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Validation of a French version of the Vancouver Obsessional Compulsive Inventory–Mental Contamination scale (VOCI-MC) and the Contamination Thought–Action Fusion scale (CTAF) in non-clinical and clinical samples

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Abstract

The Vancouver Obsessional Compulsive Inventory–Mental Contamination scale (VOCI-MC) and the Contamination Thought–Action Fusion scale (CTAF) are two self-report instruments that assess symptoms of mental contamination and fusion between thoughts, and feelings and behaviours associated with contamination, respectively. The aim of this study was to investigate the psychometric properties of the French version of these two scales in non-clinical and clinical samples. We included 79 participants diagnosed with obsessive-compulsive disorder (OCD), 31 diagnosed with anxiety disorders, who were recruited from the University Department of Adult Psychiatry in Montpellier, and 320 non-clinical participants recruited from the general population. Psychometric properties of the French VOCI-MC and CTAF were investigated. Results showed that the French versions of the VOCI-MC and the CTAF had high internal consistency, good convergent and divergent validity, as well as good temporal stability. Exploratory and confirmatory factor analyses showed a one-factor structure for the two scales in both non-clinical and OCD samples. Adequate discriminative validity was established by comparing OCD patients with contamination-related symptoms and OCD patients who did not report contamination-related symptoms. The French VOCI-MC and CTAF are valid and appropriate tools for measuring mental contamination in both clinical and research contexts.

Keywords: CTAF; Measurement; Mental health; OCD; Questionnaires; VOCI-MC

Introduction

Obsessive-compulsive disorder (OCD) is a severe mental disorder associated with important functional and quality of life impairments (Markarian *et al.*, 2010). The World Health Organization classifies anxiety disorders, including OCD, as the sixth largest and global contributor to non-fatal health loss (GBD 2019 Diseases and Injuries Collaborators, 2020). Although OCD can emerge at any age, epidemiological studies describe that in 65% of cases, the disorders appear before age 25 (Anholt *et al.*, 2014). Compared with anxiety and unipolar

mood disorders, individuals with OCD are less likely to be married, more likely to be unemployed, and report impaired social and occupational functioning. This disorder affects between 2 and 3% of the population throughout a lifetime (Kessler *et al.*, 2005), with no gender difference except for children, where boys are over-represented (Geller, 2006). Untreated OCD tends to become chronic, causing significant functional impairment and reducing quality of life (Koran *et al.*, 1996). It is characterized by intrusive thoughts or images (obsessions) that motivates rigidly ritualized behaviours (compulsions) (American Psychiatric Association, 2013).

In populations meeting the *DSM-5* diagnostic criteria for OCD, obsessions typically refer to a limited number of themes including fear of contamination, responsibility for harming (someone or oneself), sex and morality, violence, religion, order and symmetry. However, the specific content of obsessions, is heterogeneous and usually refers to the values, interests, vulnerabilities and uncertainties that an individual considers important in their life (Jacoby and Abramowitz, 2016). In order to reduce or control the distress caused by obsessive thoughts and/or to prevent the severe consequences, individuals with OCD will engage in various safety behaviours including avoidance, neutralization and observable and/or mental compulsive rituals. Therefore, obsessions and compulsions are functionally associated (Rachman, 1976).

Contamination issues (the tendency to think and notify about the possible spread of germs) are a common obsession in OCD and have as their corollaries washing and cleaning compulsions (Ruscio *et al.*, 2010). According to Rachman's contamination model (Rachman, 2004), intrusive thoughts about contamination in OCD (COCD) cause irrational fears that lead to behavioural compulsions of neutralization and excessive avoidance of potentially contaminated substances. In general, the fear of contamination is triggered by the direct or indirect contact with a person or item perceived as dirty or dangerous (i.e. contamination contact) (Rachman, 2004).

However, Rachman also describes contamination as occurring in the absence of contact with an external stimulus by simply observing or thinking about something dirty, immoral, undesirable, or having been soiled by an event (mental contamination). The main differences between these two types of contamination are based on: (1) the nature of the contamination (resulting from physical contact *vs* in the absence of direct contact), (2) the effectiveness of the washing (useful when the contaminant is physical, ineffective when it is not), (3) the perceived source of the contamination (a known and tangible source for contact contamination *vs* an intangible and equivocal source for mental contamination), (4) the kind of source (inanimate dirty/polluting substances *vs* humans for mental contamination), (5) the persons likely to be contaminated (self and others for contact contamination *vs* only self for mental contamination), and (6) the range of triggers (dirt, germs or polluted substances *vs* thoughts, memories, etc.) for mental contamination (for a review, see Rachman *et al.*, 2014). Combined, 'contact' and 'mental' contamination represent the most common manifestation of OCD (Poli *et al.*, 2019). In fact, the prevalence of mental contamination in the absence of contact contamination in OCD was estimated at 10%, whereas 15% of OCD patients reported contact contamination in the absence of mental contamination, and 36% experienced both mental and contact contamination. Thus, mental contamination is a construct that overlaps with, but is also distinct from, contact contamination (Coughtrey *et al.*, 2012).

