension of anxiety (*foolish, inappropriate, isolated, fear of criticism*) were used to form IROWAR Items 4, 5 and 6. Finally, we drew on the Burns-A items probing regular and minor or moderate symptoms (i.e. no extreme ones such as ‘diarrhoea’ or ‘smothering sensation’ evoking phobia or panic disorder) to form the somatic IROWAR items. These dealt with the physical discomfort related to Internet searching, such as a racing heart, sweating, headache, neck pain, stiff back and tiredness. The final version of the IROWAR consisted of 12 statements (thoughts/cognitive level and symptoms/somatic level) that respondents rated on a 4-point Likert-like scale ranging from *False* to *True* (see Table 2) to indicate how they generally felt about searching for information on the web.

**TABLE 1.** Parallel analysis factoring with varimax rotation on the 12 items of the IROWAR: factor loadings and communalities.

Items	First factor loadings	Second factor loadings	Final communalities	
Cognitive level	1	0.056	<b>0.595</b>	0.597
	2	-0.029	<b>0.844</b>	0.319
	3	-0.141	<b>0.790</b>	0.507
	4	0.112	<b>0.712</b>	0.371
	5	0.050	<b>0.624</b>	0.565
	6	0.285	<b>0.616</b>	0.300
Somatic level	7	<b>0.908</b>	-0.006	0.182
	8	<b>0.836</b>	0.039	0.263
	9	<b>0.927</b>	-0.043	0.195
	10	<b>0.709</b>	0.157	0.321
	11	<b>0.721</b>	-0.039	0.517
	12	<b>0.703</b>	0.027	0.479
Explained variance	35	26.5		
Total variance explained (%)		61.5		

**TABLE 2.** All 12 items of the IROWAR scale.

Instrument introduction

How do you generally feel about searching information on the Web? Please read carefully each following statements and indicate the degree to which it applies to you (tick the answer which describes you best).

Responses rating scale

False; rather false; rather true; true

Items

Thoughts (cognitive level)

1. Regarding information search on the Web, I feel concern about being overwhelmed, like drowned in an ocean of information.
2. As the content of the Web is always changing, moving of location, or not available permanently it worries me.
3. I feel worried about becoming or already being kind of addicted to the Web for acquiring more and more information or knowledge.
4. I am afraid of looking foolish or inadequate in front of others regarding the way I search for information on the Web.
5. It makes me worry I would be quickly putting apart or feeling isolated if I did not use the Web to upgrade my knowledge or information.
6. I fear criticism about my information retrieval outcomes.

Symptoms (somatic level)

7. I feel physical discomfort before searching on the Web.
8. When I search for information on the Web my heart is racing.
9. While searching information on the Web I am sweating.
10. Looking for information on the Web causes me a headache.
11. For me, search for information on the Web is associated with pain in the neck or tension in the back.
12. I get tired because of Web interrogation session.

The final study sample ( $N = 183$ ) was extracted from 223 Internet users who had completed the IROWAR. Those individuals who had only filled in part of this computerized self-administered questionnaire were removed from the sample ( $n = 11$ ). Given the variety of countries represented by the participants, we only retained Internet users who reported that they had been born and raised and/or were a citizen of the United States, Canada, the United Kingdom or Australia.

These respondents had to meet the further criterion of having advanced, proficient or native English skills, to ensure consistent language comprehension. Participants in the final sample group proved to be mainly students (84.2%), aged 15–68 years ( $M = 22$ ,  $SD = 9.46$ ) and mainly female (60.7%). Regarding education level, 83% of the final sample group had no university degree. Lastly, 89% reported using the Internet for 5 years or more on at least a weekly basis and 95.6% of these participants used it every day.

