Psicothema

The Role of Meta-Cognitive Certainty on Pornography Consumption

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Abstract

Background: The Problematic Pornography Use Scale (PPUS) was originally designed to help predicting pornography consumption. Despite the frequency with which this scale is used in the scientific literature, there is still relatively little evidence regarding the predictive validity of this important instrument. This current research introduces a construct capable of improving the ability of the scale to predict pornography consumption (meta-cognitive certainty). **Method:** Over two studies, participants completed the PPUS and the meta-cognitive certainty in their responses to the scale was measured (Study 1) or manipulated (Study 2). Self-reported porn consumption was the criterion measure in both studies, with an additional actual overt behavior relevant to consumption of porn included in Study 2. **Results:** As expected, the PPUS significantly predicted porn consumption, confirming the predictive validity of the scale. More importantly, meta-cognitive certainty was capable of moderating the extent to which scores on the PPUS could predict porn consumption, with greater consistency between the PPUS and reported behavior from those with high (vs. low) meta-cognitive certainty. **Conclusions:** These data suggest that considering meta-cognitive certainty may be useful for predicting when the link between the PPUS and porn consumption is stronger.

Keywords: Problematic Pornography Use Scale; pornography consumption; individual differences; meta-cognition; certainty; confidence.

Resumen

El Papel de Certeza Metacognitiva en el Consumo de Porno. **Introducción:** la Escala Problemática de Uso de Porno (EPUS) fue diseñada para predecir consumo de pornografía. A pesar de la frecuencia con la que es utilizada en la literatura científica, hay aún relativamente poca evidencia con respecto a la validez predictiva de este importante instrumento. La presente investigación introduce un constructo capaz de mejorar la habilidad de la escala para predecir el consumo de porno. **Método:** en dos estudios, los participantes completaron la EPUS y la certeza meta-cognitiva en sus respuestas a la escala fue medida (Estudio 1) o manipulada (Estudio 2). El consumo de porno auto-informado fue la variable dependiente en ambos estudios, con una medida conductual adicional en el Estudio 2. **Resultados:** de acuerdo con las predicciones, la EPUS predijo significativamente el consumo de porno, confirmando la validez predictiva de la escala. De mayor relevancia, la certeza meta-cognitiva moderó hasta qué punto la EPUS podía predecir el consumo de porno, con mayor consistencia entre la EPUS y la conducta informada para aquellos con alta (vs. baja) certeza meta-cognitiva. **Conclusiones:** estos datos sugieren que considerar la certeza meta-cognitiva puede ser útil para predecir cuándo la conexión entre la EPUS y el consumo de porno es más fuerte.

Palabras clave: Escala de Uso Problemático de Porno; consumo de porno; diferencias individuales; metacognición; certeza; confianza.

The past few decades have seen a trend towards increased consumption and societal acceptance of pornography. This trend may have contributed to an increase in self-reported problematic pornography use, including what some have labeled "pornography addiction" (D'Orlando, 2011). Various conceptualizations about what constitutes problematic porn use and related behaviors (e.g., cybersex) have been proposed, and their clinical implications have been documented (e.g., Schneider, 2000). Studies have shown that consuming porn may be associated with several potentially negative (Stack et al., 2004; Yoder et al., 2005) and positive (Hald & Malamuth, 2008; Paul & Shim, 2008) consequences for porn users.

Given this variety of potential consequences of porn consumption, the Problematic Pornography Use Scale (PPUS; Kor et al., 2014) was developed to provide researchers with a relevant instrument capable of predicting individual differences in porn consumption. To date, most research has focused on identifying variables related to both the person and the context that are capable of affecting responses to the scale (e.g., Allen et al., 2017; Borgogna & McDermott, 2018). However, relatively less work has studied the consequences associated with the responses to the scale. In fact, only the original research has tested this instrument's capability of predicting the frequency of pornography consumption (see Kor et al., 2014). Thus, the first goal of the current research is to contribute to this literature by providing convergent evidence regarding the predictive validity of this scale. More specifically, we aim to test the extent to which the PPUS can predict behavior related to porn consumption using both self-reports of past behavior and actual behavioral measures.