In order to better assess the construct of mental contamination, Rachman and collaborators developed the Vancouver Obsessional Compulsive Inventory–Mental Contamination scale (VOCI-MC) and the Contamination Thought–Action Fusion scale (CTAF) (Radomsky *et al.*, 2014). These tools aimed to assess symptoms of mental contamination in research and clinical practice. More specifically, the VOCI-MC collects statement choices based on the theory of mental contamination and patient descriptions of the nature of the perceived 'contaminants' as well symptoms observed in clinical practice. Sample items include: 'Some people look clean but feel dirty' and 'Having an unpleasant image or memory can make me feel dirty inside'. In contrast, the CTAF refers to the construct of Thought–Action Fusion, namely the tendency to overvalue the significance and the consequences of intrusive thoughts (Shafran *et al.*, 1996). Sample items of the CTAF include: 'If I get an image of myself being contaminated, it will

make me feel contaminated' and 'Having a thought that I might pass contamination on to someone else is almost as bad as actually doing it'. Their results indicated that the two scales have adequate psychometric properties, namely excellent internal consistency (i.e. >.93 across the different groups of study participants: OCD participants with and without contamination related concerns, Anxious Control and Student Control groups), and good convergent validity, confirmed by the significant correlations between the scales and the Contamination subscale of the Vancouver Obsessional Compulsive Inventory (VOCI). Evidence of divergent validity was shown by the low associations with depression scores. Finally, the VOCI-MC discriminated between participants with OCD contamination related concerns and all other groups of participants. In contrast, the CTAF appeared only to discriminate between clinical and non-clinical groups.

Furthermore, the VOCI-MC has been validated in the Italian language (Melli *et al.*, 2015). Results confirmed the good psychometric properties of the original English version (i.e. internal consistency, convergent and divergent validity in OCD, and discriminant validity of the VOCI-MC for OCD), as well as its factorial structure (i.e. one-factor solution), and its temporal stability. However, to our knowledge, no systematic psychometric validation of the CTAF scale has been conducted. Furthermore, although validated measures are strongly needed to further improve the understanding, prevention and treatment of mental contamination 'symptoms' in OCD, there are currently no validated self-reported measures of mental contamination in French. Finally, in a context where the science of psychology has currently come under criticism because a number of findings cannot be replicated, it appears essential for researchers to translate and validate psychological scales in different cultures. This would enhance the psychometric properties of their measures and the implications of these psychometric properties for their studies (Lilienfeld and Strother, 2020).

Consequently, the aim of the present study was to provide researchers and clinicians with a French version of the VOCI-MC and the CTAF. For this, we assessed the psychometric properties of the French version of the VOCI-MC and the CTAF in non-clinical and clinical samples. In order to do so, we first translated the two original scales into French and evaluated their factor structure, internal consistency, and test–retest reliability. We also determined the discriminative, convergent and divergent validities of French VOCI-MC and CTAF.

Method

Participants

Four hundred and thirty individuals, including 79 participants diagnosed with OCD, 31 diagnosed with anxiety disorders (anxious control group) and 320 non-clinical participants recruited from the general population (non-clinical control group), completed self-reported questionnaires containing the VOCI-MC and the CTAF as the main measures of interest (the questionnaires will be explained in more detail in the next step of the Method section). Similar to Radomsky *et al.* (2014), we included an anxious control group to assess the ability of the VOCI-MC and the CTAF to successfully discriminate between participants with OCD who reported contamination-related concerns and all other groups of participants. All participants provided written informed consent before beginning the study.

