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ORIGINAL ARTICLE

Development of a Picture-Based Measure for "Not Just Right" Experiences Associated with Compulsive Sorting, Ordering, and Arranging

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Abstract
Many individuals with obsessive-compulsive disorder report that obsessional thoughts and compulsive behaviors are often motivated by "not just right" experiences (NJREs). Individuals who experience NJREs often report symptoms related to symmetry, order, and arrangement (SOA). The current study sought to develop a brief picture-based measure of NJREs (PIC-NR10) within the context of SOA. Three independent studies were conducted to assess the psychometric properties of PIC-NR10 and its relationship with existing NJRE questionnaires, obsessive-compulsive-symptom relevant measures, and in vivo behavioral NJRE tasks. Across studies, the results provide promising initial evidence that PIC-NR10 is a psychometrically sound measure of NJREs. Clinical implications and future directions of research are discussed.

Keywords "Not just right" experience · Incompleteness · Obsessive-compulsive disorder

Obsessive compulsive disorder (OCD) is a psychiatric condition with an estimated lifetime prevalence rate of 2.3% and 12-month rate of 1.2% (Ruscio et al. 2010). OCD is characterized by intrusive obsessional thoughts and/or compulsive behaviors that cause significant distress and interference with daily life (American Psychiatric Association 2013). Earlier cognitive-behavioral models of OCD (e.g., Rachman 1997, 1998; Salkovskis 1985) posited that obsessive-compulsive (OC) behaviors (e.g., checking) were completed in an effort to avoid a potentially harmful outcome. Harm-avoidance (HA) models of OCD (e.g., Rachman 2002) have garnered significant support in the literature; however, it is now widely accepted that OCD is characterized by heterogeneous affective-motivational processes (McKay et al. 2004).

In recent years, "not just right" experiences (NJREs; Coles et al. 2003) or "incompleteness" (INC; Summerfeldt 2004) have been identified as common motivational factors associated with OCD. NJREs and INC are often referred to interchangeably in the literature, and the concept was first introduced by Pierre Janet (as cited in Pitman 1987) who proposed that some individuals experience *sentiments d'incomplétude* (i.e., an internal sense of incompleteness). This concept did not gain significant attention in the psychopathology literature until it was reintroduced by Rasmussen and Eisen (1992). Individuals who experience NJREs tend to be motivated to engage in OC behaviors until a satisfactory "just right" feeling is obtained, which contrasts the motivation of HA-related OC behaviors. HA and INC have been shown to be significantly related; however, factor analytic studies support the conceptualization of HA and INC as distinguishable motivational factors underlying OCD (Pietrefesa and Coles 2008; Summerfeldt 2004; Taylor et al. 2014). In addition to HA, NJREs are now recognized as an OCD-related factor in the DSM-5 (American Psychiatric Association 2013).

It is common for individuals who experience NJREs to have obsessional thoughts and engage in compulsions related to symmetry, ordering, and arranging (SOA). An individual may spend an excessive amount of time positioning objects (e.g., picture on a wall, clothes in a closet) until a satisfactory, exact, perfect, or "just right" level of completion is achieved, which is rather unrelated to the perception or avoidance of harm. Often, NJREs are prompted by external cues that precipitate sensory experiences. In a study of 1001 individuals with OCD, a significant proportion of

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participants reported at least one sensory experience prior to engaging in compulsions (Ferrão et al. 2012). Further, the study found that SOA symptoms were most closely associated with sensory-related OCD compared to other OCD subtypes. Epidemiological studies suggest that OCD presentations related to SOA are common (e.g., Lochner et al. 2015; Rasmussen and Eisen 1992; Sasson et al. 1997). Labad et al. (2008) reported that individuals who endorsed SOA-related OCD showed an earlier age of onset and greater history of tic disorders than other OCD subtypes (i.e., contamination, aggression, sexual, religious, and hoarding). Individuals with this OCD subtype were also found to show decreased levels of functioning and poorer response to pharmacological intervention than other OC symptom presentations (Stein et al. 2007, 2008). These findings highlight the importance of expanded research on this understudied OC-subtype.

Self-Report Measurements of NJREs and INC

The "Not Just Right" Questionnaire-Revised (NJRE-Q-R; Coles et al. 2003) is a questionnaire that prompts individuals to identify which, if any, NJRE recently occurred (e.g., "When placing a book back onto the shelf, I have had the sensation that it did not look just right with the other books"). Once identified, ratings of frequency, intensity, distress, intrusion, and sense of responsibility of the NJRE are obtained. The Obsessive Compulsive Trait Core Dimensions Questionnaire (OC-TCDQ; Summerfeldt et al. 2014) examines the extent to which OC-type behaviors are completed in an effort to avoid harm (OC-TCDQ-HA; e.g., "Even if harm is very unlikely, I feel the need to prevent it at any cost") or to obtain a "just right" feeling (OC-TCDQ-INC; e.g., "I must do things in a certain way or I will not feel right"). The NJRE-Q-R and OC-TCDQ-INC are validated measures of NJREs, and they have been used extensively in the study of NJREs associated with OCD (Coles and Ravid 2016; Pietrefesa and Coles 2008; Summerfeldt 2004; Summerfeldt et al. 2014; Taylor et al. 2014) and OC personality traits (Ecker et al. 2014). While psychometrically sound, one limitation of the NJRE-Q-R and OC-TCDQ is their reliance on retrospective self-report of NJRE experiences. NJREs are quite subtle and momentary emotional experiences, which may often be difficult to articulate, and also occur within a particular context perceived to be "not right" or "incomplete." Thus, it is a promising avenue of research to develop an adjunctive instrument that can sensitively assess NJREs using relevant contextual cues. One possibility is to use a picture-based measure of NJREs to assess emotions and urges associated with NJREs in the "here and now." A recent study by Summerfeldt et al. (2015) demonstrated that levels of perceived incompleteness and aesthetic sensitivity to pictorial stimuli, such as black and white shapes (i.e., circles and hexagons), predicted OC behaviors related to symmetry. Further, Radomsky and Rachman (2004) showed that the level of discomfort assessed by viewing pictures of disorderly scenes was significantly associated with the severity of SOA. However, they primarily aimed to assess the individual's *preference* for SOA by comparing the levels of discomfort between orderly and disorderly target pictures (Radomsky and Rachman 2004), rather than directly targeting specific NJREs (e.g., feelings of incompleteness, associated distress, and urge to get it "just right") underlying the SOA symptoms. Taken together, a picture-based measure of NJREs, in addition to the NJRE-Q-R and OC-TCDQ-INC, will further our understanding of this relatively new and abstract construct associated with OC behaviors, particularly SOA.

Study Aims

We conducted a series of studies to develop and validate a picture-based measure that specifically assesses NJREs in the context of SOA-related symptoms. This picture-based NJRE assessment is important for a few reasons. First, there is a stark paucity of measures that utilize ecologically valid materials that can vividly and potently illustrate NJREs and assess their emotional consequences in the SOA context. Second, there is a need for tools for measuring NJREs that do not rely on retrospective self-report. Lastly, contextual, in-person assessment of SOA-related NJREs will further our understanding of the understudied subtype of OCD by providing more specific characterization of distressing stimuli.

Study 1

Study 1 aimed to develop a pool of SOA-related NJREs pictures that can be used to evoke and measure acute SOA-related NJREs. A 45-item pair of SOA-related NJREs stimuli was developed − 45 "not right" pictures and 45 "just right" pictures (PIC-NR45 and PIC-JR45, respectively). We examined the psychometric properties of the new scale and constructed a final 10-item version of the scale (PIC-NR10). Further, we examined the relationship between PIC-NR10, two well-established questionnaires of NJREs, and OCD symptoms (including SOA) and other related symptoms, to obtain initial evidence of the construct validity of the measure.

Method

Participants

Study 1 was completed using an online survey via Qualtrics. The sample included 177 individuals (male = 33,

Table 1 Mean scores and standard deviations of NJREs/INC and clinical measures for Studies 1, 2, and 3

	Study 1		Study 2		Study 3	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*
NJRE-Q-R—quantity	3.41	2.43	4.63	2.67	4.40	2.23
NJRE-Q-R—severity	21.51	9.80	23.98	8.77	23.38	8.80
OC-TCDQ—INC	14.18	8.35	14.70	10.15	14.27	9.22
SOAQ	20.80	18.83	25.44	19.77	22.29	17.61
OCI-R						
Washing	1.62	2.22	2.13	2.82	2.23	25.87
Obsessing	2.38	2.98	2.79	2.96	2.83	3.39
Hoarding	3.05	2.78	3.41	3.12	3.77	3.54
Ordering	4.05	3.19	4.55	3.25	4.38	3.16
Checking	2.44	2.36	3.18	3.09	2.65	2.51
Neutralizing	1.43	2.36	1.93	2.81	1.33	2.06
Total	13.51	10.28	16.39	12.89	15.63	12.21
DASS						
Depression	8.93	9.76	5.05	5.06	4.52	4.19
Anxiety	7.36	7.13	4.31	4.45	3.92	4.66
Stress	14.01	10.05	6.67	5.07	6.19	4.64
Total	30.29	24.66	16.03	13.51	14.63	12.15
OBQ						
Threat	13.50	6.70	13.89	6.63	13.65	6.50
Intolerance	16.44	6.86	17.04	7.49	15.23	6.94
Responsibility	16.27	7.90	16.05	7.75	15.81	7.07
Imp thoughts	12.33	6.68	12.67	6.42	11.50	6.01
Total	58.53	24.32	59.65	24.93	56.19	20.99
FMPS						
Personal standards	24.41	5.46	23.08	5.95	23.62	6.01
Organization	22.91	5.22	22.52	4.92	23.27	5.11
Concern mistakes/doubts	32.32	11.02	32.85	11.37	29.00	9.50
Parental expect/criticism	24.83	8.12	24.90	8.08	23.98	7.05
Total	107.68	22.34	106.52	24.50	102.92	21.44

NJRE-Q-R "Not Just Right" Questionnaire-Revised (Quantity and Severity), *OC-TCDQ* Obsessive-Compulsive Trait Core Dimensions Questionnaire (Incompleteness), *SOAQ* Symmetry, Ordering, and Arranging Questionnaire, *OCI-R* Obsessive Compulsive Inventory-Revised, *OBQ* Obsessive Beliefs Questionnaire, *FMPS* Frost Multidimensional Perfectionism Scale, *DASS* Depression, Anxiety, and Stress Scales

female = 144) with a mean age of 23.4 years ($SD = 5.9$) who were recruited from a medium-sized university in the Midwestern United States. Racial diversity of participants included: White (78%), Black/African-American (8%), Hispanic/Latino (8%), and multiracial/other (6%). Clinical characteristics of participants for Study 1 are presented in Table 1.