### 2.3 Protocol

Internet users were recruited through standardized emails disclosing the professional identity, academic affiliation and contact details of the authors, in compliance with netiquette ruling on emailing. These emails also provided very general information about the purpose of the research (understanding people's relationship with the Internet). Participants were requested to complete the questionnaire at once, without pausing (duration: approx. 5 minutes). Finally, participants were asked to kindly forward the email to their own contacts (family, friends, classmates, colleagues, associates). Internet users could access the online questionnaire survey by clicking on a hyperlink. Answers were automatically and anonymously recorded, as guaranteed to the participants. They did not receive any incentive for taking part.

### 2.4 Measures

The discriminant validity of the instrument was assessed using a research questionnaire that had been validated with English-speaking Internet users, including some from the US (Rodon and Meyer, 2018). This questionnaire includes a measure of self-efficacy that yields information about the value attributed by individuals to their ability to organize and execute information searches on the Web: the 8-item Information Retrieval On the Web Self-Efficacy (IROWSE) scale ( $\alpha = 0.87$  in the current study, similar to its previous validation). It also includes a 13-item measure of self-reported Internet search skills ( $\alpha = 0.72$  in the current study, similar to its previous validation) and a measure of general attitude towards the Internet via three positive and three negative items ( $\alpha = 0.56$ ). All these measures were rated on a 4-point Likert-like scale ranging from 1 (*False*) and 2 (*Rather false*) to 3 (*Rather true*) and 4 (*True*). Levels of experience with the Internet were measured in terms of length of Internet use (less than 6 months, 6–12 months, 1–2 years, 2–5 years, 5–10 years, more than 10 years) and frequency of Internet use (several times a day, once a day, several times a week, once a week, several times a month, once a month). Additionally, by recording respondents' specific online activities (never, sometimes, regularly), such as information retrieval, online shopping, downloading, communication and entertainment activities, we were able to consider their experience of using the Internet at a more specific level. Finally, we looked for gender and/or age effects.

### 2.5 Data analysis

We ran the data analyses with SPSS and AMOS software. We used the mean substitution method to replace eight missing data values. We then tested the IROWAR to determine its intrinsic psychometric properties and assess its criterion-related validity. First, reliability was explored by examining the results of principal axis factoring (PAF) jointly with split-half test analysis and internal consistency (Cronbach, 1951). We then addressed the factorial structure of the IROWAR as that of an original instrument. We began by running Bartlett's sphericity test and the Kaiser-Meyer-Olkin (KMO) test of sampling adequacy, to ensure data factorability for confirmatory factor analysis (CFA). We used the unweighted least squares (ULS) estimation method, as suggested by Browne



(1982, cited in Heeren et al., 2011), as the data did not justify the assumption of multivariate normality (Lubke and Muthén, 2004). We applied the following fit indices to the second-order model with the two latent factors (cognitive and somatic anxiety) we tested: goodness of fit index (GFI), adjusted goodness of fit (AGFI), parsimony goodness of fit index (PGFI), parsimony ratio (PRATIO) and root-mean-square residual (RMR).