Non-clinical participants were community-dwelling adults who were recruited by means of advertisements and personal contacts and through snowballing techniques. All non-clinical participants completed a face-to-face clinical interview conducted by trained licensed psychologists (C.D., C.N., V.A., C.B.) to assess medical, neurological and psychological conditions, and to collect sociodemographic data. Current mood and anxiety disorders were assessed according to *Diagnostic and Statistical Manual of Mental Disorders* (5th edition; *DSM-5*) criteria. Assessment of current mood and anxiety disorders included major depressive

disorder, dysthymic disorder and social phobia, panic disorder, generalized anxiety disorder, specific phobia, obsessive-compulsive disorder, agoraphobia, and post-traumatic stress disorder. The presence of medical (e.g. cancer) and neurological (e.g. Parkinson's disease, head injury) diseases were self-reported. No participants had a history of neurological or psychiatric disorders.

OCD participants and anxious controls were recruited from the University Department of Adult Psychiatry (UADP) in Montpellier, over a 2-year period (September 2019 to June 2021). The UADP offers effective evidence-based treatment options for individuals with a diagnosis of OCD and anxiety disorders (i.e. cognitive and behavioural therapy, CBT). All clinical participants were recruited before the beginning of their CBT treatment. Exclusion criteria were as follows: (a) age under 18; (b) not fluent French speakers; (c) known neurological disease; (d) presence of psychosis; (e) current mania; and (f) substance dependence. Participants in the study were treated in accordance with international ethical standards and the study was approved by the hospital's institutional review board (IRB-MTP_2021_09_202100938).

Clinical participants were diagnosed according to *DSM-5* criteria using a standardized face-to-face clinical interview (the Anxiety Disorder Interview Schedule IV, ADIS-IV; Brown and Barlow, 2014). All participants in the anxious control group met the *DSM-5* criteria for at least one anxiety disorder (primary diagnoses were: social phobia, $n = 11$; generalized anxiety disorder, $n = 8$; panic disorder, $n = 6$; agoraphobia, $n = 1$; or specific phobia, $n = 5$). An exclusionary criterion for those in the anxious control group was the presence of sub-clinical levels of OCD. Participants who met the diagnostic criteria for OCD as a primary diagnosis ($n = 79$) were divided into two sub-groups for the purpose of determining the discriminant validity of the scale. Those who reported contamination-related symptoms or concerns as a primary complaint, as determined by the ADIS-IV ($n = 28$), were assigned to the OCD contamination (OCD-C) sub-group. Participants who met the diagnostic criteria for primary OCD, but who did not report contamination-related symptoms or concerns as primary complaint ($n = 51$) were assigned to the OCD non-contamination (OCD-NC) sub-group. Clinical psychologists (A.D.C., C.D., C.N.) with an extensive training in the diagnosis and management of OCD, administered the diagnostic interviews. All interviews underwent consensus supervision (S.R.) to resolve discrepancies. The time required to conduct the clinical interviews was approximately 45 minutes.

Measures

Vancouver Obsessional Compulsive Inventory–Mental Contamination Scale (VOCI-MC)

The VOCI-MC was designed by Rachman (Radomsky *et al.*, 2014) to assess a variety of symptoms of mental contamination. This self-report questionnaire is composed of 20 items, rated on a 5-point Likert-type scale, ranging from 0 (not at all) to 4 (very much), with higher scores indicating higher levels of mental contamination. The total score of the scale may range from 0 to 80. The English (Radomsky *et al.*, 2014) and Italian versions of the VOCI-MC (Melli *et al.*, 2015) have good internal consistency ($\alpha < .93$) in OCD samples.

Contamination Thought–Action Fusion Scale (CTAF)

Building on the construct of Thought–Action Fusion, the CTAF is a self-report questionnaire designed by Radomsky *et al.* (2014) to assess the fusion between thoughts about contamination and feelings and behaviours associated with contamination. It is composed of nine items, rated on a 5-point Likert-type scale, ranging from 0 (strongly disagree) to 4 (strongly agree), with higher scores indicating higher levels of fusion of thoughts and actions about contamination. The total score of the scale may range from 0 to 36. The English version of the CTAF (Radomsky *et al.*, 2014) has good internal consistency ($\alpha = .96$) in OCD samples.

Vancouver Obsessional Compulsive Inventory (VOCI) (Thordarson et al., 2004)

The VOCI is a 55-item scale, used to assess a variety of symptoms of OCD, including six subscales assessing various symptom clusters (i.e. Checking; Contamination; Obsessions; Hoarding; 'Just Right'; and Indecisiveness). Items are rated on a 5-point Likert-type scale, with higher scores indicating higher symptom severity. The VOCI has excellent internal consistency in students ($\alpha = .96$), community ($\alpha = .90$), OCD ($\alpha = .94$), and clinical control populations ($\alpha = .98$; (Thordarson *et al.*, 2004)). Convergent and divergent validity of the VOCI were also very high (Radomsky *et al.*, 2006; Thordarson *et al.*, 2004). The French version of the VOCI demonstrated similar and excellent psychometric properties to those exhibited by the original English version of the scale (Radomsky *et al.*, 2006).