Measures

Not Just Right Experiences Questionnaire-Revised (NJRE-Q-R; Coles et al. 2003) This questionnaire assesses NJREs from three different perspectives: (1) quantity of NJREs, (2) recency of NJREs, and (3) severity of NJREs. Items 1–10 provide sample NJREs (e.g., "When placing a book back onto a shelf, I have had the sensation that it did not look just right with the other books"), and participants are asked to indicate (yes/no) whether they experienced the NJRE within the past month. An *NJRE Quantity* score is calculated by summing the number of "yes" responses. Item 11 assesses which NJRE from items 1–10 was most recently experienced, and item 12 measures when the NJRE actual occurred (e.g., "within the past few hours," "within the past day"). An *NJRE Severity* score is calculated by summing items 13–19. These items are scored on a seven-point scale with higher scores indicating greater severity. The internal consistency of the NJRE Quantity score was acceptable ($\alpha = 0.73$), and the NJRE Severity score was excellent ($\alpha = 0.92$) in Study 1.

Obsessive-Compulsive Trait Core Dimensions Questionnaire (OC-TCDQ; Summerfeldt et al. 2014) The OC-TCDQ is a 20-item measure that assesses HA and INC. Each item is rated from 0 (never) to 4 (always), with higher scores indicating a greater level of HA and INC, respectively. The HA and INC subscales were significantly correlated; however, confirmatory factor analysis (CFA) supported a two-factor structure (Summerfeldt et al. 2014). The OC-TCDQ has been used in clinical and research settings, and has shown good convergent validity with other OC-symptom measures (Summerfeldt et al. 2014). We used the INC subscale of the OC-TCDQ as a second measure of NJRE in this study, as this assesses more generalized and trait-like experiences of NJRE whereas the NJRE-Q-R taps into recent NJREs based on a particular episode. The internal consistency of the OC-TCDQ-INC in the current study was excellent ($\alpha = 0.95$) for Study 1.

Symmetry, Ordering, and Arranging Questionnaire (SOAQ; Radomsky and Rachman 2004) The SOAQ is a 20-item instrument that examines the current severity of SOA compulsions. This measure was developed in response to the lack of OCD measures that specifically probed SOA symptoms (Radomsky and Rachman 2004). Respondents use a 5-point scale ("not at all" to "extremely") to indicate their level of agreement with questions such as "I feel calm/at ease only when my surroundings are neat and tidy," and "Things in my home have a proper and exact place." Higher scores indicated a greater level of SOA symptoms. The measure has shown excellent internal consistency and good test–retest reliability (Radomsky and Rachmane 2004; Radomsky et al. 2006) and significant associations with OC behaviors and NJREs (Summerfeldt et al. 2015). For Study 1, the internal consistency was excellent ($\alpha = 0.98$).

Obsessive Compulsive Inventory-Revised (OCI-R; Foa et al. 2002) The OCI-R is an 18-item questionnaire that is a condensed version of the 42-item OCI (Foa et al. 1998). The OCI-R assesses six subtypes of OCD: (1) washing, (2) checking, (3) obsessions, (4) mental neutralizing, (5) ordering, and (6) hoarding. Participants use a 5-point scale from 0 (not at all) to 4 (extremely) to rate OCD symptom distress within the past month. OCI-R total score ranges from 0 to 72, with higher scores indicating greater distress. The internal consistency of the OCI-R was good ($\alpha = 0.89$) in Study 1.

Obsessive Belief Questionnaire Short Form (OBQ-20; Moulding et al. 2011) The OBQ-20 is shorter version of the OBQ-87 (OCCWG 2001) and OBQ-44 (OCCWG 2005). This measure assesses obsessional beliefs across four domains: (1) threat, (2) responsibility, (3) importance of thoughts, and (4) intolerance of uncertainty/perfectionism. Participants use a 7-point scale from 1 (disagree very much) to 7 (agree very much). Total scores range from 20 to 140, with higher scores suggesting the presence of obsessive beliefs. The internal consistency of the OBQ-20 in Study 1 of the current study was excellent ($\alpha = 0.94$).

Frost Multidimensional Perfectionism Scale (FMPS; Frost et al. 1990) The FMPS is a 35-item scale that assesses perfectionistic personality features (Frost et al. 1990). A recent psychometric analysis proposed a four-factor structure: (1) personal standards, (2) organization, (3) concern over mistakes and doubts about actions, and (4) parental expectations and parental criticisms (Stöber 1998). The FMPS showed excellent internal consistency ($\alpha = 0.95$) for Study 1.

Depression, Anxiety, and Stress Scales (DASS-21; Lovibond and Lovibond 1995b) The DASS-21 is a shorter version of the original 42-item Depression (DASS-42), Anxiety and Stress Scales (Lovibond and Lovibond 1995a). The DASS-21 measures general emotional distress over three factors (depression, anxiety, and stress) during the past week. Participants use a 4-point scale (0–3), with higher scores indicating greater emotional distress. Subscale scores are multiplied by 2 for interpretations purposes with the DASS-42 (Lovibond and Lovibond 1995a). Total scores range from 0 to 126, with higher scores indicated greater distress. Internal consistency of the DASS-21 was excellent for Study 1 ($\alpha = 0.95$).

PIC-NR: Initial Item Pool

For an initial pool of items, we took and collected a large number of pictures depicting various day-to-day contexts (e.g., messy desk, uneven window blinds) that are directly relevant for the SOA symptom domain and expected to trigger NJREs potently, based on reviews of the relevant SOA and NJRE literature and their existing measures. Each NJRE picture (PIC-NR) was paired with a corresponding control "just right" experience picture (PIC-JR). For instance, a picture of a messy desk was taken, along with a corresponding picture of a neat and organized desk. After careful inspection of the initial items, 45 pairs of unique SOA-related NJREs were selected (PIC-NR45 and PIC-JR45) for analysis. Each of the pictures was edited (e.g., cropped, resized) using Adobe Photoshop.

Each of the 90 pictures was presented in a randomized order with three rating items that are designed to assess SOA-related NJRE experiences: Q1—"How much does this picture look incomplete or 'not just right?'"; Q2—"How much does this picture 'bother or annoy you?'"; and Q3—"How strong is your urge to make this picture 'just right?'" Using the three items, participants rated each picture on an 11-point scale with the following anchors: 0 ("not

Table 2 Mean scores and standard deviations of PIC-NR45 and PIC-JR45 (Study 1)

	PIC-NR45		PIC-JR45			PIC-NR45		PIC-JR45	
	Mean	SD	Mean	SD		Mean	SD	Mean	SD
P1	4.24	3.55	0.80	1.84	P24	5.27	3.18	0.35	1.38
P2	3.54	3.62	0.57	1.89	P25	3.76	3.59	0.45	1.43
P3	5.87	3.41	0.74	1.90	P26	4.51	3.02	0.39	1.28
P4	5.14	3.52	0.93	1.82	P27	4.67	3.43	1.90	2.75
P5	3.88	3.12	0.30	1.17	P28	5.31	3.55	0.88	2.05
P6	2.27	2.96	0.21	0.83	P29	5.60	3.23	1.50	2.42
P7	3.76	3.38	1.00	2.17	P30	1.87	2.92	0.26	1.07
P8	3.71	3.37	0.61	1.62	P31	2.94	3.76	0.34	1.59
P9	5.07	3.21	0.31	1.15	P32	2.61	3.26	0.77	2.10
P10	6.53	3.18	0.61	1.69	P33	6.19	3.17	0.77	1.84
P11	4.10	3.28	0.35	1.36	P34	2.13	2.74	0.64	1.91
P12	4.77	3.08	0.35	1.47	P35	4.53	3.34	0.95	1.94
P13	5.07	3.29	0.68	1.79	P36	5.54	3.38	0.50	1.66
P14	5.92	3.15	0.21	0.90	P37	5.51	3.37	0.55	1.80
P15	3.58	3.37	0.26	1.00	P38	4.28	3.36	0.23	0.81
P16	3.27	3.10	0.26	1.06	P39	4.78	3.37	0.27	1.29
P17	4.15	3.16	0.33	1.19	P40	2.49	3.00	0.56	1.52
P18	3.37	3.08	0.41	1.39	P41	3.89	3.18	0.35	1.07
P19	5.85	3.28	0.86	2.10	P42	2.67	3.43	0.72	2.00
P20	4.05	3.28	0.84	1.95	P43	2.35	2.94	0.59	1.74
P21	5.42	3.38	0.53	1.56	P44	5.73	3.02	0.56	1.74
P22	5.64	3.22	0.28	1.10	P45	3.48	3.18	0.56	1.56
P23	4.67	3.27	0.38	1.40	Total	4.31	3.26	0.58	1.58

at all"), 5 ("moderately"), and 10 ("extremely"). An 11-point scale was used to allow for more variability and sensitivity in detecting subtle subjective changes associated with NJREs. The scale structure is similar to the Subjective Units of Distress Scale (SUDS; Wolpe 1973) that is commonly used in behavioral exposure tasks and uses score ranges from 0 to 10 or 0 to 100. A composite score was computed for PIC-NR45 and PIC-JR45 by averaging the three ratings for each picture.