In addition to showing the association between the PPUS and subsequent pornography consumption, the current research seeks to specify under which conditions and/or for which people this relationship is stronger. To accomplish this goal, we turn to meta-cognitive certainty.

A growing literature suggests that to better predict behavior from mental constructs, one must also consider the certainty with which such mental construct is held. Mental constructs are more predictive of judgment and behavior when people report holding their mental constructs with high (vs. low) confidence and/or certainty (Petty et al., 2007). For example, attitude certainty has been shown to moderate the correspondence between attitudes and behavior as illustrated by research on attitude strength (Petty & Krosnick, 1995). Similarly, thought certainty can moderate the correspondence between relevant thoughts and judgments as illustrated by research on the self-validation hypothesis (Petty et al., 2002). Certainty refers to the subjective sense of conviction one has about one's mental content, or the extent to which one believes one's mental content is correct or valid (Petty et al., 2007). Certainty can also be considered as a meta-cognitive tag on an attitude that reflects a secondary assessment (i.e., "Is my evaluation correct?") of a primary cognition (i.e., the evaluation itself; Petty & Briñol, 2006).

Beyond attitudes and thoughts, recent literature indicates that the predictive utility of certain individual-difference scales can be increased by adding measures of meta-cognitive certainty in such scales. For example, Shoots-Reinhard et al. (2015) demonstrated that individual-difference scores in the Need to Evaluate scale (NE, Jarvis & Petty, 1996) and in Political Ideology (Vitriol et al., 2019) were more predictive of relevant outcomes when people reported having relatively high (vs. low) meta-cognitive confidence in their dispositions (see also Paredes et al., 2020).

In sum, prior research has revealed that meta-cognitive certainty is capable of moderating various constructs ranging from political ideology (Shoots-Reinhard et al., 2015), to individual-difference variables such as identity fusion (Paredes et al., 2020). Additional evidence has also suggested that higher certainty in responses to personality tests leads to greater consistency in responses (Koriat et al., 2020). Considering these findings, the current studies examined for the first time whether meta-cognitive certainty in one's responses to the PPUS can moderate the relationship between the PPUS and porn consumption.

Although the prediction that certainty will moderate the impact of the PPUS on porn consumption is based on accumulated evidence on meta-cognitive certainty, it might appear somewhat paradoxical given that many behavioral problems tend to be associated with insecurity. Therefore, increasing certainty is often proposed as a useful strategy to mitigate those problematic behaviors (Resnick & Rosenheck, 2008). Unlike relatively intuitive frameworks for which confidence is seen as a predictor and/or precursor of positive outcomes such as recovery (e.g., type of framework; Resnick & Rosenheck, 2008), we propose that confidence has the potential to magnify the effect of any variable, at least when it operates by validating mental constructs (Paredes et al., 2020), resulting even in enhanced negative outcomes like greater aggressive behavior (see Santos et al., 2019).

Additionally, if consuming porn has a compensatory nature, it is possible that lower rather than higher levels of certainty could be associated with more predictive power of the PPUS. In line with this reasoning, consider the work of Baumeister et al. (1993) on certainty in self-esteem and aggression. The authors found that if people have meta-cognitive doubts in their (high) self-esteem (e.g., because their self-esteem happens to be unstable or unclear), they can exhibit extreme behaviors such as those related to aggression (Baumeister et al., 1993). In sum, we acknowledge

that although there are some possible reasons to expect that low certainty could enhance scale prediction, our hypothesis was based on the dominant finding in the literature that certainty in individual difference measures would enhance behavioral prediction.

As noted, the goal of the present research is to consolidate the predictive validity of the PPUS (Kor et al., 2014) and to provide a simple means to predict when the relationship between this scale and porn consumption will be stronger. In a nutshell, we test the hypothesis that increased meta-cognitive confidence in one's responses to the scale results in increased predictive validity of the scale. Specifically, we predict that the PPUS will be associated with porn consumption to a greater extent as participants are more certain in their responses to the scale.