The Dimensional Obsessive-Compulsive Scale (DOCS) (Abramowitz et al., 2009)

The DOCS is composed of 20 items measuring obsessive-compulsive symptom dimensions of OCD: (1) contamination obsessions and washing/cleaning compulsions; (2) obsessions about responsibility for causing harm and checking compulsions; (3) obsessions about order and symmetry and ordering/arranging compulsions; and (4) repugnant obsessional thoughts and mental compulsive rituals or other covert neutralizing strategies. Within each symptom dimension, items are rated on a scale ranging from 0 ('no symptoms') to 4 ('extreme symptoms') and assess five severity parameters in relation to the past month. The original English version of the DOCS (Abramowitz *et al.*, 2009) has good internal consistency ($\alpha > .94$ in all subscales; $\alpha = .90$ for the DOCS total score), adequate temporal stability, and good construct validity.

Obsessional Belief Questionnaire 44 (OBQ-44) (Obsessive Compulsive Cognitions Working Group, 2005)

The OBQ-44 is a self-reported 44-item questionnaire used to assess the presence and severity of obsessive beliefs associated with OCD rated on a 7-point Likert scale (from 'strongly disagree' to 'strongly agree'). Three subscales assess the beliefs associated with the over-importance of the need to control one's thoughts (control of thought), the beliefs about an increased sense of responsibility to prevent danger or perceived threats (responsibility), and the beliefs about the need for perfectionism and intolerance to uncertainty (perfectionism). The original English version of the OBQ-44 has shown excellent internal consistency for the different subscales ($\alpha = .89–.93$ in the OCD sample). The factor structure was found to be consistent across two OCD samples and a student sample. There is support for the convergent and divergent validity of the OBQ-44 (Obsessive Compulsive Cognitions Working Group, 2005). The psychometric properties of the French version (Julien *et al.*, 2008) of the OBQ-44 confirmed the three-factor structure of the scale in OCD, and provided partial support for convergent/divergent validity of the OBQ-44.

Anxiety sensitivity Index Revised (ASI-R) (Reiss et al., 1986)

The ASI-R was used to measure individual differences in sensitivity to anxiety. A two-factor structure was observed for the French version of this scale (Sandin *et al.*, 2001): 'Fear of the consequences related to the physical sensations of Anxiety' (CP) including 19 items, and 'Fear of Social and Cognitive Consequences of Anxiety' (CSC) including 17 items rated on a 5-point Likert scale (from 'very little' to 'very much'). The original version of the ASI-R has adequate reliability, and convergent and divergent validity (Reiss *et al.*, 1986). The French version of the ASI-R has a similar underlying structure to the original version, and good internal consistency ($\alpha = .91$ for the entire questionnaire, $\alpha = .88$ for the CP subscale and $\alpha = .83$ for the CSC subscale) (Sandin *et al.*, 2001).

Beck Depression Inventory (BDI-II) (Beck et al., 1998)

The BDI-II is composed of 21 items that assess the severity of self-reported depression. It is scored by summing each of the 21 items. Each item is rated on a 4-point Likert scale ranging from 0 to 3, and total scores can range from 0 to 63. The psychometric properties of the English version of the BDI are well established (Beck *et al.*, 1998). The French version of the BDI-II shows excellent internal consistency (Beck *et al.*, 1998).

Procedure

In order to adapt the VOCI-MC and the CTAF scale in French, a precise translation procedure was carried out. First, we contacted the original authors of the two scales (i.e. Rachman and collaborators, 2014) and obtained their formal authorization to conduct the adaptation of the instruments to French. Second, two expert psychologists independently translated the scale from English to French. The different translations were compared to obtain a first translation of the tool. A bilingual expert then translated the French version of the questionnaire into English. To ensure the conceptual equivalence of the translation, a review of the back translation against the original version was practised. This new back translation was compared with the original version by a panel of experts to verify the equivalence of the two English versions in terms of meaning and conceptual content. Following the suggestions of the experts, a new version in French was proposed. The finalized translations were proofread to correct any remaining spelling, diacritical, grammatical, or other errors and the final version was written.