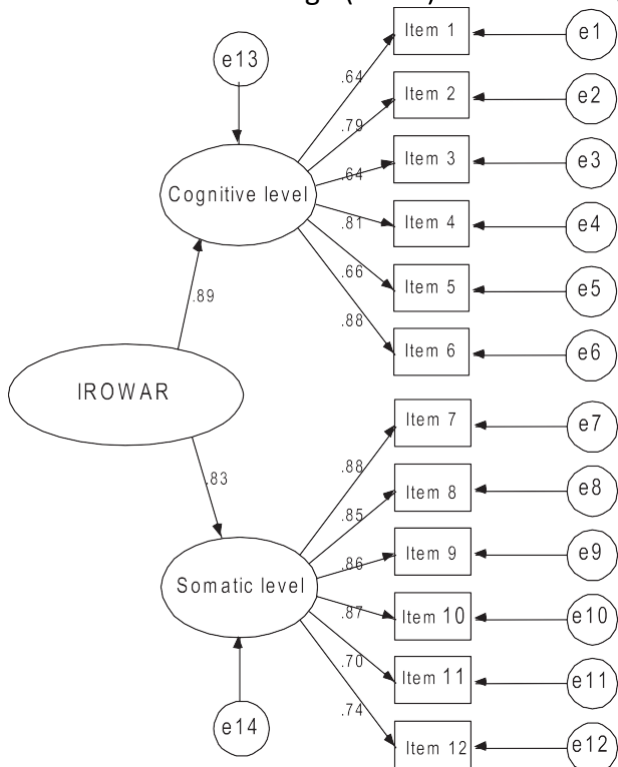
Next, we tested the IROWAR’s criterion-related validity in two steps. First, we ran Spearman correlation tests to assess the relationships between the IROWAR item sum scores and those of self-efficacy, self-reported skills and attitudes in this specific Internet-domain activity. We computed analyses of variance (ANOVAs) with experience levels (length and frequency of use and specific frequency of online activities), gender and age as between-participants factors, after we had checked the assumption of normality distribution for the instrument. Levene’s test confirmed that the assumption of equality of variance (homogeneity) for each category of each independent variable ( $P > 0.05$ ) was met, to ensure robust  $F$  tests when analysing the Likert scale ratings (Carifio and Perla, 2007). For all ANOVAs, Tukey’s HSD was used for *post hoc* pairwise comparisons.

### 3. RESULTS

#### 3.1 Intrinsic psychometric properties

##### 3.1.1 Exploratory factor analysis

We conducted exploratory factor analyses using the PAF extraction method with varimax rotation to assess the scale’s two dimensions (somatic and cognitive). The PAF on all 12 items identified two factors which, together, explained 62.5% of the total variance—regarded as a satisfactory level in the social sciences (see Hair, 2014, on the acceptable minimum explained variance in factor analysis). The first factor we identified corresponded to somatic anxiety (i.e. physical feelings of anxiety) and the second to cognitive anxiety (i.e. mental load, fear of dependence and negative anticipation of searching). Loadings ranged from 0.671 to 0.849 for the somatic anxiety factor and from 0.565 to 0.778 for the cognitive anxiety factor which were satisfactory since above the accepted threshold of 0.40. This threshold is commonly used in the literature (Henson and Roberts, 2006), although it is still subject to debate (Howard, 2016). Except for Item 6 (cognitive level) which had a first factor loading of 0.505 and a second of 0.659, none of the items loaded highly on more than one factor. Final communalities were high ( $>0.60$ ) to moderate ( $>0.40$ ), which is acceptable and does not necessarily require



**FIGURE 1.** CFA second-order model with latent cognitive and somatic factors tested on the 12 items of the IROWAR.

items to be removed. Similarly, the scree plot displaying the eigenvalues and the breakpoint in the data indicated that the scale had a two-factor structure (eigenvalue >1; (Costello and Osborne, 2005). In addition, a parallel analysis of the data supported the claim of two underlying factors (see Table 1). As the other values were consistent (see ‘Internal reliability’ subsection below), we were justified in keeping all 12 items in the instrument.

Data factorability was supported by a significant Bartlett’s sphericity test ( $\chi^2 = 1545.695, P < 0.001$ ) and a high KMO test value of sampling adequacy (0.910) exceeding the minimum recommended value of 0.60 (Tabachnick and Fidell, 2007).

### 3.1.2 Internal reliability

Cronbach’s alpha values were 0.92 for all 12 items, 0.87 for the first factor and 0.91 for the second factor. Eliminating some items would not have increased these alphas. Similarly, split- half reliability tests were satisfactory: a correlation of 0.67 between the groups, a Spearman-Brown coefficient of 0.80 and a Guttman split-half coefficient of 0.80.

### 3.1.3 Confirmatory factor analysis

The ULS estimation method yielded fit indices for a second- order model with two latent factors (cognitive and somatic anxiety; Fig. 1) that were highly satisfactory (see Table 3). The

TABLE 3. Fit indices.