The first goal of the present research was to consolidate the association between the Problematic Pornography Use Scale (Kor et al., 2014) and subsequent porn consumption. Most importantly, the aim of this research was to examine whether meta-cognitive certainty could make this effect even stronger. Study 1 examined to what extent measuring meta-cognitive certainty in the PPUS can contribute to specifying when the relationship between the PPUS and a self-report measure of porn consumption will be stronger or weaker. Study 2 was designed to replicate this potential effect by manipulating certainty rather than measuring it. Additionally, Study 2 included a more behavioral measure of porn consumption. As noted, we predicted that meta-cognitive certainty would moderate the ability of the PPUS to predict porn use across studies: the greater the certainty, the stronger the link between the PPUS and porn consumption.

Study 1

The goal of this study was to (1) provide convergent evidence of the link between PPUS and porn consumption, and (2) test for the first time whether meta-cognitive certainty in scale responses would moderate the predictive power of the scale. First, participants responded to the PPUS, then reported the extent to which they were certain about their responses to the scale (meta-cognitive certainty). These two variables and their interaction served as predictors of porn consumption. Participants' reports of their recent behavior were assessed and served as the criterion measure. Retrospective reports of behavior, although not perfect, tend to be well-correlated with overt behavior, particularly for behaviors that are more readily observable (Gosling et al., 1998). Based on past research, we expected that as participants' certainty in their answers to the PPUS increased, so too would the correspondence of these responses with participants' reported porn consumption.

Method

Participants

Two hundred and sixty-eight undergraduate students (30.1% males) from Universidad Complutense de Madrid, participated anonymously in this study. Participants were recruited in exchange for extra credit in one of their courses. The age of the participants ranged from 18 to 34 (M_{age} = 20.14, SD = 1.49). The PPUS and meta-cognitive certainty were measured as predictor variables and porn consumption was measured as the criterion variable. A power analyses was conducted using G*Power (Faul et al., 2007). Because no prior research had examined the predicted interaction

between the PPUS and meta-cognitive certainty, we were unable to obtain an estimated effect size from the literature. Thus, we planned for a generic relatively small effect (Cohen's $f^2 = .03$; Cohen, 1988). The results of the power analysis concluded that the desired sample size for a two-tailed test ($\alpha = .05$) of the predicted two-way interaction with .80 power was N = 264 participants. In the end, we exceeded this recommendation slightly by obtaining N = 267 participants.

Procedure

Participants were provided with a brief passage that described the experiment as a study on scale validation. Participants first completed the Problematic Pornography Use Scale (Kor et al., 2014). Next, participants reported their certainty in their responses to the scale. Participants then reported the number of times they had consumed porn in the last month, which served as our criterion measure. Participants were then debriefed, thanked and dismissed.

Instruments

Predictor Variables

Problematic Pornography Use Scale (PPUS). We used the twelve-item Problematic Pornography Use Scale (Kor et al., 2014) translated into Spanish. Specifically, a bilingual translator (Spanish-English) translated all items from the original PPUS scale to Spanish. The translator was a person with knowledge of the literature and some experience related to the construction of personality questionnaires. Next, another bilingual translator translated the Spanish version back to English. Finally, two expert researchers compared this final translation with the original scale, coming to a final Spanish version by consensus with the translators (e.g., Hernández et al., 2020; Muñiz et al., 2013). Responses were provided on scales ranging from 0 (*strongly disagree*) to 6 (*strongly agree*). The scale did not have reverse questions (Vigil-Colet et al., 2020), therefore all the items were averaged into a composite index ($\alpha = .87$). Higher scores reflected more problematic porn use ($M = 1.85$, $SD = 1.04$).

The average total score in this scale (ranging from 0 to 72) was 10.50 in this sample of college students (i.e., 13% of the maximum possible score). This is slightly higher than the averages found in the original study (i.e., 9% of the maximum possible score), which used samples from the general population in Israel.

Examples of items include: "I spend too much time being involved in thoughts about pornography" and "I have been unsuccessful in my efforts to reduce or control the frequency I use pornography in my life." This scale is comprised of four sub-scales, namely: Distress and Functional Problems ($\alpha = .58$), Excessive Use ($\alpha = .75$), Control Difficulties ($\alpha = .70$), and Use for Escape/Avoid Negative Emotions ($\alpha = .84$). The use of a general unidimensional score in the entire scale, as well as its relation to porn use, were supported in the original article (Kor et al., 2014).