All participants took part voluntarily in the study and signed written informed consent forms prior to the experiment. All clinical groups and the non-clinical control group completed the same questionnaires, described in the previous section. All clinical groups completed the questionnaires in a paper format, whereas non-clinical participants completed the questionnaires either on a secured online research platform set up by the Epsylon laboratory and paper format. The time required to complete the questionnaires was approximately 30 minutes.

Of the 320 non-clinical participants from the general population, 183 completed the VOCI-MC and the CTAF twice at a 3-week interval, and their data were used to test the temporal stability of scores.

Data analysis

All variables were inspected for normality before analysis. The parametric variables were described by their mean and standard deviations. Demographics and clinical variables for the study participants are presented in Table 1.

Factor structure

Initially, we investigated the factor structure of the scales on the general population data. For this, we randomly divided the GP sample into two sub-groups, using the SPSS 21.0 'Random sample of cases' function and set the sub-group size at 'approximately 50%' to create two equivalent samples. The first sample ($n = 142$) was used to conduct exploratory factor analyses, and the second sample ($n = 178$) for confirmatory factor analyses. Samples were checked for equivalence in terms of age ($t_{317} = -1.41$, $p = .15$), sex proportion (Fisher's exact test 2-sided, $p = .81$), and level of education ($t_{317} = 0.64$, $p = .51$). We finally performed an additional confirmatory factor analysis (CFA) on the data from the OCD group (see below). We used the Kaiser–Meyer–Olkin (KMO) measure and Bartlett test of sphericity to test the sampling adequacy. We used the screen test (i.e. scree plot) and the parallel analysis with a set at 0.01 to determine the number of factors to retain. Items with

Table 1. Demographic and clinical characteristics participants

	OCD Contamination ($n = 28$)	OCD Non-contamination ($n = 51$)	Anxious controls group ($n = 31$)	Non-clinical controls group ($n = 320$)
Age	36.82 (13.18)	34.59 (11.51)	34.35 (12.39)	35.99 (14.10)
Sex (% female)	78.6%	56.9%	64.5%	62.2%
Education, years	14.04 (3.42)	14.31 (3.22)	14.97 (2.84)	14.74 (2.73)
Marital status (%)				
Single	50%	54.9%	74.2%	46.3%
Married	50%	45.1%	25.8%	52.8%
Widow	0%	0%	0%	0.6%
Occupation				
Employee	17.9%	25.5%	22.6%	58.8%
Retired	10.7%	2%	0%	3.1%
Homemaker	10.7%	3.9%	3.2%	1.6%
Unoccupied	14.3%	31.4%	29%	4.4%
Student	25%	19.6%	29%	24.7%
Other	21.4%	17.6%	12.9%	6.6%
VOCI-MC	42.39 (18.75)	12.51 (16.26)	12.26 (13.87)	9.31 (9.61)
CTAF	15.21 (10.75)	10.75 (9.77)	6.45 (8.24)	6.09 (6.72)
VOCI Total	106.32 (35.39)	71.60 (31.88)	53.81 (33.46)	37.90 (25.55)
VOCI Contamination	29.32 (9.60)	8.16 (8.72)	7.06 (6.18)	7.40 (7.25)
DOCS Contamination	13.93 (4.58)	3.43 (4.12)	2.58 (3.01)	4.34 (5.51)
OBQ-44	176.50 (61.08)	148.13 (64.09)	143.06 (54.29)	129.26 (46.43)
ASI				
Physical sensations subscale	44.89 (20.24)	39.59 (17.77)	44.03 (13.47)	29.84 (12.58)
Social and Cognitive subscales	49.89 (17.16)	42.35 (14.71)	47.06 (12.09)	27.76 (10.27)
BDI	31.57 (13.93)	20.53 (14.38)	19.87 (11.73)	8.73 (7.91)

Values are means (*SD*). VOCI-MC, Vancouver Obsessional Compulsive Inventory – Mental Contamination scale; CTAF, Contamination Thought–Action Fusion scale; VOCI, Vancouver Obsessional Compulsive Inventory; DOCS, Dimensional Obsessive-Compulsive Scale; OBQ-44, Obsessional Beliefs Questionnaire – 44 Item Version; TAF, Thought–Action Fusion scale; DS, Disgust Sensitivity scale; ASI, Anxiety Sensitivity Index; BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory-II.

loading of at least 0.32 were considered to retain a statistically meaningful factor (Costello and Osborne, 2005; Tabachnick and Fidell, 2013).

