

The nature and assessment of mental contamination: A psychometric analysis

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Abstract

There has been a recent expansion of interest in the concept of mental contamination. Despite a growing number of experiments and interview-based studies of mental contamination, there is a need for questionnaire-based assessment measures, and for a further understanding of the degree to which mental contamination is related to other aspects of OCD symptomatology and/or to established cognitive constructs relevant to OCD. We assessed the psychometric properties of three new measures of mental contamination (the Vancouver Obsessional Compulsive Inventory – Mental Contamination Scale, the Contamination Sensitivity Scale, and the Contamination Thought-Action Fusion Scale) in participants diagnosed with OCD ($n = 57$), participants diagnosed with an anxiety disorder other than OCD ($n = 24$) and in undergraduate student controls ($n = 410$). For some of these analyses, our OCD sample was subdivided into those with contamination-related symptoms and concerns ($n = 30$) and those whose OCD excluded concerns related to contamination fear ($n = 27$). Results showed that the three new scales had excellent psychometric properties, including internal consistency, convergent and divergent validity, and discriminant validity. Further, the new measures accounted for significant unique variance in OCD symptoms over and above that accounted for by depression, anxiety, traditional contact-based contamination, and OCD beliefs. Results are discussed in terms of the clinical utility of the scales, and of the nature of contamination fears in OCD.

Keywords: Mental contamination; OCD; Assessment; Symptoms; Beliefs.

The measurement and nature of mental contamination: A psychometric analysis

Until recently, our understanding of contamination fear in association with obsessive-compulsive disorder (OCD) was focused on contaminants which were physical in nature and which were perceived to be threatening as a result of direct contact. As a result of these general assumptions about feared contaminants, laboratory-based studies and treatments carried out in the clinic for contamination-related OCD have tended to rely upon exposure to real or perceived contaminants. With the description and recent phenomenological and experimental work on *mental contamination*, the construct of contamination has been greatly expanded, with important implications for treatment. This manuscript presents first a review of the theory and findings relating to mental contamination, and then a psychometric analysis of the construct of mental contamination stemming from the development of three new measures: the Vancouver Obsessional Compulsive Inventory – Mental Contamination Scale (VOCI-MC), the Contamination Sensitivity Scale (CSS), and the Contamination Thought-Action Fusion Scale (CTAF).

Since the advent of behaviour therapy for OCD (which began with a then-novel approach to treating contamination-related OCD; Meyer, 1966), CBT for contamination-related problems has remained largely unchanged. Clients/patients are engaged in the process of building a hierarchy and are then encouraged to gradually and systematically expose themselves for long periods of time to an increasingly-challenging array of contaminants in an increasingly-challenging array of situations. Indeed, the fear of contamination is typically treated in a similar way to specific phobias. Although some therapists work to incorporate

cognitive elements (see OCCWG, 1997, 2001), the treatment of contamination fear is largely behavioural in nature (although see Jones & Menzies, 1997, 1998 for one exception). This continued behavioural prominence in the treatment of contamination fear is at odds with the increasing cognitive emphasis within CBT for OCD and other anxiety disorders growing from cognitively-based theories (e.g., Clark, 1986; Clark & Wells, 1995; Ehlers & Clark, 2000; Rachman 1997, 1998, 2002; Salkovskis, 1985; etc.), and resultant efficacious interventions.

In addition, concerns have been raised about the degree to which the prevailing behavioural approach, exposure with response prevention (ERP) is effective; “Of 118 subjects with OCD treated with 12 weeks of ERP, 48 appeared to be nonresponders” (van Balkom, Emmelkamp, Eikelenboom, Hoogendoorn, Smit & van Oppen, 2012, p. 366; although see Rosa-Alcázar, Sánchez-Meca, Gómez-Conesa & Marín-Martínez, 2008 for an interesting review in which the addition of imaginal exposure to ERP for OCD was better than exposure alone). The continued focus on behavioural methods is also of concern given the high number of drop-outs and refusals associated with traditional exposure-based interventions for OCD and other anxiety disorders (e.g., Foa et al., 2005; Bados, Balaguer & Saldaña, 2007). Our own recent work on this subject has revealed that certain cognitively-based approaches to the treatment of anxiety disorders (Milosevic & Radomsky, 2013) and of contamination-related OCD (Levy & Radomsky, in press) may indeed be more acceptable to potential clients/patients than traditional behaviour therapy (see also Parrish, Radomsky & Dugas, 2008; Rachman, Radomsky & Shafran, 2008; Rachman, Shafran, Radomsky & Zysk, 2011; van den Hout, Engelhard, Toffolo & van Uijen, 2011).

The concept of mental contamination was first described by Rachman (2004), who distinguished it from contact contamination (in which feelings of contamination arise from direct physical contact with a contaminant) by defining it as feelings of contamination that arise in the absence of direct contact with a contaminant. Indeed, this definition highlights the broad range of situations and (non-external) stimuli which can lead to mental contamination, and the ways in which elements of mental contamination may maintain, or even exacerbate instances of contact contamination and/or doubts about contamination-related situations and stimuli.