In order to test the Factorial Validity of the Spanish scale compared to the original, an Exploratory Factor Analysis was run merging the samples from the two studies included in this manuscript (N = 419), using the Pearson correlation matrix, Maximum Likelihood as the estimation method, and Direct Oblimin as the rotation method (Ferguson & Cox, 1993). Based on

the original article (Kor et al., 2014), four factors were extracted, explaining more than 70 percent of the total variance. The four factors extracted in the original article also explained a similar amount of variance (i.e., higher than 70 percent). These factors did not moderate the effect of meta-cognitive certainty.

Meta-Cognitive Certainty. Participants were asked to think back to the PPUS and report the confidence they had in their responses overall. Self-ratings were provided on three items, including certainty, confidence, and validity. Responses were measured on 9-point scales (1 = *not at all certain/ not at all confident/ not at all valid* to 9 = *very certain/ very confident/ extremely valid*, respectively). A composite index of meta-cognitive certainty was formed by averaging responses to these three measures ($\alpha = .75$). Higher values on this index indicated more meta-cognitive certainty in participants' responses to the PPUS ($M = 8.11$, $SD = 1.18$).

Criterion Variable

Reported Porn Consumption. Participants reported their monthly porn consumption (i.e., "How many times have you consumed porn in the last month?"). Responses were recorded on a 7-point scale; 0 ("*zero times*"), 1 ("*between 1 and 3 times*"), 2 ("*between 4 and 6 times*"), 3 ("*between 7 and 9 times*"), 4 ("*between 10 and 12 times*"), 5 ("*between 13 and 15 times*"), 6 ("*more than fifteen times*"). Higher values on this index indicated greater porn consumption ($M = 1.69$, $SD = 2.00$).

Data analysis

A preliminary analysis of the relationships between the variables was conducted using Pearson correlations. The criterion variable was submitted to a multiple regression analysis. Meta-cognitive certainty, the PPUS, and the interaction term (i.e., PPUS × Meta-Cognitive Certainty) were entered as predictors. The critical two-way interaction was tested using the PROCESS add-on for SPSS (model 1; Hayes, 2013). The continuous variables (i.e., the PPUS and meta-cognitive certainty) were mean-centered.

Results

A positive correlation was observed between the PPUS and porn consumption, $r(265) = .620$, $p < .001$; and a negative correlation between the PPUS and certainty, $r(265) = -.262$, $p < .001$. Lastly, the correlation between meta-cognitive certainty and porn consumption was not significant, $r(265) = -.096$, $p = .115$.

Reported Porn Consumption. The results indicated a main effect of the PPUS, $B = 1.303$, $t(264) = 13.179$, $p < .001$, 95% CI: [1.109, 1.498], indicating that people scoring higher in the PPUS consumed more porn monthly. We did not find a main effect of certainty, $B = 0.102$, $t(264) = 1.228$, $p = .220$, 95% CI: [-0.061, 0.266]. The predicted interaction between the PPUS and meta-cognitive certainty was significant, $B = 0.154$, $t(264) = 2.643$, $p = .008$, 95% CI: [0.039, 0.269]. As illustrated in Figure 1, among those with higher meta-cognitive certainty scores (+1SD), the PPUS was positively associated with more porn consumption, $B = 1.440$, $t(264) = 11.537$, $p < .001$, 95% CI: [1.194, 1.686]. However, for those with lower meta-cognitive certainty scores (-1SD), a significantly weaker albeit significant relationship also emerged between the PPUS and porn consumption, $B = 1.121$, $t(264) = 11.004$, $p < .001$, 95% CI: [0.920, 1.322].
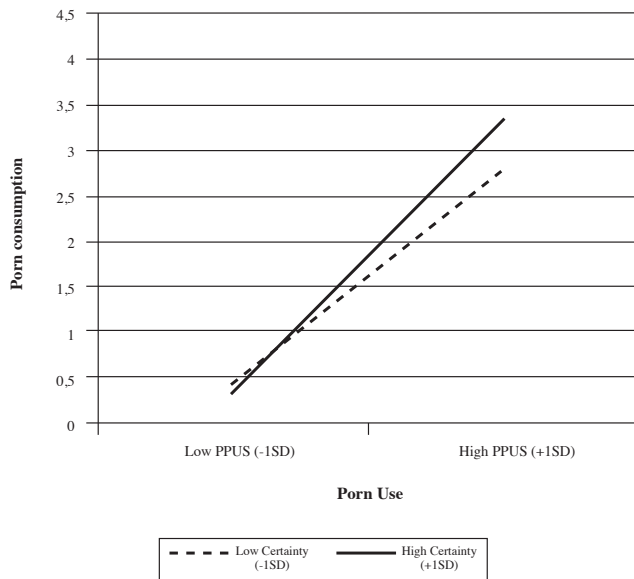
Figure 1. Porn Consumption as a Function of Responses to the PPUS and Measured Meta-Cognitive Certainty in Study 1