CFAs were conducted with Lisrel 11 (Long, 1983) in order to validate the factorial structure of the scales suggested by the exploratory factor analyses. The following indices were computed: χ^2 to degrees of freedom (χ^2/d.f.), the root mean square error of approximation (RMSEA<.06), the comparative fit index (CFI>.90), normed fit index (NFI>.95), and the non-normed fit index (NNFI>.95). The analyses were conducted on the standardized variables.

Internal consistency and reliability

The normality of the distribution was verified through the distribution kurtosis and skewness for each item of the VOCI-MC and CTAF scales and in each group. Scale consistency and reliability were determined by the item-total correlation and the Omega coefficient (i.e. values below 0.60 indicate a lack of reliability of the tool; McDonald, 2013), as well as the test–retest intraclass correlation coefficient.

Convergent validity and divergent validity

Convergent validity was evaluated with Pearson correlations between the total scores of both the VOCI-MC and CTAF scales and other measures that assess contamination-related symptoms in OCD (i.e. the Contamination subscale of the Vancouver Obsessional Compulsive Inventory,

VOCI and the Contamination subscale of the Dimensional Obsessive-Compulsive Scale). Divergent validity was evaluated with Pearson correlations between total scores on the VOCI-MC and CTAF scales and depressive and anxiety symptoms (i.e. the Anxiety Sensitivity Index, ASI; the Beck Depression Inventory-II, BDI-II).

Discriminant validity

A one-way ANOVA was conducted to compare mean scores on the VOCI-MC and CTAF across the four groups (i.e. non-clinical controls, anxious control group, OCD non-contamination, OCD contamination).

Results

Factor structure

Using data from the first sample ($n = 142$), we carried out an exploratory factor analysis using a principal axis factoring (PAF) on the two following scales: the VOCI-MC and the CTAF (to test the construct validity). The KMO measure of sampling adequacy for the VOCI-MC and the CTAF were 0.90 and 0.86, respectively, suggesting that the sample size was suitable. The Bartlett test of sphericity was significant for the two scales ($p<0.001$), indicating adequation of the data for conducting exploratory factor analyses.

Examination of the scree plot and parallel analysis for the VOCI-MC and the CTAF suggested a one-factor solution for both scales. Based on these criteria, a forced one-factor exploratory factor analysis using PAF was performed on the VOCI-MC and the CTAF scales explaining, 33.55% and 59.97%, respectively, of the total variance. The one-factor solution for the VOCI-MC provided salient loadings (item loadings ranging from 0.46 to 0.76). We observed the same pattern for the CTAF scale (item loadings ranging from 0.61 to 0.89).

We then used CFA on the second sample of the general population ($n = 178$) to test the one-factor model for each scale supported by our exploratory factor analyses. Consistent with the exploratory factor analyses results, the one-factor model showed an excellent fit for the VOCI-MC (CFI = 0.97, NFI = 0.95, NNFI = 97, RMSEA = 0.05), as well as for the CTAF scale (CFI = 0.99, NFI = 0.96, NNFI = 0.99, RMSEA = 0.03).

Finally, we performed an identical CFA for the VOCI-MC and CTAF, on the data from the OCD group ($n = 79$). The fit indices for this model indicated a good fit for both scales, the VOCI-MC: RMSEA = 0.06, CFI = .98, NFI = 0.97, NNFI = 0.99; and the CTAF: RMSEA = 0.05, CFI = 0.91, NFI = 0.99, NNFI = 1.

Internal consistency and reliability

Distribution and item analyses for each scale and each group are presented in Table 2. The Omega values for the VOCI-MC were 0.97, 0.92 and 0.90 for the OCD, anxious controls and non-clinical control group, respectively. For the CTAF scale, the Omega values were 0.95, 0.94 and 0.90, respectively. For both the VOCI-MC and the CTAF scales, corrected item-total correlations scores exceeded 0.30 in each group and the mean inter-item correlations were always greater than 0.30 (Table 2). The test–retest intraclass correlation coefficient computed between the VOCI-MC and CTAF total scores were high (respectively, $r = 0.80$ with a 95% confidence interval from 0.73 to 0.85, and 0.82 with a 95% confidence interval from 0.77 to 0.87), suggesting adequate temporal stability for the two scales.