Procedure

Participants in Study 1 were recruited using an online research recruitment program provided by the university. An electronically signed informed consent was obtained for eligible participants. Participants completed a battery of questionnaires and a picture rating task of PIC-NR45 and PIC-JR45 during one online session over the Internet. The median length of time to complete the study was 37.4 min. Those who completed the study were awarded partial course credit.

Results

The means and standard deviations of the 45 items are presented in Table 2. The average rating of PIC-NR45 was significantly higher than the average rating of PIC-JR45, $t(176) = 23.64$, $p < .001$. Excellent internal consistency coefficients were found for PIC-NR45 ($\alpha = 0.98$) and PIC-JR45 ($\alpha = 0.98$). To assess the dimensionality of PIC-NR45, we conducted an exploratory factor analysis using maximum likelihood extraction and quartimax rotation, which showed a single predominant factor (eigenvalue = 23.93) explaining 52.28% of the variance. Although there were four additional factors with eigenvalues ranging from 1.00 to 2.22, they explained in total only 9% of the variance. The shape of the scree plot also indicated that PIC-NR45 is characterized by a single dominant factor, and all 45 items showed sizable factor loadings to this factor ranging from 0.42 to 0.85. Taken together, PIC-NR45 is a fairly homogeneous and internally-consistent set of stimuli.

To enhance the feasibility and utility of the new scale, we chose the ten most potent PIC-NR45 stimuli (see Table 2; items # 3, 10, 14, 19, 22, 29, 33, 36, 37, 44; see Fig. 1 for items) based on (1) high factor loadings (range from 0.73 to 0.83) and (2) high mean rating scores.[1] We further examined the psychometric properties of PIC-NR10. The means and SDs of the averaged ratings from PIC-NR10 and PIC-JR10

[1] The full 45-item stimulus pool is available upon request.

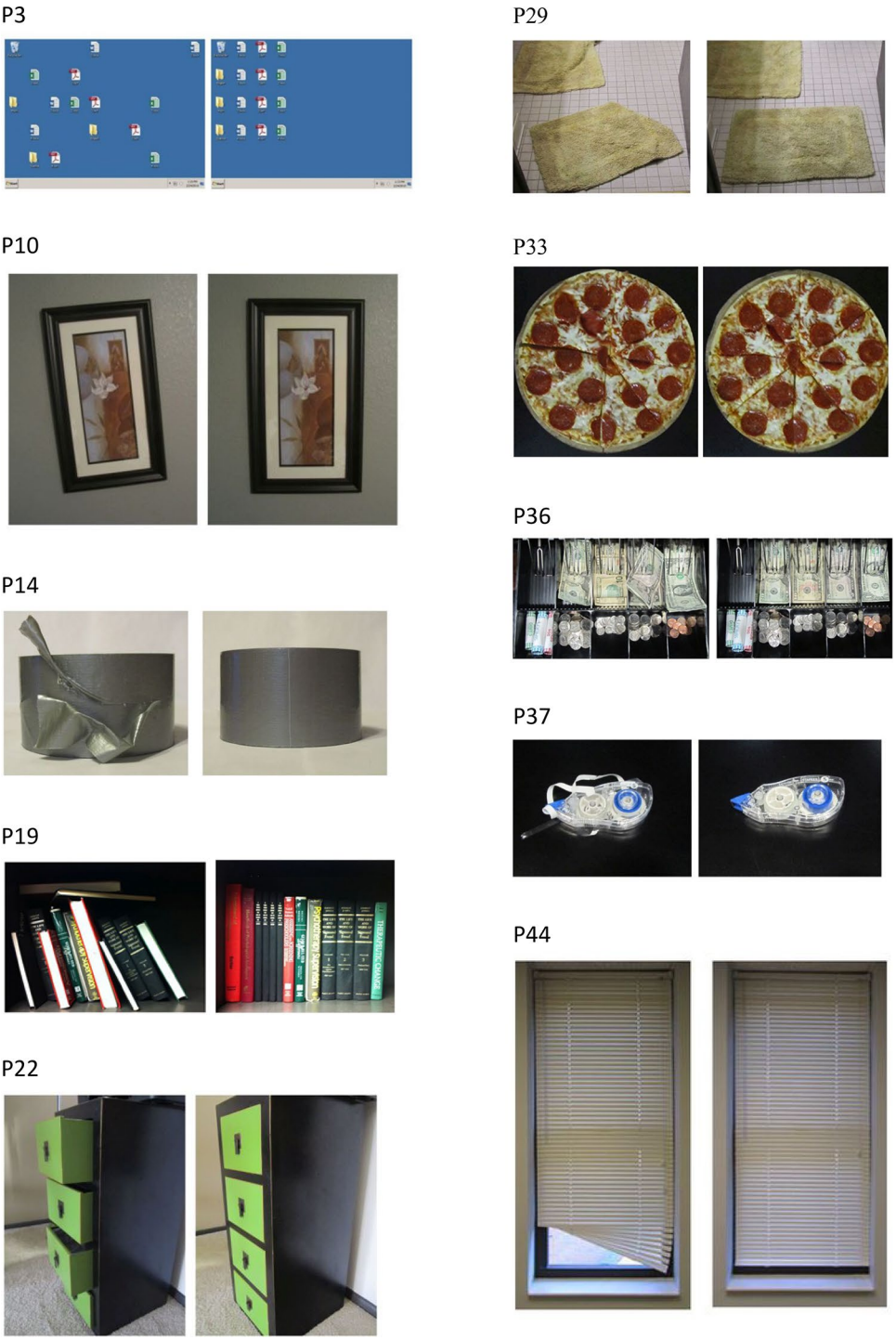

Fig. 1 PIC-NR10 (left) and PIC-JR10 (right)

are presented in Table 3. All PIC-NR10 items showed moderate or higher levels of urge, distress, and NJRE feelings, whereas all ratings on PIC-JR10 items were minimal. Internal consistency was $\alpha = 0.95$ for PIC-NR10 and $\alpha = 0.78$ for PIC-JR10. The zero-order correlation between PIC-NR45 and PIC-NR10 was 0.93, and the correlation between PIC-JR45 and PIC-JR10 was 0.90. We also conducted a series of *t* tests to compare the ratings evoked by each of PIC-NR10 items against their PIC-JR10 counterpart. All *t* tests were significant ($ps < .001$, Cohen's d range was 1.25–1.79 among the 10-items and 2.05 for the full 10-item set), suggesting that each of the PIC-NR10 items was more potent in evoking NJRE than PIC-JR10 items. Additionally, we conducted an exploratory factor analysis of PIC-NR10 using maximum likelihood extraction and a quartimax rotation. Only one factor was extracted, which explained 66.22% of the variance

Table 3 Mean ratings, standard deviations, difference scores, and paired-sample *t* tests between PIC-NR10 and PIC-JR10

Picture	PIC-NR10 Mean	PIC-NR10 SD	PIC-JR10 Mean	PIC-JR10 SD	Diff Score Mean	Diff Score SD	*t*	*p*
Pic 1	5.87	3.41	0.74	1.90	5.14	3.44	19.86	< .001
Pic 2	6.53	3.18	0.61	1.69	5.92	3.33	23.68	< .001
Pic 3	5.92	3.15	0.21	0.90	5.71	3.19	23.84	< .001
Pic 4	5.85	3.28	0.86	2.10	4.99	3.36	19.75	< .001
Pic 5	5.64	3.22	0.28	1.10	5.36	3.27	21.83	< .001
Pic 6	5.60	3.23	1.50	2.42	4.10	3.27	16.69	< .001
Pic 7	6.19	3.17	0.77	1.84	5.42	3.20	22.51	< .001
Pic 8	5.54	3.38	0.50	1.66	5.04	3.47	19.31	< .001
Pic 9	5.51	3.37	0.55	1.80	4.96	3.37	19.59	< .001
Pic 10	5.73	3.02	0.56	1.74	5.16	3.34	20.57	< .001
Total	5.86	2.70	0.70	1.10	5.16	2.52	27.23	< .001

Total score is the average score across PIC-NR10 and PIC-JR10

PIC-NR10 10-item "not right" pictures, *PIC-JR10* 10-item "just right" pictures

Table 4 Pearson correlations between PIC-NR10, NJRE-Q-R and OC-TCDQ-INC (Study 1 and 2)

	PIC-NR10 total	PIC-NR10 INC	PIC-NR10 distress	PIC-NR10 urge	NJRE-Q-R quantity	NJRE Q-R severity
Study 1						
PIC-NR10 INC	0.97					
PIC-NR10 distress	0.98	0.94				
PIC-NR10 urge	0.97	0.92	0.95			
NJRE-Q-R quantity	0.42	0.41	0.41	0.40		
NJRE-Q-R severity	0.41	0.39	0.42	0.40	0.46	
OC-TCDQ INC	0.49	0.48	0.47	0.50	0.54	0.42
Study 2						
PIC-NR10 INC	0.95					
PIC-NR10 distress	0.96	0.91				
PIC-NR10 urge	0.95	0.89	0.91			
NJRE-Q-R quantity	0.34	0.31	0.34	0.34		
NJRE-Q-R severity	0.31	0.25	0.31	0.33	0.53	
OC-TCDQ INC	0.38	0.30	0.36	0.39	0.51	0.49

All correlations significant at $p < .001$. PIC-NR10 total = composite score, PIC-NR10 INC = subjective level of incompleteness/NJRE, distress = subjective level of distress, urge = subjective urge to correct

NJRE-Q-R "Not Just Right" Questionnaire-Revised (Quantity and Severity), *OC-TCDQ-INC* Obsessive-Compulsive Trait Core Dimensions Questionnaire (Incompleteness)

(eigenvalue = 6.96). All items of PIC-NR10 loaded to this single factor at values between 0.74 and 0.87. Further, the three PIC-NR10 indicators (i.e., feelings of incompleteness, distress, and urge to correct) showed an excellent Cronbach's alpha coefficient ($\alpha = 0.98$). Taken together, PIC-NR10 is a unidimensional, internally-consistent stimuli set, assessing NJREs related to SOA.