Although the key two-way interaction was not moderated by gender when it was included as an additional predictor, $B = -0.088$, $t(260) = 0.574$, $p = .566$, there was a significant main effect of gender, $B = -1.62$, $t(260) = -7.393$, $p < .001$, meaning that males reported watching significantly more porn than females.

As expected, the PPUS predicted reports of porn composition overall. This effect replicates previous literature (Kor et al., 2014) and reaffirms the predictive validity of the PPUS used in this study. Most relevant for the present concerns, the effect of the PPUS on porn consumption was moderated by reported certainty in the scale responses. As hypothesized, we found that the PPUS was associated with porn consumption to a greater extent as participants were more certain in their responses on the PPUS (meta-cognitive certainty). Thus, as participant's meta-cognitive certainty in their responses increased, so too did the ability of the PPUS to predict porn consumption. This suggests that researchers interested in using the PPUS can benefit by adding an additional measure of meta-cognitive certainty.

Given that certainty in the first study was measured rather than manipulated, there might be other confounding variables co-varying along with certainty. In order to address this issue and isolate the effect of meta-cognitive certainty, as well as to generalize our results even further, we added a different behavioral outcome and moved towards an experimental design by manipulating certainty. That is, our next goal was to analyze additional behavioral outcomes and to increase causal control in our core construct by manipulating the extent of certainty.

Study 2

As shown previously, certainty played a critical role in the relationship between the PPUS and reported porn consumption such that the PPUS predicted porn consumption to a greater extent among participants relatively high in certainty. However, given the correlational nature of the first study, the relationship between certainty and the PPUS' ability to predict porn-related behavior might be open to different interpretations (e.g., certainty might

be related to perceived social support, prior experience, socio economic status, knowledge, etc). Furthermore, the relationship between the two constructs could be bidirectional with people making inferences about their certainty based on their recalled behavior (Bem, 1972). To address these potential concerns and to provide causal evidence for the role of meta-cognitive certainty, our second study manipulated participant's feelings of certainty. Moreover, this study introduced several additions designed to generalize across measures, and to gain further understanding of the obtained effects.

In sum, Study 2 had three main goals. The first goal was to test the robustness of the patterns found in Study 1 by extending the results to a new sample and following a different set of procedures. The second and more important goal of Study 2 was to test whether changes in meta-cognitive certainty were *causing* changes in the association between the PPUS and porn consumption. Consequently, Study 2 manipulated rather than measured meta-cognitive certainty, so that the predicted effect would solely be caused by the condition to which participants were assigned. Lastly, we added a different behavioral outcome to generalize our results even further.