Table 2. Internal consistency and reliability for the VOCI-MC and the CTAF in general population ($n = 320$), obsessive-compulsive disorders ($n = 79$) and anxiety disorders ($n = 31$) groups

VOCI-MC	OCD group	Anxious controls group	Non-clinical controls group
Skewness (range)	0.42 to 1.54	0.82 to 3.59	0.44 to 4.30
Kurtosis (range)	−0.01 to 1.48	−0.65 to 17.44	0.88 to 19.99
Omega	0.97	0.92	0.90
Mean inter-item correlation	0.64	0.41	0.36
Corrected item-total correlation (range)	0.68 to 0.89	0.55 to 0.81	0.50 to 0.66
CTAF	OCD group	Anxious controls group	Non-clinical controls group
Skewness (range)	0.14 to 0.75	0.43 to 2.01	0.70 to 1.86
Kurtosis (range)	−0.78 to −1.37	−0.63 to 3.16	−0.61 to 1.86
Omega	0.95	0.94	0.90
Mean inter-item correlation	0.65	0.69	0.55
Corrected item-total correlation (range)	0.57 to 0.91	0.66 to 0.92	0.58 to 0.79

Table 3. Interrelationships between the VOCI-MC and CTAF and associations with other clinical measures by group

	VOCI-MC	CTAF
CTAF	—	—
OCD	0.55*	—
Anxious controls	0.50	—
Non-clinical controls	0.43*	—
VOCI contamination subscale		
OCD	0.77*	0.39*
Anxious controls	0.60*	0.50
Non-clinical controls	0.44*	0.42*
DOCS contamination subscale		
OCD	0.82*	0.32*
Anxious controls	0.49*	0.52
Non-clinical controls	0.35*	0.34*
Beck Depression Inventory-II		
OCD	0.49*	0.40*
Anxious controls	0.28	0.20
Non-clinical controls	0.38*	0.35*
Anxiety Sensitivity Index		
Physical sensations subscale		
OCD	0.41*	0.57*
Anxious controls	0.25	0.55
Non-clinical controls	0.22	0.30*
Social and Cognitive subscales		
OCD	0.51*	0.58*
Anxious controls	0.43	0.24
Non-clinical controls	0.36*	0.39*

*Given the number of analyses conducted, α was set to .001 (Bonferroni, 1935).

Convergent validity and divergent validity

As shown in Table 3, VOCI-MC was significantly more strongly correlated with subscales that assess specifically contamination-related OCD symptoms (VOCI-MC, *r* ranged from 0.77 to 0.82 in the OCD group; VOCI-MC, *r* ranged from 0.49 to 0.60 in the Anxious control group; VOCI-MC, *r* ranged from 0.35 to 0.44 in the non-clinical controls group) than with subscales that assess depression and anxiety symptoms (*r* ranged from 0.41 to 0.51 in the OAD group;

r ranged from 0.25 to 0.43 in the Anxious controls group; *r* ranged from 0.22 to 0.38 in the non-clinical control group). In general, there were weaker associations between the CTAF and the Contamination Subscales of the VOCI and the DOCS. Except for the OCD group, correlations between the CTAF and the BDI and ASI were overall lower than those with Contamination subscale scores.

Discriminant validity

ANOVA performed on the mean scores on the VOCI-MC and the CTAF across the four groups were significant ($F = 55.41$; $p < 0.001$; $F = 5.47$; $p = 0.002$, respectively). *Post-hoc* comparisons indicated that the OCD Contamination group scored significantly higher on the VOCI-MC than all the other groups of participants (i.e. non-contamination OCD group, Anxious controls, and Non-clinical controls group, all $p < 0.001$), indicating excellent discriminant validity of the scale. *Post-hoc* comparisons indicated that both OCD groups scored significantly higher on the CTAF than the Anxious controls and Non-clinical controls groups (all $p < 0.001$). There were no differences between the OCD groups ($p = 0.11$). Thus, the CTAF appeared only to discriminate between OCD participants and anxious and non-clinical controls.

Discussion

The aim of the present study was to investigate the psychometric properties of the French versions of the VOCI-MC and the CTAF in non-clinical and clinical samples. To address this aim, we studied a non-clinical sample of adults recruited from the general population and performed a clinical interview for identifying clinical participants, i.e. OCD participants and anxious controls. In addition, and to the best of our knowledge, this is the first article using exploratory and confirmatory factor analysis to investigate the factorial structure of the VOCIMC and the CTAF in French non-clinical and clinical samples.

Our study, including 79 participants diagnosed with OCD, 31 diagnosed with anxiety disorders (anxious controls group) and 320 non-clinical participants (non-clinical control group), showed that the French versions of the VOCI-MC and the CTAF have high internal consistency throughout the groups of participants (i.e. Omega values for the VOCI-MC range from 0.90 to 0.97; Omega values for the CTAF scale range from 0.90 to 0.95), as well as good temporal stability. Additionally, good convergent and divergent validity was demonstrated. In agreement with the original versions of the scales, our exploratory and confirmatory factor analyses showed a one-factor structure for the two scales in both non-clinical and OCD samples.