To test the relationship between PIC-NR10 and existing measures of NJREs (NJRE-Q-R and OC-TCDQ-INC), we examined the zero-order correlations among the measures and relevant clinical symptom measures. Results showed that PIC-NR10 total score and its three respective indicators were moderately correlated with the NJRE-Q-R Quantity, NJRE-Q-R Severity, and OC-TCDQ-INC (see Table 4). PIC-NR10 was also strongly associated with SOA-related symptoms as measured by the SOAQ ($r = .48$) and OCI-R Ordering ($r = .50$), as well as overall OC-symptoms, OCI-R Total ($r = .38$), $ps < .001$. We also found that PIC-NR10 was associated with personality features and belief domains relevant for OCD psychopathology, OBQ Total ($r = .40$) and FMPS Total ($r = .35$), $ps < .001$. Finally, with general emotional distress as measured by DASS-21 ($r = .33$), PIC-NR10 showed

Table 5 Pearson correlations between PIC-NR10, NJRE-Q-R, OC-TCDQ-INC, and clinical measures (Study 1)

	PIC-NR10 total	PIC-NR10 INC	PIC-NR10 distress	PIC-NR10 urge	NJRE-Q-R quantity	NJRE-Q-R severity	OC-TCDQ INC
SOAQ	0.48***	0.45***	0.47***	0.49***	0.33***	0.36***	0.60***
OCI-R							
Washing	0.16*	0.14	0.15*	0.18*	0.26***	0.28***	0.42***
Obsessing	0.23**	0.22**	0.21**	0.23**	0.36***	0.32***	0.54***
Hoarding	0.21**	0.20**	0.20**	0.23**	0.34***	0.25***	0.38***
Ordering	0.50***	0.47**	0.48***	0.51***	0.46***	0.31***	0.66***
Checking	0.25***	0.23***	0.25**	0.26**	0.30***	0.32***	0.52***
Neutralizing	0.29***	0.29**	0.28***	0.29***	0.25***	0.25***	0.47***
Total	0.38***	0.36***	0.36***	0.39***	0.46***	0.40***	0.70***
DASS							
Depression	0.22**	0.19*	0.23**	0.22**	0.24***	0.44***	0.33***
Anxiety	0.28***	0.24**	0.30***	0.28***	0.28***	0.46***	0.42***
Stress	0.40***	0.38***	0.41***	0.40***	0.36***	0.53***	0.47***
Total	0.33***	0.30***	0.35***	0.33***	0.32***	0.52***	0.44***
OBQ							
Threat	0.30***	0.29***	0.29***	0.31***	0.30***	0.35***	0.58***
Intolerance	0.40***	0.38***	0.40***	0.40***	0.27***	0.43***	0.60***
Responsibility	0.29***	0.28***	0.29***	0.30***	0.24**	0.27***	0.51***
Imp thoughts	0.18*	0.18*	0.16*	0.18**	0.13	0.27***	0.42***
Total	0.34***	0.33***	0.33***	0.34***	0.27***	0.38***	0.61***
FMPS							
Personal standards	0.22***	0.21**	0.23**	0.22**	0.06	0.20**	0.35***
Organization	0.22***	0.20**	0.21**	0.24**	0.05	0.00	0.18**
Mistakes/doubts	0.33***	0.31***	0.35***	0.32***	0.25**	0.45***	0.50***
Parental expect	0.16*	0.15*	0.15*	0.17*	0.01	0.22**	0.16*
Total	0.35***	0.32***	0.35***	0.35***	0.18*	0.36***	0.44***

PIC-NR10 total = composite score, PIC-NR10 INC = subjective level of incompleteness/NJRE, distress = subjective level of distress, urge = subjective urge to correct

NJRE-Q-R "Not Just Right" Questionnaire-Revised (Quantity and Severity), *OC-TCDQ-INC* Obsessive-Compulsive Trait Core Dimensions Questionnaire (Incompleteness), *SOAQ* Symmetry, Ordering, and Arranging Questionnaire, *OCI-R* Obsessive Compulsive Inventory-Revised, *OBQ* Obsessive Beliefs Questionnaire, *FMPS* Frost Multidimensional Perfectionism Scale, *DASS* Depression, Anxiety, and Stress Scales

*<.05; **<.01; ***<.001

a moderate correlation, whereas the NJRE-Q-R Severity ($r = .52$) and OC-TCDQ-INC ($r = .44$) showed medium to large correlations.

Discussion

The aim of Study 1 was to develop and test a stimulus set that assesses SOA-related NJREs. Our findings showed that SOA-related NJREs can be assessed with visual stimuli. Both PIC-NR45 and PIC-NR10 demonstrated excellent internal consistency and were significantly correlated with existing measures of NJREs. Moreover, PIC-NR10 showed a strong association with SOA-related symptom measures. Taken together, these findings suggest that PIC-NR10 is a potentially useful and valid instrument in the assessment of SOA-related NJRE, which does not rely on retrospective self-evaluation of NJREs (Table 5).

Study 2

Study 2 was conducted to further verify PIC-NR10 with an independent sample of undergraduates. First, we conducted a CFA to examine the unidimensional structure of PIC-NR10. Second, we tested its psychometric properties including internal consistency and convergent/divergent validity with NJREs, SOA, OC-symptoms and general emotional distress measures. We predicted that, similar to Study 1, PIC-NJR10

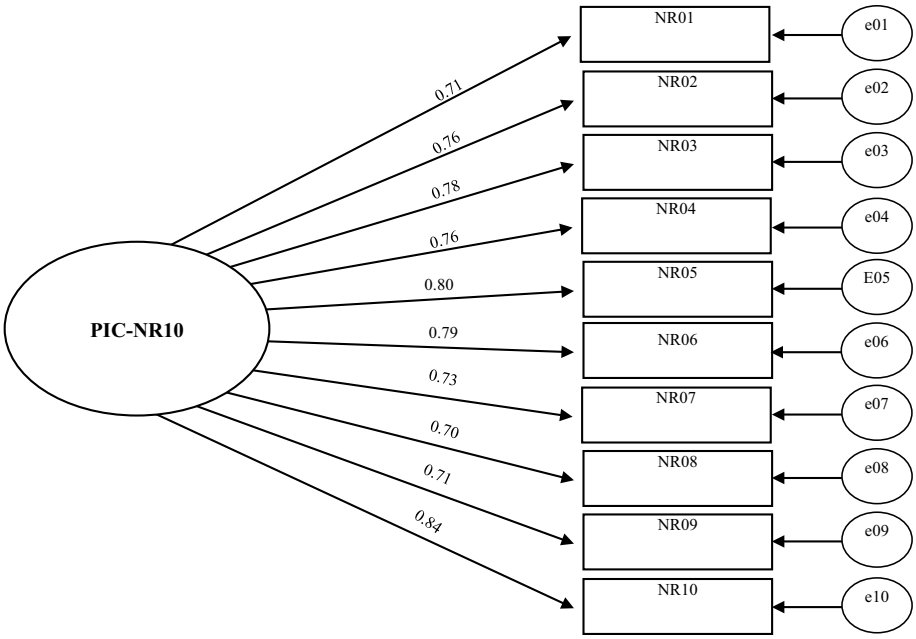

Fig. 2 Standardized path coefficients for the unidimensional model of PIC-NR10

would show strong psychometric properties and significant relationships with relevant measures.

Method

Participants

Study 2 was completed online via Qualtrics with a new, independent sample. All participants provided electronic informed consent prior to enrollment. Participants included 166 individuals (male = 26, female = 139) with a mean age of 21.8 years (*SD* = 4.2). Racial diversity of participants included: White (74%), Black/African-American (8%), Hispanic/Latino (15%), and multiracial/other (3%). Clinical characteristics are presented in Table 1. Participants completed the study over the Internet, and the median length of time to complete the study was 37.2 min. Those who completed the study were awarded partial course credit.

Measures

Participants first completed the PIC-NR10 and PIC-JR10 ratings, followed by other self-report measures, including NJRE-Q-R, OC-TCDQ-INC, SOAQ, OCI-R, OBQ, FMPS, and DASS-21. Internal consistency of each measure was comparable to values obtained in Study 1.

Results

The average ratings of urge, distress, and NJRE feeling associated with PIC-NR10 stimuli were at least moderate, whereas those for PIC-JR10 were minimal. The internal consistency was $\alpha = 0.93$ for PIC-NR10 and $\alpha = 0.81$ for PIC-JR10. Multiple *t* tests were conducted to compare the ratings evoked by each of PIC-NR10 items against their PIC-JR10 counterpart. All *t* tests were significant ($ps < .001$, Cohen's d range was 1.21–2.07 among the 10-items and 2.32 for the full 10-item set), suggesting that each of PIC-NR10 items was more effective in evoking NJREs than PIC-JR10.

We conducted a CFA of PIC-NR10 to verify its unidimensionality, using the ten rating scores from its items as indicators of the latent factor (see Fig. 2). Model fit was evaluated by commonly used indices: (a) the goodness-of-fit index (GFI; Jöreskog and Sörbom 1986), (b) adjusted goodness-of-fit (AGFI; Jöreskog and Sörbom 1986), (c) comparative fit index (CFI; Bentler 1990), (d) Tucker-Lewis Index (TLI; McDonald and Marsh 1990), and (e) the root mean square error of approximation (RMSEA; Browne and Cudeck 1993). The literature suggests the following cut points: GFI > 0.90 (Hu and Bentler 1999), AGFI > 0.90 (Hu and Bentler 1999), CFI > 0.90 (Hu and Bentler 1999), TLI > 0.90 (Bentler 1990), RMSEA < 0.08 (Browne and Cudeck 1993). Results showed that all ten indicators were significantly loaded on to the latent factor, and all examined indices demonstrated an excellent model fit: $\chi^2(df = 35) = 42.56$ ($p = .18$), GFI = 0.956, AGFI = 0.930, CFI = 0.992, TLI = 0.990, RMSEA = 0.036. These findings provide further support for the unidimensionality of PIC-NR10. Similar to Study 1, the three PIC-NR10 indicators also showed an excellent Cronbach's alpha coefficient ($\alpha = 0.96$). The Kolmogorov–Smirnov test also showed that the PIC-NR10 total scores did not deviate from a normal distribution ($p = .20$).