Method

Participants

One hundred and fifty-one undergraduate students (34.4% males) from Universidad Complutense de Madrid, participated anonymously in this study. Participants were recruited in exchange for extra credit in one of their courses. The age of the participants ranged from 20 to 56 ($M_{age} = 22.02$, $SD = 3.82$). Participants responded to the PPUS and meta-cognitive certainty was manipulated as an independent variable. Porn consumption and porn-related behavior were measured as the criterion variables. A power analyses was conducted using G*Power (Faul et al., 2007). We planned for an effect size similar to the one found in Study 1 (Cohen's $f^2 = .027$; Cohen, 1988). The desired sample size for a two-tailed test ($\alpha = .05$) of the predicted 2-way interaction with .80 power was a total of $N = 231$. Although we collected as many participants as possible during the academic semester (151 participants), we did not reach the estimated number due to the cancellation of classes following the COVID-19 pandemic. Given this potential limitation, a *sensitivity* power analysis was also conducted using G*Power (Faul et al., 2007). Results of G*Power analysis indicated that the obtained sample ($N = 151$) with our design was able to detect effect sizes larger than Cohen's $f^2 = .060$ with a power of .80. The effect size obtained for the main behavioral result in Study 2 was indeed detectable by our sample (Cohen's $f^2 = .062$).

Procedure

The information was presented as a study on scale validation. Participants first completed the Problematic Pornography Use Scale (Kor et al., 2014). Then, participants were assigned to the certainty or doubt condition. Participants were assigned to write a personal experience in which they felt either confidence or doubt. Next, participants reported their monthly porn consumption, which served as our first criterion variable. At the end of the study, participants were told that their university was taking part in the development of a new porn festival in Madrid. Participants were

told that, as a parting gift, they would receive promotional codes to receive a €5 coupon redeemable at the porn festival. Then, they were asked to indicate how much they would like to actually use the coupon, which served as our second criterion variable. Participants were then debriefed, thanked and dismissed.

Instruments

Predictor Variables

Problematic Pornography Use Scale (PPUS). We used the same twelve-item Problematic Pornography Use Scale used in Study 1 (Kor et al., 2014). Similar to Study 1, all items were averaged into a composite index (α =.82). Higher scores reflected more problematic porn use ($M = 1.79$, $SD = 0.76$).

The average total score in this scale (ranging from 0 to 72) was 9.58 in this sample of college students (i.e., 13% of the maximum possible score). Similar to Study 1, this average is also slightly higher that the averages found in the original study (i.e., 9% of the maximum possible score).

Meta-Cognitive Certainty. Following completion of the PPUS, participants were assigned to describe a past personal experience in which they felt either confidence or doubt. Participants were told that they could write about any topic they chose and were told not to worry about grammar or spelling. Some examples of experiences listed in the doubt condition included: "*While doing an exam I felt doubts because I was not sure what I had to answer,*" and "*I wanted to buy a new cell phone that was very expensive and I was not sure if I should buy it or not.*" Some examples of experiences recalled in the confidence condition were: "*The last time I felt confident was in an argument with a friend. I was sure I was right,*" and, "*Once I had to present a work in public. I prepared it so well that I felt very confident at the time of the speech.*" Prior research has shown that this manipulation is successful at inducing meta-cognitive certainty and doubt (Petty et al., 2002). Although it was unlikely that this manipulation affected the measure of porn addition (since it followed the completion of the measure), nonetheless, we still examined this relationship and found no effect of the induction on the measure of PPUS, $p =.622$.

Criterion Variables

Reported Porn Consumption. Participants reported their monthly porn consumption by answering the same question of Study 1 (e.g. "*How many times have you consumed porn in the last month?*"). Higher values on this index indicated greater porn consumption ($M = 2.60$, $SD = 1.84$).

Porn-Related Behavior. Participants' porn-related behavior was assessed by recording the number of promotional codes that they decided to take at the end of the study. They were told that these promotional codes allowed them and some of their friends to get a discount in the upcoming porn festival in Madrid. Specifically, they could take from 0 to 5 promotional codes to receive a €5 coupon for them and their friends redeemable at the porn festival. We decided to use the behavior of taking promotional codes for them and their friends as an indicator of porn behavior (for similar measures, see Gilbert & Jackaria, 2002). This measure was scored so that taking more promotional codes represented greater willingness to attend the porn festival; whether with friends or multiple times by oneself ($M = 0.63$, $SD = 1.46$).