Models	Df	GFI	AGFI	PGFI	PRATIO	RMR
Default	53	0.991	0.986	0.673	0.803	0.04

GFI and AGFI had values close to 1, indicating a perfect fit and the PGFI exceeded the 0.60 value. The PRATIO was also above 0.60, which is generally considered satisfactory (Heeren et al., 2011). Lastly, the RMR value was close to zero, suggesting a good fit (Schermelleh-Engel et al., 2003).

## 3.2 Criterion-related validity

### 3.2.1 Correlation analysis

We wanted to assess how anxiety (IROWAR) was related to self-efficacy (IROWSE), self-reported skills and attitude in this specific domain of Internet search activity, on the basis of their respective item sum scores. Spearman correlations were calculated. We found a significant negative correlation coefficient between the IROWAR and IROWSE, with a value of  $-0.37 (P < 0.001)$  indicating a divergent relationship consistent with the conceptual relationship between anxiety and self-efficacy.

As expected, results also indicated a significant negative relationship between the IROWAR and general positive attitude towards the Internet ( $r = -0.30, P < 0.001$ ). The correlation with self-reported skills for retrieving information on the Web was not significant ( $r = -0.10$ ).

### 3.2.2 ANOVAs

As the sample was normally distributed, we ran ANOVAs on the IROWAR for experience levels (length of use, frequency of use and specific frequency of online activities), gender and age as between-participants factors. For the relationship between the IROWAR and Internet experience, the significance level was set at  $P < 0.10$ , which is a convenient and commonly accepted threshold for preliminary validation or pilot studies, especially in

the social sciences (for arguments for going beyond the threshold of  $P < 0.10$ , see [Betensky, 2019](#); [Wasserstein et al., 2019](#)). Effect sizes were small to medium (partial  $\eta^2$ ). Results indicated that the level of Internet search anxiety, as measured with the IROWAR scale, decreased with both length and frequency of Internet use (see [Table 4](#)). Tukey's HSD was significant for the comparisons between the lowest length of Internet use (less than 6 months) and the two highest levels (5–10 years and more than 10 years,  $P = 0.08$  and  $P = 0.04$ ) and between the lowest and highest levels of Internet use frequency ( $P = 0.04$ ). The ANOVAs failed to reveal a significant relationship between the IROWAR sum-score and the frequency of either Internet searching,  $F(2, 182) = 1.168$ ,  $P = 0.313$ , online communications,  $F(2, 181) = 0.361$ ,  $P = 0.69$ , downloading,  $F(2, 182) = 0.036$ ,  $P = 0.96$ , entertainment,  $F(2, 179) = 0.881$ ,

**TABLE 4.** Summary of ANOVAs on the 12 items of the IROWAR with length and frequency of Internet use and Tukey's HSD.

Experience variables									
Length of Internet use:				Less than 6 months	6–12 months	1–2 years	2–5 years	5–10 years	More than 10 years
<i>F</i> (4,182)	<i>P</i>	Partial eta-squares	Counts	3			5	130	162
2.306	0.06	0.049	Means	31.7 <sup>a</sup>	24.0		19.5	20.0 <sup>b</sup>	18.50 <sup>a</sup>
			SD	13			7.31	7.72	7.79
Frequency of Internet use:				Several times a day	Once a day	Several times a week	Once a week	Several times a month	Once a month
<i>F</i> (3,182)	<i>P</i>	Partial eta-squares	Counts	3	1		16	87	76
2.387	07	0.038	Means		19.3 <sup>a</sup>		20.1	20.8	31.3 <sup>a</sup>
			SD		17.8		5.87	8.79	7.58

<sup>a</sup>Indicates the significant differences between means to the threshold  $P < 0.05$ .

<sup>b</sup> $P < 0.10$  according to the tests of Tukey HSD.

$P = 0.42$ , or e-shopping,  $F(2, 178) = 0.398$ ,  $P = 0.67$ .