Table 6 Pearson correlations between PIC-NR10, NJRE-Q-R, OC-TCDQ-INC, and clinical measures (Study 2)

	PIC-NR10 total	PIC-NR10 INC	PIC-NR10 distress	PIC-NR10 urge	NJRE-Q-R quantity	NJRE-Q-R severity	OC-TCDQ INC
SOAQ	0.39***	0.31***	0.40***	0.39***	0.49***	0.47***	0.69***
OCI-R							
Washing	0.21**	0.15*	0.23**	0.20**	0.38***	0.41***	0.57***
Obsessing	0.15	0.11	0.17*	0.14	0.37***	0.45***	0.60***
Hoarding	0.25**	0.23**	0.25**	0.25**	0.33***	0.27***	0.60***
Ordering	0.42***	0.38***	0.41***	0.43***	0.45***	0.48***	0.69***
Checking	0.24**	0.19**	0.23**	0.23**	0.39***	0.48***	0.70***
Neutralizing	0.22**	0.19*	0.28***	0.22**	0.33***	0.29***	0.53***
Total	0.33***	0.27***	0.40***	0.32***	0.51***	0.51***	0.80***
DASS							
Depression	0.11	0.08	0.17*	0.10	0.31***	0.37***	0.48***
Anxiety	0.14	0.10	0.18*	0.12	0.35***	0.41***	0.56***
Stress	0.31***	0.26**	0.33***	0.29***	0.40***	0.52***	0.63***
Total	0.20**	0.16*	0.25**	0.18*	0.39***	0.47***	0.60***
OBQ							
Threat	0.22**	0.17*	0.25**	0.21**	0.26**	0.39***	0.53***
Intolerance	0.35***	0.29***	0.33***	0.34***	0.23**	0.40***	0.63***
Responsibility	0.31***	0.27***	0.33***	0.29***	0.23**	0.41***	0.53***
Imp thoughts	0.22**	0.19*	0.26**	0.20*	0.20*	0.34***	0.42***
Total	0.32***	0.26**	0.33***	0.30***	0.26**	0.44***	0.60***
FMPS							
Personal standards	0.31***	0.25**	0.26**	0.33***	0.26**	0.34***	0.49***
Organization	0.33***	0.24**	0.32***	0.33***	0.13	0.07	0.20**
Concern mistakes/doubts	0.31***	0.26**	0.31***	0.33***	0.33***	0.45***	0.64***
Parental expect/criticism	0.24**	0.18*	0.27**	0.24**	0.17*	0.24**	0.38***
Total	0.38***	0.30***	0.37***	0.39***	0.31***	0.40***	0.61***

PIC-NR10 total = composite score, PIC-NR10 INC = subjective level of incompleteness/NJRE, distress = subjective level of distress, urge = subjective urge to correct

NJRE-Q-R "Not Just Right" Questionnaire-Revised (Quantity and Severity), *OC-TCDQ-INC* Obsessive-Compulsive Trait Core Dimensions Questionnaire (Incompleteness), *SOAQ* Symmetry, Ordering, and Arranging Questionnaire, *OCI-R* Obsessive Compulsive Inventory-Revised, *OBQ* Obsessive Beliefs Questionnaire, *FMPS* Frost Multidimensional Perfectionism Scale, *DASS* Depression, Anxiety, and Stress Scales

*<.05; **<.01; ***<.001

Similar to Study 1, we examined the zero-order correlations among PIC-NR10, NJRE-Q-R Quantity, NJRE-Q-R Severity, OC-TCDQ-INC, and relevant clinical symptom measures. Results showed that PIC-NR10 total score and its three respective indicators were moderately correlated with the NJRE-Q-R Quantity, NJRE-Q-R Severity, and OC-TCDQ-INC (see Table 4). PIC-NR10 was also strongly associated with SOA-related symptoms as measured by the SOAQ ($r = .39$) and OCI-R Ordering ($r = .42$), as well as overall OC-symptoms, OCI-R Total ($r = .33$), $ps < .001$. PIC-NR10 was associated with personality features and belief domains relevant for OCD psychopathology, OBQ Total ($r = .32$) and FMPS Total ($r = .38$), $ps < .01$. Finally, PIC-NR10 was *not* associated with general depression and anxiety scores, whereas NJRE-Q-R Quantity, NJRE-Q-R Severity, and OC-TCDQ-INC were still significantly correlated with depression and anxiety (see Table 6).

We conducted a series of hierarchal linear regression analyses to examine the incremental validity of PIC-NR10, after controlling for each of the two existing NJRE measures. Given that the NJRE-Q-R and OC-TCDQ-INC reflect somewhat different aspects of NJREs, we constructed separate regression models to examine the unique contribution of PIC-NR10 relative to each of these representative NJRE self-report measures. In predicting SOAQ scores, DASS total scores were entered at Step 1, NJRE-Q-R Quantity

and NJRE-Q-R Severity (or the OC-TCDQ-INC score) were entered at Step 2, and PIC-NR10 scores at Step 3. The same procedure was repeated to predict the OCI-R Ordering score.

In predicting SOAQ scores, the DASS total score accounted for 20.8% variance in Step 1, $F(1, 163) = 42.71$, $p < .001$, and the NJRE-Q-R indices accounted for an additional 14.3% in Step 2, $F(3, 161) = 28.93$, $p < .001$. At Step 3, PIC-NR10 accounted for an additional 3.8% variance, $F(4, 160) = 25.38$, $p < .001$; $\beta = 0.21$, $t = 3.15$, $p = .002$ ($f^2 = 0.06$, small to medium effect; Cohen 1992). Similarly, in predicting OCI-R Ordering scores, Step 1 accounted for 22.5%, $F(1, 163) = 47.35$, $p < .001$, Step 2 accounted for 11.5% variance, $F(3, 161) = 27.65$, $p < .001$, and the PIC-NR10 accounted for an additional 5.60% variance in Step 3, $F(4, 160) = 26.52$, $p < .001$; $\beta = 0.26$, $t = 3.90$, $p < .001$ ($f^2 = 0.09$, small to medium effect; Cohen 1992).

In predicting SOAQ scores while controlling for the OC-TCDQ-INC score, the DASS total scores accounted for 20.8% variance in Step 1, $F(1, 163) = 42.71$, $p < .001$, and the OC-TCDQ-INC accounted for an additional 27.6% in Step 2, $F(2, 162) = 75.98$, $p < .001$. At Step 3, PIC-NR10 accounted for an additional 2.00% variance, $F(3, 161) = 54.52$, $p < .001$; $\beta = 0.15$, $t = 2.54$, $p = .012$ ($f^2 = 0.03$, small to medium effect; Cohen 1992). In predicting OCI-R Ordering scores, Step 1 accounted for 22.5% variance, $F(1, 163) = 47.35$, $p < .001$, Step 2 accounted for an additional 25.7% variance, $F(2, 162) = 75.36$, $p < .001$. At Step 3, PIC-NR10 accounted for an additional 3.1% variance, $F(3, 161) = 47.35$, $p < .001$; $\beta = 0.19$, $t = 3.20$, $p = .002$ ($f^2 = 0.06$, small to medium effect; Cohen 1992).[2]

[2] We conducted additional analyses by entering the PIC-NR10 in Step 2 and the NJRE scale scores in Step 3. In predicting SOAQ scores, PIC-NR10 explained 9.4% additionally in Step 2, $F(1, 162) = 21.79$, $p < .001$; and the NJRE-Q-R indices explained 8.7% of the variance additionally in Step 3, $F(2, 160) = 11.33$, $p < .001$. Similarly, in predicting OCI-R Ordering scores, PIC-NR10 explained 11.1% variance in Step 2, $F(1, 162) = 27.07$, $p < .001$, and the NJRE-Q-R indices explained 6.0% variance additionally in Step 3, $F(2, 160) = 7.98$, $p < .001$. Similar analyses were repeated for the OC-TCDQ-INC. In predicting SOAQ scores, following identical results in Steps 1 and 2, the OC-TCDQ-INC score explained 20.2% of the variance additionally in Step 3, $F(1, 161) = 65.68$, $p < .001$. In predicting OCI-R Ordering scores, the OC-TCDQ-INC score explained 17.7% variance additionally in Step 3, $F(1, 161) = 58.47$, $p < .001$. In all these analyses, the PIC-NR10 remained as a significant predictor of SOA variables.We also tested the incremental validity of PIC-NR10 while controlling for the two NJRE self-report measure scores within the same regression model. In predicting SOAQ scores, the DASS total explained 20.3% variance in Step 1, $F(1, 163) = 42.71$, $p < .001$, the NJRE-Q-R Quantity and Severity and the OC-TCDQ-INC scores together explained an additional 30.9% variance in Step 2, $F(4, 160) = 42.78$, $p < .001$, and PIC-NR 10 accounted for an additional 1.4% variance at Step 3, $F(5, 159) = 36.02$, $p < .001$, $\beta = 0.13$, $t = 2.20$, $p = .03$. In predicting the OCI-R Ordering scores, the DASS total explained 22.5% variance in Step 1, $F(1, 163) = 47.35$, $p < .001$, the NJRE-Q-R Quantity and Severity and the OC-TCDQ-INC scores together explained an additional 28.1% variance in Step 2, $F(4, 160) = 40.92$, $p < .001$, and PIC-NR 10 accounted for an additional 2.7% variance at Step 3, $F(5, 159) = 36.29$, $p < .001$; $\beta = 0.18$, $t = 3.05$, $p = .003$. Overall, these findings provide support for the incremental validity of the PIC-NR10 in conjunction with the existing NJRE scales.