Data analysis

A preliminary analysis of the relationships between the variables was conducted using Pearson correlations. The criterion variables were submitted to a multiple regression analysis. Meta-cognitive certainty, the PPUS, and the interaction term (i.e., PPUS × Meta-Cognitive Certainty) were entered as predictors. The critical two-way interaction was tested using the PROCESS add-on for SPSS (model 1; Hayes, 2013). The continuous variable (i.e., the PPUS) was mean-centered.

Results

Replicating the patterns observed in Study 1, a positive correlation was observed between the PPUS and porn consumption, $r(150) = .562$, $p < .001$. There was also a significant correlation between the PPUS and porn-related behavior, $r(150) = .278$, $p < .001$, and between reported porn consumption and porn-related behavior, $r(150) = .207$, p = .011.

Reported Porn Consumption. Once again, the results indicated a main effect of the PPUS, $B = 0.450$, $t(147) = 8.018$, $p < .001$, 95% CI: [0.978, 1.618], indicating that people scoring higher in the PPUS consumed more porn monthly. Replicating Study 1, we did not find a main effect of certainty, $B = 0.172$, $t(147) = 1.403$, $p = .162$, 95% CI: [-0.070, 0.415]. More central to our predictions, the interaction between the PPUS and meta-cognitive certainty was significant, $B = 0.343$, $t(147) = 2.115$, $p = .036$, 95% CI: [0.022, 0.664]. As illustrated in Figure 2, among those assigned to the certainty condition, the PPUS was positively associated with more porn consumption, $B = 1.635$, $t(147) = 7.622$, $p < .001$, 95% CI: [1.211, 2.059]. However, for those assigned to the doubt condition, a significantly weaker, albeit significant relationship also emerged between the PPUS and porn consumption, $B = 0.948$, $t(147) = 3.891$, $p < .001$, 95% CI: [0.466, 1.429].

Although the key two-way interaction was not moderated by gender, $B = -0.300$, $t(142) = -0.840$, $p = .402$, there was a significant main effect of gender, $B = -1.457$, $t(142) = -5.275$, $p < .001$, meaning that males reported watching significantly more porn than females.
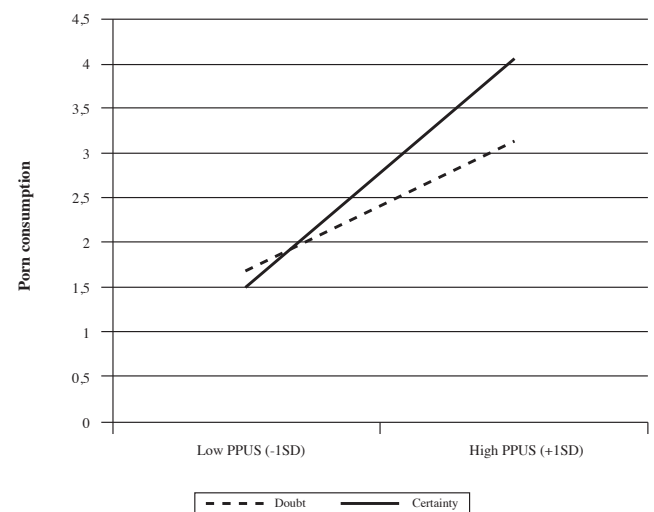
Figure 2. Porn Consumption as a Function of Responses to the PPUS and Manipulated Meta-Cognitive Certainty in Study 2

Porn-Related Behavior. The results indicated a main effect of the PPUS, $B = 0.473$, $t(147) = 3.193$, $p = .001$, 95% CI: [0.180, 0.766], indicating that people scoring higher in the PPUS took more promotional codes. We did not find a main effect of meta-cognitive certainty, $B = 0.113$, $t(147) = 1.010$, $p = .314$, 95% CI: [-0.108, 0.336]. The predicted interaction between the PPUS and meta-cognitive certainty was significant, $B = 0.450$, $t(147) = 3.032$, $p = .003$, 95% CI: [0.157, 0.744]. As illustrated in Figure 3, among those assigned to the certainty condition, the PPUS was positively associated with taking more promotional codes, $B = 0.915$, $t(147) = 4.660$, $p < .001$, 95% CI: [0.527, 1.303]. However, for those assigned to the doubt condition, there was no relationship between the PPUS and taking promotional codes, $B = 0.014$, $t(147) = 0.062$, $p = .950$, 95% CI: [-0.427, 0.454].