Finally, gender had no effect on the total IROWAR score,  $F(1, 180) = 0.001$ ,  $P = 0.99$  and nor did age,  $F(28, 176) = 0.768$ ,

$P = 0.79$ .

#### 4. DISCUSSION

Studies have shown that people experience adjustment difficulties and anxiety generated by rapid changes in computer applications and the potential of the Internet. The IROWAR is an original scale for measuring situational anxiety specifically related to the use of the Internet for information retrieval (i.e. actual use and/or anticipation of having to use it). Regarding the IROWAR's psychometric qualities, its 12 items had good fit indices, with two factors explaining 62.5% of the total variance ( $\alpha = 0.92$ ). Satisfactory CFA fit indices supported the two-factor structure, which allowed two dimensions of anxiety to be measured: somatic and cognitive. The first factor ( $\alpha = 0.87$ ) identified the physical feelings of anxiety (body tension, racing heart, sweating, pain, fatigue), while the second factor ( $\alpha = 0.91$ ) identified the negative cognitions related to anxiety (mental load, fear of dependence, negative anticipation of searching). Item 6 ('I fear criticism about my information retrieval outcomes') deserves mention on account of its loading on both the first factor (0.505) and the second factor (0.659). The results of our CFA did not, however, indicate that this item should be deleted. There is no obvious explanation for this double loading, except that the specific fear of criticism lies at the

cognitive-somatic interface.

Regarding criterion-related validity, as expected, Spearman correlation coefficients showed a divergent relationship of anxiety (IROWAR) to self-efficacy (IROWSE), as well as to positive attitude towards the Internet, consistent with their conceptual relationships. Interestingly, we also found that in the specific activity of retrieving information from the web, self-reported skills and anxiety were not significantly linked, even though a negative relationship had been demonstrated in the general domain of the Internet and computer technology (Cazan et al., 2016; Durndella and Haag, 2002; Ozdamli and Uzunboylu, 2008). We also ran ANOVAs to explore *the relationships between anxiety and experience*. Results indicated that Internet search anxiety measured with the IROWAR scale moderately decreased (small to medium effect size) with length of use ( $P = 0.06$ ). In other words, anxiety levels were slightly higher among Internet newbies.

Anxiety was also moderately associated with less frequent use ( $P = 0.07$ ), although this does not tell us whether anxiety is more the consequence or the source of infrequent use. In any event, both these results are consistent with those of Joiner et al. (2007) on the inverse relationship between anxiety and self-reported Internet use. In our sample, experience with specific types of Internet usage, such as Internet searching, online communications, downloading, entertainment and e-shopping, made no significant contribution to reducing anxiety. This result is consistent with the absence of a significant correlation with self-reported skills, insofar as specific usages may also reflect specific search skills.

One modest explanation for the present set of results is that while Internet literacy might be expected to reduce activity-related anxiety, it does not entirely eradicate it. In this regard, Ekizoglu and Ozcinar (2010) argued that there are several different factors for Internet anxiety. For example, as new Internet applications and technologies continue to emerge, individuals cannot rely on their basic Internet skills and are expected to regularly develop new ones. Hence, any impediment to a feeling of personal mastery or a perceived lack of control may create or foster users' anxiety. Moreover, Internet use exposes individuals to risks like viruses and spyware, which make them anxious when using the Internet for banking transactions, gambling, shopping and so on.

Finally, there were no effects of gender or age on IROWAR sum scores. We can surmise that age was not a significant variable because of the highly skewed distribution towards the mean of 22 years, despite the wide age range of 15–68 years. Another explanation is that the youngest users today are much less anxious than they were in the 1990s, owing to the widespread use of computer and Internet technologies.