Discussion

Study 2 was conducted to provide additional psychometric support for PIC-NR10 and its relationship with existing NJREs and clinical measures. We obtained several findings that support its excellent psychometric properties and its relevance for assessing the SOA-related NJRE experiences. First, the CFA analysis confirmed the unidimensionality of PIC-NR10, along with high internal-consistency reliability. Second, PIC-NR10 was significantly associated with SOA-relevant OCD symptoms and self-report measures of NJRES; whereas, it was not significantly associated with general depression and anxiety symptoms. Third, PIC-NR10 demonstrated incremental validity by significantly predicting SOA symptoms, even after controlling for general emotional distress and the two well-established self-reported indices of NJRES. Taken together, PIC-NR10 is considered a brief, psychometrically reliable measure with some promising preliminary evidence for its construct validity.

Study 3

Studies 1 and 2 provided initial evidence for the utility of PIC-NR10. However, the findings are limited in that the target OCD symptom domain (i.e., SOA) exclusively relied on self-reported measures. It is not yet known how PIC-NR10, as compared with the two existing NJREs questionnaires, would predict individuals' reactions during an in vivo SOA-related behavioral task that is designed to provoke the urges and feelings related to NJRE. If PIC-NR10 is significantly predictive of NJRE reactions in response to actual behavioral tasks, its ecological validity would be further supported. To this end, we recruited an independent sample of undergraduates to test the relationship between PIC-NR10 and outcomes on various in vivo behavioral tasks. We predicted that PIC-NR10 would account for a significant amount of variance in NJRE task ratings and outcome, even after controlling for scores on the questionnaires of NJREs and general emotional distress.

Method

Participants

Fifty-two individuals (male = 9 and female = 43) with a mean age of 21.37 years (*SD* = 3.95) participated in the in-person study procedure. Informed written consent was obtained before administration of the protocol. Racial diversity of participants included: White (61%), Black/African-American (13%), Hispanic/Latino (21%), and multiracial/other (5%). Clinical characteristics are presented in Table 1. Those who completed the study were awarded partial course credit.

Self-Report Measures

Similar to Study 2, participants first completed the PIC-NR10 and PIC-JR10, followed by other self-report measures, including NJRE-Q-R, OC-TCDQ-INC, SOAQ, OCI-R, and DASS-21. Internal consistency of each measure was comparable to values obtained in Studies 1 and 2.

Behavioral NJRE Exposure Tasks

Participants were then presented with three behavioral tasks intended to evoke SOA-related NJREs: (1) an unorganized book shelf, (2) a messy desk with every day household items, and (3) crooked pictures on a wall. The behavioral tasks used in the current study were similar to those validated in existing studies (Coles et al. 2003, 2005; Cougle et al. 2013).

Messy Desk Task In this task, participants were asked to re-arrange a cluttered desk. Various items (e.g., paper clips, pencils/pens, rubber bands, mug, binder, envelopes, loose papers, coins) were placed on the desk in a disorganized fashion in order to evoke SOA-related NJREs.

Crooked Pictures Task Three framed pictures were hung on a wall by frame wire and a small nail. The pictures were not aligned horizontally; rather, they were aligned unevenly in an offset row (i.e., one slightly higher/lower than the other). Each of the three pictures was tilted at a 20° angle or greater.

Unorganized Bookshelf Task Participants were instructed to view a two-tier bookshelf with approximately 40 different books that varied in size and color. Two sets of duplicate books were included, as well as two books from a series (i.e., 1, 2, 3) to allow for some consistency with order and arrangement.

While exposed to the stimuli, prior to task engagement, current NJREs were assessed using the three items from PIC-NR/JR scale (i.e., current NJRE feeling, being bothered by the stimuli, urge to fix the stimuli) for each of the three settings. After providing NJRE ratings for all three settings, participants were instructed to "fix" the stimuli until they achieved a desired "just right" feeling. Upon completion of each of the tasks, participants were again asked to report their current NJRE experiences using the three rating items. Additionally, they provided a rating of their subjective level of satisfaction in "fixing" the presented stimuli to a desired "just right" state. Participants were given up to 5 min to finish each task; however, they were unaware of this limit. An undisclosed time limit was necessary for study feasibility. Four participants reached maximum time while arranging the desk and bookshelf, and no participants reached the maximum time while completing the picture hanging task. While participants were engaging with the behavioral task, they were left alone in the room (so that they could respond to the task in a naturalistic way without a nearby observer).

Procedure

Informed consent was obtained prior to administration of the study protocol. Next, participants were brought into a small room with a personal computer. Here, they completed the battery of measures, including PIC-NR10 ratings. Lastly, participants were taken to a separate room to complete the NJRE behavioral tasks.

Results

The means and SDs of the averaged ratings from the clinical measures and existing NJREs measures are presented in Table 1. PIC-NR10 showed strong internal consistency (α = 0.85), and the average mean score of PIC-NR10 (*M* = 6.52, *SD* = 1.76) was similar to that of ratings obtained in Study 1 (*M* = 5.86, *SD* = 2.70) and Study 2 (*M* = 6.15, *SD* = 2.44). The PIC-NR10 total scores were also normally distributed (Kolmogorov–Smirnov test, *p* = .20).

The average amount of time to complete all three behavioral tasks was 7 min and 1 s: desk = 3 min and 15 s, pictures = 49 s, and bookshelf = 2 min and 57 s. The overall average pre-task NJRE ratings demonstrated that the behavioral tasks evoked moderate levels of NJREs (*M* = 6.74, *SD* = 1.81): desk (*M* = 6.43, *SD* = 2.66), pictures (*M* = 6.29, *SD* = 2.23), and bookshelf (*M* = 7.51, *SD* = 1.91). Post-task NJRE ratings showed that participants reported significantly lower levels of NJREs after they ordered and arranged each task to obtain a desired "just right" feeling. Paired sample *t* tests demonstrated that the post-task ratings were significantly lower than pre-task ratings across tasks: the amount of pre-to-post reductions in overall NJRE (*M* = 5.26, *SD* = 1.60, *t* = 23.71, *p* < .001), desk NJRE (*M* = 4.40, *SD* = 2.40, *t* = 13.23, *p* < .001), pictures NJRE

($M = 6.63$, $SD = 2.28$, $t = 20.99$, $p < .001$), and bookshelf NJRE ($M = 4.76$, $SD = 2.52$, $t = 13.62$, $p < .001$). Together, these findings suggest that (1) the SOA-related NJRE tasks in the current study were effective in evoking NJREs, and (2) SOA-related NJRE can be experimentally manipulated and changed over a very short period of time.

Several hierarchical linear regression analyses were conducted to test our hypothesis that PIC-NR10 would significantly predict in vivo SOA-related NJRE task outcomes while controlling for the existing self-report measures of NJREs (NJRE-Q-R Quantity, NJRE-Q-R Severity, and OC-TCDQ-INC Incompleteness), and general emotional distress (DASS-21). For a stringent test of the predictive validity of the PIC-NR10, we included both self-report NJRE measures in the same regression model in Study 3.

First, in predicting NJRE ratings obtained from the pre-task exposure, the PIC-NR10 was the only significant positive predictor, accounting for a significant amount of additional variance at Step 3 for each of the NJRE-related tasks: desk = 10%, pictures = 28%, and bookshelf = 22%, (see Table 7, top). While the NJRE-Q-R Severity scale significantly predicted pre-task ratings for the messy bookshelf, an unexpected negative relationship was observed.

Second, PIC-NR10 was also the only NJREs measure that accounted for a significant amount of variance (10%) in the total amount of time taken to complete three tasks.

Further, we examined how sensitively PIC-NR10 could predict changes in NJREs ratings from pre- to post-behavioral tasks, using the reduction scores as the dependent measures in similar hierarchical regression analyses. PIC-NR10 significantly predicted pre-to-post reductions in NJRE ratings from the behavioral tasks (see Table 7, bottom). Compared to the NJRE questionnaires, PIC-NR10 was able to more sensitively capture changes in NJREs.

Discussion

In Study 3, we sought to test the usefulness of PIC-NR10 in predicting SOA-related NJREs during the completion of in vivo tasks. We predicted that PIC-NR10 would account for a significant amount of variance in NJRE task ratings and outcome, even after controlling for existing NJRE measures and general emotional distress. Consistent with predictions, there were significant positive relationships between PIC-NR10 ratings and pre-task NJRE ratings, as well as total time spent completing the tasks. We also found that PIC-NR10 significantly predicted pre-to-post change in NJRE task ratings, even after controlling for existing NJREs measures and general emotional distress. This provides initial support of its utility as a sensitive index for quantifying the variable level of NJREs in a context of experimental manipulation. These findings suggest that future research may be warranted to examine the PIC-NR10 as a potential outcome measure in an intervention context. Taken together, PIC-NR10 has the potential to be utilized as a useful, ecologically valid measure of SOA-related NJREs.

General Discussion

The aim of the current series of studies was to develop a new picture-based measure that can be used for assessing SOA-related NJREs. SOA-related NJREs are an important area of research given that many individuals with OCD experience both SOA symptoms (Lochner et al. 2015; Rasmussen and Eisen 1992; Sasson et al. 1997) and NJREs (Coles et al. 2003; Summerfeldt 2004). Yet, there is a paucity of literature that has examined SOA symptoms and NJREs together, and existing measures of NJREs rely on self-report recollection and do not specifically address SOA-symptoms. Considering the significance of NJREs that are heavily manifested in SOA-related OCD often difficult to treat (Stein et al. 2007, 2008), there is a great need for a reliable measure of NJRE experiences linked to SOA. Thus, we developed PIC-NR10 to further research on the relationship between SOA-related NJREs and OCD symptomology.