Specific and strong relationships were found between the total score on the French VOCI-MC and CTAF and contamination-related OCD symptoms assessed with the French Contamination of the VOCI and the DOCS subscales, demonstrating good convergent validity. In contrast, the total scores of the two scales showed lower correlations with measures of depression and anxiety, providing evidence for the discriminant validity of the French VOCIMC and CTAF. These findings are in line with results from the English and Italian versions of the instruments (Melli *et al.*, 2015; Radomsky *et al.*, 2014).

Exploratory factor analysis in the non-clinical sample demonstrated that the French versions of the VOCI-MC and CTAF were composed of one factor that explained, respectively, 33.55% and 59.97% of the total variance. Confirmatory factor analyses supported this one-factor model for the VOCI-MC and CTAF items in both non-clinical and OCD samples. This pattern is in accordance with the one-factor/structure of the VOCI-MC obtained in the study of Melli *et al.* (2015) encompassing a large sample of non-clinical controls ($n = 320$) and a sample of OCD patients ($n = 120$). Concerning the CTAF, this is, however, the first study to examine its factorial structure. These results need to be supported by further studies assessing its internal factorial structure in both non-clinical and clinical samples. Our study showed that the internal

consistency and test–retest reliability of the French versions of the VOCI-MC and CTAF over a 3-week period in a non-clinical sub-sample ($n = 183$) were good. These findings are in accordance with the original English versions of both scales, as well as with the Italian version of the VOCI-MC (Melli *et al.*, 2015; Radomsky *et al.*, 2014).

Finally, similarly to the study of Radomsky and co-workers (Radomsky *et al.*, 2014), our results have shown that the French version of the VOCI-MC effectively discriminated between OCD patients with contamination-related symptoms and OCD patients who did not report contamination-related symptoms as their primary complaint, although the CTAF appeared only to discriminate between clinical and non-clinical groups. Like the construct of thought–action fusion that occurs also across anxiety disorders (Abramowitz *et al.*, 2003), our results indicated that it is also the case for thought–action fusion specific to mental contamination.

Although this study has several strengths, such as a large population-based sample and use of face-to-face clinical interviews to diagnose clinical participants, we must acknowledge several limitations of our study. First, no statistical measure of reliability was conducted for diagnostic interviews. Also, we did not calculate sample size and power estimates to use confirmatory factor analyses, particularly in the OCD samples, although our results showed excellent goodness of fit indices. In addition, the number of participants assigned to each group of the study were not balanced. Finally, we did not include another clinical group of OCD with contact-contamination-related symptoms to detect differences between those with contact-contamination concerns and those with mental-contamination concerns. Future studies should assess this aspect of convergent/construct validity of the scales.

This study has a number of clinical implications. Intrusive thoughts associated with mental contamination are normal, but it is the interpretation of these thoughts that is important in determining, for instance, whether or not an individual will engage in compulsive washing behaviour (Rachman, 2010). Therapists and caregivers would therefore benefit from preferring cognitive approaches targeting negative biases and metacognitions, over behavioural therapies, when dealing with mental contamination (Rachman *et al.*, 2014). In addition, by allowing researchers and clinicians to assess symptoms of mental contamination and fusion between thoughts, feelings and behaviours associated with contamination, the VOCI-MC and the CTAF scales constitute valuable instruments for tracing treatment outcomes in the field of cognitive therapy for mental contamination concerns.

In conclusion, the French versions of the VOCI-MC and CTAF demonstrate satisfactory psychometric properties (adequate structure, convergent and discriminant validity, good internal consistency, and temporal stability). The French translation of the two scales adds valuable questionnaires to assess mental contamination in France. In this respect, these are useful instruments in detecting cases of OCD with mental contamination concerns in clinical populations. The French versions of the VOCI-MC and CTAF are the first formally validated specific mental contamination measures and will therefore be a valuable tool for researchers and clinicians in French-speaking settings.

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Conceptualization (equal), Investigation (equal), Methodology (equal), Project administration (equal), Resources (equal), Supervision (equal), Writing – review & editing (equal).

S.R. and C.L. designed the study. A.D.C., C.D., C.N., V.A., D.C., C.B. and S.R. were involved in interviewing participants and collecting data for the process evaluation. C.L. led the statistical analyses. C.L. wrote the first draft of the paper. All authors read the manuscript critically and approved the final submission.

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