#### 4.1 Limitations

Although our sample was large enough ( $N = 183$ ) to run factorial analyses in this initial validation study, an even larger one (300–1000) would have been needed to meet the criteria proposed by Williams et al. (2010). However, it appears that when commonalities are high (above 0.60) and the factor is defined by more than four items, as it was in the current study, sample sizes can actually be relatively small (Henson and Roberts, 2006). With 12 items for two factors and commonalities close to the recommended value or higher, size criticisms are less justified here. Nonetheless, sample limitations in terms of size and snowball recruitment should be taken into consideration. The current findings need to be replicated in a new study with a larger and more diversified sample. One particular limitation of our sample is that it contained only a few people with low length and frequency of Internet use. One goal will be to achieve stronger significance and a greater effect size when running ANOVAs to explore selected variables such as age and gender.

#### 4.2 Continuations

Future studies should continue to test the properties of this instrument in different cultural contexts and among different Internet users with different profiles.

While ascertaining the levels of stress or anxiety that individuals experience regarding information retrieval on the Web is obviously interesting in itself, it is also important to look at the processes that users implement to

manage a situation they perceive to be stressful or anxiety-provoking, referring for example to the coping model developed by Lazarus and Folkman (1984, cited in [Hellemans, 2004](#)). The latter identified several ways of understanding how stress emerges, is maintained and overcome by individuals in a specific situation (coping strategies), by studying their cognitive and behavioural reactions (or efforts). Analyzing the dynamics of interactions over time between anxiety and web searching is one of our research perspectives. In particular, we could take our work further by exploring the impact of anxiety about retrieving information on the web on Internet users' performance expectations. Previous results yielded by a paradigm for estimated and actual performance on the web for fact-finding tasks (questions) in different domains of knowledge and levels of difficulty ([Rodon and Meyer, 2012](#)) indicated that participants overestimated completion durations, thus contradicting a classic planning fallacy ([Buehler and Griffin, 2003](#); [Buehler et al., 1994](#); [Kahneman and Lovallo, 1993](#)). One possible explanation is that self-regulation took place in a pessimistic-defensive mode triggered by situational anxiety ([Norem and Cantor, 1986a, 1986b](#); [Norem and Illingworth, 2004](#); [Showers, 1992](#)). The IROWAR would make it possible to consider anxiety as a factor for pessimistic predictions of search completion times in this specific Internet domain.

At a more general level, future studies could improve current knowledge about the anticipation and self-regulation (motivational, cognitive) of Internet users when they seek to inform themselves using the web. We could explore how far self-regulation in a pessimistic mode regarding anticipated completion duration can encourage, rather than discourage, commitment to self-documentation behaviour on the web. This is of a particular interest, for example, when applied to web searches for health information, as it could then be used to promote or reduce health self-monitoring.

## 5. CONCLUSION

By combining the results of the EFA and CFA with its basic theoretical underpinning, our study makes a good first contribution to understanding and measuring the specific form of Internet anxiety related to information retrieval on the web. A promising, validated instrument, the IROWAR will be useful for investigating the determinants of web anxiety and the characteristics of individuals' web anxiety. In the current study, we used the IROWAR to demonstrate that Web search anxiety is real, for while the majority of participants had little or no anxiety, 31.7% of participants exhibited moderate anxiety and 26.2% high anxiety. This instrument provides a more up-to-date means of examining anxiety towards computers, by identifying two major dimensions (somatic and cognitive) of the anxiety specifically triggered by information retrieval on the Web. Although it is a short scale, the IROWAR can probe this anxiety not only for different search topics on the web, but also for different websites or search engines. It could therefore be used to determine the adjustments required to reduce the anxiogenic characteristics that have been identified.

Beyond the research field, the IROWAR will have applications in both educational and work environments. It will be useful in schools and libraries with an interest in Internet literacy and for Internet-based learning programs and learning by web-searching play ([Kao and Chien, 2017](#)). For instance, the IROWAR can tell us about the positive outcomes or negative side effects of web search learning sessions. This instrument could also be useful to companies seeking to improve the way they manage technologies (e.g. knowledge management), by helping to explain any gaps between the potential offered by information technology and its actual use (disuse situations).

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