In Studies 1 and 2, we demonstrated with exploratory- and confirmatory-factor analysis that PIC-NR10 is a psychometrically sound instrument in the assessment of SOA-related NJREs. We also showed significant positive associations between PIC-NR10, SOAQ, and relevant OCD symptom measures (e.g., OCI-R Ordering, FMPS Organization). Further, in Study 2, the PIC-NR10 showed greater overall divergence from general emotional distress (i.e., DASS-21: Depression, Anxiety, and Stress) than the NJRE-Q-R and OC-TCDQ-INC. Taken together, Studies 1 and 2 provided initial data supporting the convergent and discriminant validity of PIC-NR10. In Study 3, we examined the ecological validity of PIC-NR10 using three established in vivo behavioral tasks (Coles et al. 2003, 2005; Cougle et al. 2013). Greater PIC-NR10 ratings were predictive of greater pre-task NRE ratings, more time taken to compete the correcting task, and greater pre-to-post change scores than the NJRE-Q-R Quantity and Severity, and OC-TCDQ-INC measures. Thus, PIC-NR10 has demonstrated ecological validity in a non-clinical sample.

We believe that the new picture-based measure of SOA-related NJREs is a useful addition to the existing assessment resources for NJREs. While the NJRE-Q-R and OC-TCDQ-INC are well-established instruments in the assessment of NJREs, they are constrained by methodological limitations stemming from the retrospective self-reported mode of assessment. PIC-NR10 is a novel approach that captures SOA-related NJREs evoked by vivid real-life examples in the current moment. Given that NJREs are often triggered

Table 7 Summary of hierarchical regression analyses for variables predicting pre-task NJRE rating and total time correcting NRJEs

Variable	Desk task			Picture task			Bookshelf task			Total time		
	β	*t*	*p*	β	*t*	*p*	β	*t*	*p*	β	*t*	*p*
[a]DV = pre-task exposure NJRE ratings												
Step 1	($R = .13$, $R^2 = .02$, $\Delta R^2 = .02$)			($R = .04$, $R^2 \leq .01$, $\Delta R^2 \leq .01$)			($R = .11$, $R^2 = .01$, $\Delta R^2 = .01$)			($R = .06$, $R^2 \leq .01$, $\Delta R^2 \leq .01$)		
DASS total	0.13	0.95	.35	−0.04	−0.31	.76	0.11	0.76	.45	0.06	0.40	.69
Step 2	($R = .47$, $R^2 = .22$, $\Delta R^2 = .20$)			($R = .39$, $R^2 = .15$, $\Delta R^2 = .15$)			($R = .47$, $R^2 = .22$, $\Delta R^2 = .21$)			($R = .16$, $R^2 = .02$, $\Delta R^2 = .02$)		
DASS total	−0.25	−1.44	.16	−0.32	−1.75	.09	−0.11	−0.61	.54	0.06	0.30	.77
NJRE-Q-R quantity	0.22	1.28	.21	0.15	0.81	.42	0.32	1.86	.07	0.13	0.70	.49
NJRE-Q-R severity	0.01	0.07	.94	−0.13	−0.69	.49	−0.38	−2.17	.03	−0.18	−0.93	.36
OC-TCDQ-INC	0.44	2.60	.01	0.45	2.51	.02	0.43	2.53	.01	0.05	0.27	.79
Step 3	($R = .57$, $R^2 = .33$, $\Delta R^2 = .10$, $f^2 = 0.16$)[c]			($R = .66$, $R^2 = .43$, $\Delta R^2 = .28$, $f^2 = 0.49$)			($R = .66$, $R^2 = .44$, $\Delta R^2 = .22$, $f^2 = 0.39$)			($R = .35$, $R^2 = .12$, $\Delta R^2 = .10$, $f^2 = 0.11$)		
DASS total	−0.18	−1.12	.27	−0.21	−1.36	.18	−0.01	−0.06	.95	0.12	0.65	.52
NJRE-Q-R quantity	0.20	1.23	.22	0.11	0.75	.46	0.29	1.97	.06	0.11	0.62	.54
NJRE-Q-R severity	0.00	0.01	.99	−0.15	−0.96	.34	−0.40	−2.64	.01	−0.19	−1.02	.31
OC-TCDQ INC	0.25	1.44	.16	0.13	0.82	.42	0.16	0.97	.34	−0.13	−0.67	.51
PIC-NR10	0.37	2.66	.01	0.61	4.79	< .01	0.53	4.25	< .01	0.35	2.25	.03
[b]DV = pre-post NJRE change scores												
Step 1	($R = .07$, $R^2 \leq .01$, $\Delta R^2 \leq .01$)			($R = .12$, $R^2 = .01$, $\Delta R^2 = .02$)			($R = .03$, $R^2 = < .01$, $\Delta R^2 = < .01$)					
DASS total	< 0.01	0.05	.96	−0.12	−0.86	.40	0.03	0.20	.84			
Step 2	($R = .40$, $R^2 = .16$, $\Delta R^2 = .16$)			($R = .35$, $R^2 = .12$, $\Delta R^2 = .11$)			($R = .42$, $R^2 = .18$, $\Delta R^2 = .18$)					
DASS total	−0.17	−1.62	.11	−0.35	−1.92	.06	−0.13	−0.72	.47			
NJRE-Q-R quantity	0.74	1.32	.19	0.09	0.52	.61	0.17	0.95	.35			
NJRE-Q-R severity	−0.10	−0.68	.50	−0.10	−0.51	.61	−0.37	−2.06	.05			
OC-TCDQ-INC	0.32	2.23	.02	0.39	2.17	.04	0.46	2.60	.01			
Step 3	($R = .47$, $R^2 = .22$, $\Delta R^2 = .06$, $f^2 = 0.08$)			($R = .53$, $R^2 = .28$, $\Delta R^2 = .16$, $f^2 = 0.22$)			($R = .59$, $R^2 = .35$, $\Delta R^2 = .18$, $f^2 = 0.26$)					
DASS total	−0.24	−1.36	.18	−0.27	−1.59	.12	−0.04	−0.26	.80			
NJRE-Q-R quantity	0.22	1.26	.21	0.07	0.41	.68	0.14	0.90	.38			
NJRE-Q-R severity	−0.13	−0.75	.46	−0.11	−0.64	.53	−0.39	−2.39	.02			
OC-TCDQ-INC	0.27	1.42	.16	0.16	0.86	.40	0.21	1.20	.24			
PIC-NR10	0.28	1.90	.06	0.46	3.22	< .01	0.48	3.54	< .01			

[a]Dependent variable of the regression model is 'pre-exposure NJRE ratings'

[b]Dependent variable of the regression model is mean difference scores from pre to post

[c]Effect size (f^2) for the increased R^2 in Step 3: $f^2 = 0.02$ (small); 0.15 (medium); 0.35 (large) (Cohen 1992)

by external sensory cues (e.g., visual, tactile), an effective way to assess them would be to provide an analogous context of NJRE, as in the case of PIC-NR10. Thus, PIC-NR10 is expected to provide valuable additional information in assessing NJREs by supplementing the existing retrospective self-report measures. Given that PIC-NR10 potently evoked NJRE reactions in the current study samples, this new instrument is also expected to be useful as an induction method of SOA-related NJREs. Thus, the utility of PIC-NR10 shows promise as an NJRE-assessment and an experimental NJRE-induction task.

Limitations and Future Direction

There were several limitations of the current study which will require future research. First, the current study relied exclusively on undergraduate student samples. Therefore, the extent to which PIC-NR10 can sensitively assess SOA-related NJREs among a clinical sample of OCD remains unclear. To establish its clinical utility, future research should examine the psychometric properties and clinical utility of the PIC-NR10 in patient samples of OCD, as compared with healthy controls, across various contexts (e.g., cross-sectional assessment of NJREs along with other relevant clinical variables, and longitudinal assessments of NJREs to examine its predictive validity or sensitivity in explaining the status or change in relevant symptom). Considering its medium to large-sized correlations with SOA symptoms, it is expected that clinical samples will display stronger NJRE reactions on PIC-NR10 than the current sample. Second, NJREs are manifested in a wide range of modalities of stimuli (e.g., auditory, tactile) in OCD and its related disorders (e.g., trichotillomania, excoriation disorder). Although current findings point to overall sound psychometric properties of PIC-NR10, this instrument was designed to measure specifically SOA-related NRJEs, which may limit its clinical utility, considering the clinical heterogeneity of OCD and other numerous NJRE-related conditions. Therefore, it is imperative to examine whether assessing NJREs by the PIC-NR10 using the SOA-relevant contextual cues is applicable and useful in explaining other domains of OCD symptoms and other OCD-related disorders in continuing investigations. Third, the PIC-NR10 materials depict a rather clear deviation from SOA. Due to their explicitly disorderly look, there is a possibility that its resulting scores may reflect the severity of SOA symptoms themselves in addition to their underlying sensory-affective NJREs. In this regard, future research needs to address relevant questions, including how to conceptualize and assess distinctively overt SOA symptoms and their associated NJREs, and whether more implicit and subtly deviant pictures of SOA would trigger NJREs more effectively. Fourth, to minimize the influence of other measures on the new picture-based instrument under development, we administered the PIC-NR10 as the first component in all three studies, followed by other questionnaires/behavioral tasks. Thus, this study cannot answer whether the preceding exposure to the PIC-NR10 pictures affected participants' response on other well-validated measures, whereas we can be certain that the PIC-NR10 data were obtained while excluding potential influence of other measures. Fifth, there was gender disparity among the current sample, with significantly more women (83%) than men (17%) across studies. Future research should examine PIC-NR10 among a gender-balanced sample to examine similarities and differences between groups. The restricted range of age in the current sample consisting of undergraduate students is also an important limitation, and future research needs to test PIC-NR10 among a wide range of age groups. This new instrument assesses NJREs in the present moment using pictures of straightforward and familiar objects, which can be easily applied to children and adolescents. Therefore, we expect that this measure has a wider applicability in terms of the suitable age range, including a pediatric sample of OCD-related disorder (OCRD). Sixth, data showed that our non-clinical, undergraduate sample reported stronger levels of NJREs in response to PIC-NR10 than PIC-JR10. Although, we expect that a clinical sample of individuals with an OCRD would show even stronger NJRE reactions, we do not know what would constitute a clinical or pathological level of NJREs compared to "normal range" discomfort associated with NJREs. Therefore, normative data would be useful in providing relevant cutoff points of PIC-NR10, and future research should address this limitation. Finally, the observed effect size of the PIC-NR10 in explaining SOA symptoms in Study 2 was quite modest (small to medium) after controlling for the influence of negative affect and the well-established NJRE scores, although it still remained as the significant predictor of SOA variables in all regression models. In contrast, in Study 3, the PIC-NR10 explained behavioral SOA outcome variables with medium to large effects even after controlling for both the NJRE-Q-R and OC-TCDQ-INC scores. Thus, future research should more systematically examine the PIC-NR10's predictive validity as a function of the assessment mode of outcome criteria (e.g., self-report, behavioral, or physiological).