Again, replicating previous literature, the PPUS predicted reports of overall porn consumption (Kor et al., 2014). As in Study 1, participants' responses to the PPUS were associated with self-reported porn consumption to a greater extent in high certainty conditions. However, study 2 manipulated rather than measured certainty, offering evidence in favor of a causal link between certainty and the relationship between responses to the PPUS and behavior. Lastly, Study 2 extends the effects found in Study 1 to a different, more behavioral, criterion variable.
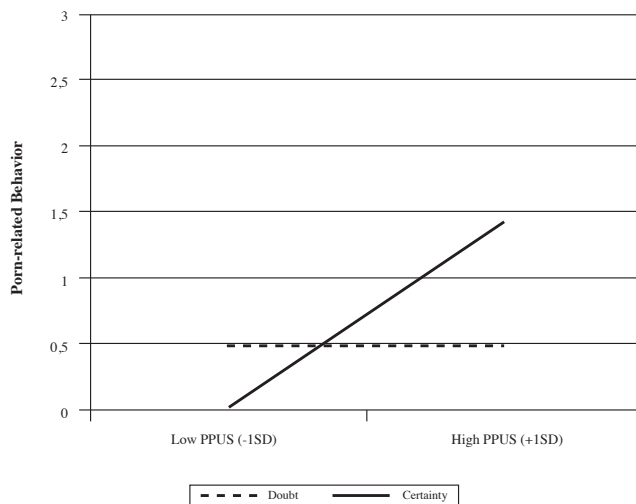
Figure 3. Porn-related Behavior as a Function of Responses to the PPUS and Manipulated Meta-Cognitive Certainty in Study 2

Discussion

The current research successfully reaffirmed the predictive validity of the PPUS (Kor et al., 2014) by showing its capability of predicting relevant porn-related behavior. Most importantly, across two studies, the results support our hypothesis that meta-cognitive certainty moderates the effects of the PPUS on porn consumption. Specifically, we found that scores on the PPUS were associated with porn consumption to a greater extent when participants were higher in meta-cognitive certainty in their responses to the scale (both measured and manipulated). Thus, as meta-cognitive certainty increased, so too did the association between this scale and subsequent reported porn consumption. Although we conducted this research on young adults because of the interventions' focus on this collective (Doornwaard et al., 2015, 2016; Farré et al., 2020; for a review see Peter & Valkenburg, 2016), we advise readers to be cautious in generalizing the results of our research to other populations given the restricted nature of our sample (composed exclusively by young undergraduate college students).

Having shown the predicted effects in both self-report and behavioral measures, a number of avenues for future research may come up. When it comes to self-reported porn consumption, further clarification is needed regarding the extent to which the scale is predicting more or less *accurately* when meta-cognitive certainty is high (e.g., confidence increasing accuracy in recalling prior responses of past behavior), or whether higher meta-cognitive certainty coming right after the scale is causing them to *report* subsequent behavior that is more in line with their self-reports (i.e., I am certain that I like porn so I must use it more). Future studies can benefit from specifying whether and when motivations for accuracy or motivations for consistency are likely to be involved.

Future endeavors should explore whether the moderating role of meta-cognitive certainty in the association between individual-difference scales and behavior can be extended to examine other instruments originally developed to assess problematic behaviors (e.g., substance-abuse). Lastly, future studies should also investigate whether there are other moderators beyond meta-cognitive certainty that can contribute to increase the predictive validity associated with this scale. For example, activating key aspects of the situation associated with the PPUS (e.g., mere presence of erotic stimuli) might increase the perceived relevance of the construct assessed by the scale (e.g., Paredes et al., 2021) or even increase the readiness and preparation to act (Carroll et al., in press) and therefore increase the validity of the responses to the scale to guide subsequent behavior. Future research can benefit also from examining the interaction between this scale and other scales designed to capture individual differences in the propensity to hold mental constructs with certainty (DeMarree et al., in press), and with other scales that increase the reliance on meta-cognitive confidence (Falces et al., 2001).

Acknowledgements

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