Conclusion

The current study extends our understanding of SOA-related OC-symptoms within the context of NJREs. We developed PIC-NR10, a psychometrically valid picture-based measure that can assess SOA-related NJREs. The development of this measure was important to further our understanding of the nature of NJREs and this relatively understudied subtype of OCD.

Compliance with ethical standards

Conflict of interest Taylor Davine, Ivar Snorrason, Gregory Berlin, Ashleigh M. Harvey, Salahadin Lotfi, and Han-Joo Lee declare that they have no conflict of interest.

Informed Consent All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual subjects participating in the study.

Animal Rights No animal studies were carried out by the authors for this article.

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: American Psychiatric Association.

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin, 107*, 238–246.

Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 136–162). Newbury Park: Sage.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*(1), 155–159.

Coles, M. E., Frost, R. O., Heimberg, R. G., & Rhéaume, J. (2003). "Not just right experiences": Perfectionism, obsessive-compulsive features and general psychopathology. *Behaviour Research and Therapy, 41*, 681–700.

Coles, M. E., Heimberg, R. G., Frost, R. O., & Steketee, G. (2005). Not just right experiences and obsessive–compulsive features: Experimental and self-monitoring perspectives. *Behaviour Research and Therapy, 43*(2), 153–167.

Coles, M. E., & Ravid, A. (2016). Clinical presentation of not-just right experiences (NJREs) in individuals with OCD: Characteristics and response to treatment. *Behaviour Research and Therapy, 87*, 182–187.

Cougle, J. R., Fitch, K. E., Jacobson, S., & Lee, H.-J. (2013). A multimethod examination of the role of incompleteness in compulsive checking. *Journal of Anxiety Disorders, 27*(2), 231–239.

Ecker, W., Kupfer, J., & Gönner, S. (2014). Incompleteness as a link between obsessive–compulsive personality traits and specific symptom dimensions of obsessive–compulsive disorder. *Clinical Psychology & Psychotherapy, 21*(5), 394–402.

Ferrão, Y. A., Shavitt, R. G., Prado, H., Fontenelle, L. F., Malavazzi, D. M., de Mathis, M. A., … do Rosári, M. C. (2012). Sensory phenomena associated with repetitive behaviors in obsessive-compulsive disorder: An exploratory study of 1001 patients. *Psychiatry Research, 197*(3), 253–258.

Foa, E. B., Huppert, J. D., Leiberg, S., Langner, R., Kichic, R., Hajcak, G., & Sals, P. M. (2002). The obsessive–compulsive inventory: Development and validation of a short version. *Psychological Assessment, 14*, 485–496.

Foa, E. B., Kozak, M. J., Salkovskis, P., Coles, M. E., & Amir, N. (1998). The validation of a new obsessive–compulsive disorder scale: The Obsessive–Compulsive Inventory. *Psychological Assessment, 10*, 206–214.

Frost, R. O., Marten, P., Lahart, C., & Rosenblate, R. (1990). The dimensions of perfectionism. *Cognitive Therapy and Research, 14*(5), 449–468.

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*(1), 1–55.

Jöreskog, K. G., & Sörbom, D. (1986). *LISREL VI: Analysis of linear structural relationships by maximum likelihood, instrumental variables, and least squares methods*. Mooresville: Scientific Software, Inc.

Labad, J., Menchon, J. M., Alonso, P., Segalas, C., Jimenez, S., Jaurrieta, N., … Vallejo, J. (2008). Gender differences in obsessive–compulsive symptom dimensions. *Depression and Anxiety, 25*, 832–838.

Lochner, C., McGregor, N., Hemmings, S., Harvey, B. H., Breet, E., Swanevelder, S., & Stein, D. J. (2015). Symmetry symptoms in obsessive-compulsive disorder: Clinical and genetic correlates. *Revista Brasileira de Psiquiatria, 38*, 17–23.

Lovibond, S. H., & Lovibond, P. F. (1995a). *Manual for the Depression Anxiety Stress Scales* (2nd ed.). Sydney: Psychology Foundation.

Lovibond, S. H., & Lovibond, P. F. (1995b). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behavior Research and Therapy, 33*(3), 335–343.

McDonald, R. P., & Marsh, H. W. (1990). Choosing a multivariate model: Noncentrality and goodness-of-fit. *Psychological Bulletin, 707*, 247–255.

McKay, D., Abramowitz, J. S., Calamari, J. E., Kyrios, M., Radomsky, A., Sookman, D., … Wilhelm, S. (2004). A critical evaluation of obsessive-compulsive disorder subtypes: Symptoms versus mechanisms. *Clinical Psychology Review, 24*, 283–313.

Moulding, R., Anglim, J., Nedeljkovic, M., Doron, G., Kyrios, M., & Ayalon, A. (2011). The Obsessive Beliefs Questionnaire (OBQ): Examination in nonclinical samples and development of a short version. *Assessment, 18*, 357–374.

Obsessive Compulsive Cognitions Working Group. (2001). Development and initial validation of the obsessive beliefs questionnaire and the interpretation of intrusions inventory. *Behaviour Research and Therapy, 39*(8), 987–1006.

Obsessive Compulsive Cognitions Working Group. (2005). Psychometric validation of the obsessive belief questionnaire and interpretation of intrusions inventory—Part 2: Factor analyses and testing of a brief version. *Behaviour Research and Therapy, 43*(11), 1527–1542.

Pietrefesa, A. S., & Coles, M. E. (2008). Moving beyond an exclusive focus on harm avoidance in obsessive compulsive disorder: Considering the role of incompleteness. *Behavior Therapy, 39*(3), 224–231.

Pitman, R. (1987). Pierre Janet on obsessive-compulsive disorder (1903). *Archives of General Psychiatry, 44*, 226–232.

Rachman, S. (1997). A cognitive theory of obsessions. *Behaviour Research and Therapy, 35*, 793–802.

Rachman, S. (1998). A cognitive theory of obsessions: Elaborations. *Behaviour Research and Therapy, 36*, 398–401.

Rachman, S. (2002). A cognitive theory of compulsive checking. *Behaviour Research and Therapy, 40*(6), 625–639.

Radomsky, A. S., Ouimet, A. J., Ashbaugh, A. R., Lavoie, S. L., Parrish, C. L., & O'Connor, K. P. (2006). Psychometric properties of the French and English versions of the Vancouver Obsessional-Compulsive Inventory and the Symmetry, Ordering, and Arranging Questionnaire. *Cognitive Behaviour Therapy, 35*, 164–173.

Radomsky, A. S., & Rachman, S. (2004). Symmetry, ordering and arranging compulsive behavior. *Behaviour Research and Therapy, 42*, 893–913.

Rasmussen, S. A., & Eisen, J. L. (1992). The epidemiology and clinical features of obsessive compulsive disorder. *The Psychiatric Clinics of North America, 15*(4), 743–758.

Ruscio, A. M., Stein, D. J., Chiu, W. T., & Kessler, R. C. (2010). The epidemiology of obsessive-compulsive disorder in the National Comorbidity Replication. *Molecular Psychiatry, 15*, 53–63.

Salkovskis, P. M. (1985). Obsessional-compulsive problems: A cognitive-behavioural analysis. *Behaviour Research and Therapy, 23*, 571–583.

Sasson, Y., Zohar, J., Chopra, M., Lustig, M., Iancu, I., & Hendler, T. (1997). Epidemiology of obsessive-compulsive disorder: A world view. *Journal of Clinical Psychiatry, 58*, 7–10.

Stein, D. J., Andersen, E. W., & Overo, K. F. (2007). Response of symptom dimensions in obsessive-compulsive disorder to treatment with citalopram or placebo. *Revista Brasileira de Psiquiatria, 29*(4), 303–307.

Stein, D. J., Carey, P. D., Lochner, C., Seedat, S., Fineberg, N., & Andersen, E. W. (2008). Escitalopram in obsessive-compulsive disorder: Response of symptom dimensions to pharmacotherapy. *CNS Spectrums, 13*(6), 492–498.

Stöber, J. (1998). The Frost Multidimensional Perfectionism Scale: More perfect with four (instead of six) dimensions. *Personality and Individual Differences, 24*(4), 481–491.

Summerfeldt, L. J. (2004). Understanding and treating incompleteness in obsessive-compulsive disorder. *Journal of Clinical Psychology, 60*(11), 1155–1168.

Summerfeldt, L. J., Gilbert, S. J., & Reynolds, M. (2015). Incompleteness, aesthetic sensitivity, and the obsessive-compulsive need for symmetry. *Journal of Behavior Therapy and Experimental Psychiatry, 49*, 141–149.

Summerfeldt, L. J., Kloosterman, P. H., Antony, M. M., & Swinson, R. P. (2014). Examining an obsessive-compulsive core dimensions model: Structural validity of harm avoidance and incompleteness. *Journal of Obsessive-Compulsive and Related Disorders, 3*, 83–94.

Taylor, S., McKay, D., Crowe, K. B., Abramowitz, J. S., Conelea, C. A., Calamari, J. E., & Sica, C. (2014). The sense of incompleteness as a motivator of obsessive-compulsive symptoms: An empirical analysis of concepts and correlates. *Behavior Therapy, 45*(2), 254–262.

Wolpe, J. (1973). *The practice of behavior therapy*. New York: Pergamon.