Although differences between contact and mental contamination have been well described (see Rachman 2004, 2006), key proposed theoretical differences include the nature of contaminants (i.e., resulting from direct contact vs. resulting in the absence of direct contact), the proposed effectiveness of washing (i.e., washing is proposed to be helpful – in removing the contaminant – when the contaminant is physical, but unhelpful when it is not), the proposed source of the contaminant (i.e., an external source in contact contamination vs. a human source in mental contamination) and the proposed range of contaminants or contamination provocations (dirt, germs and/or harmful substances vs. thoughts, memories, betrayal, etc.). A preliminary study of the presence of mental contamination in a sample of 177 people with obsessive-compulsive symptoms found that 10% reported mental contamination in the absence of contact contamination, 15% reported contact contamination in the absence of mental contamination and 36% people experienced clinically relevant symptoms of both mental and contact contamination. These findings demonstrated that mental contamination is a construct that overlaps with, but is distinct from contact contamination (Coughtrey, Shafran, Knibbs & Rachman, 2012). It became apparent through this study, and following many of those

reported below, that there was a need for easy-to-use self-report measures of mental contamination and related phenomena.

In one of the initial provocation studies of mental contamination, Fairbrother and Rachman (2004) asked 50 female participants to recall and discuss an experience of sexual assault. Following the recall exercise, a surprising proportion of participants reported not only feelings of dirtiness and urges to wash, but also engaged in washing behaviour. This study was followed by a series of 'dirty kiss' experiments, which were designed to examine causal factors and mechanisms underlying mental contamination. The first of these was conducted by Fairbrother, Newth and Rachman (2005) and demonstrated that simply by listening to an audio recording of a non-consensual kiss, female undergraduate students could also be made to feel 'dirty' and engage in washing behaviour – in the absence of direct contact with a contaminant. Additional dirty kiss experiments examined the role of attractiveness (Herba & Rachman, 2007), immoral behaviour (Elliott & Radomsky, 2009), imagined physical dirt (Elliott & Radomsky, 2012), and betrayal (importantly, this study differed from the others as it involved male participants; Rachman, Radomsky, Elliott & Zysk, 2012); all of these factors were shown to exacerbate and amplify feelings of contamination. In all of the above experiments, a number of participants engaged in actual rinsing or washing behaviour following listening to a recording. In all cases, instances of washing behaviour were associated with factors linked to mental contamination experiences, and occurred in the absence of direct contact with a contaminant (although note that mental contaminants can often also be spread via physical means; Coughtrey, Shafran & Rachman, in press). Furthermore, an additional experiment has demonstrated that mental contamination can be evoked following the recall of unwanted

memories associated with betrayal and immorality that do not involve physical violation (Lee, Shafran, Burgess, Carpenter, Millard & Thorpe, 2013). Similarly, imagining wearing clothing belonging to undesirable and immoral people leads to feelings of contamination and urges to wash (Coughtrey, Shafran & Rachman, under review). Though the above experiments and other studies were able to provide much information about the evocation and spread of mental contamination, none of them employed standardized self-report measures of mental contamination.

Mental contamination is postulated to occur because of the ways that individuals interpret various thoughts, images and experiences (Rachman, 2004, 2006). In an attempt to assess the degree to which appraisals/interpretations can predict mental contamination phenomenology, two studies have been conducted. The first (Radomsky & Elliott, 2009) showed that appraisals of responsibility (for the non-consensual kiss), personal violation and immorality (of the man who was described in the recording) significantly predicted unique variance in feelings of dirtiness, urges to wash and negative emotions over and above symptoms of traditional (contact) contamination, disgust, anxiety sensitivity, fear of negative evaluation and neuroticism, following a recording that portrayed a non-consensual kiss from a man who was described as engaging in a series of other immoral acts (i.e., lying, stealing, etc.). A similar study (Elliott & Radomsky, 2013) also showed that appraisals were unique predictors of mental contamination indices following a recording in which the non-consensual kiss was given by a man described as physically dirty (i.e., imagined physical dirt; beer breath, crumbs on face, etc.). Together, these studies highlight not only some of the cognitive underpinnings of mental contamination, but also some of the potential targets of treatment.

In order to build upon the above advances in our understanding of the nature and cognitive underpinnings of mental contamination, three new measures were developed to help assess and understand mental contamination. The items were based on the theory of mental contamination (Rachman, 2004) and on client descriptions of the nature of their perceived 'contaminants' as well as clinical observations. The first of these new measures, the Vancouver Obsessional Compulsive Inventory – Mental Contamination Scale (VOCI-MC) was designed to capture 'symptoms' of mental contamination. Sample items include "Some people look clean, but feel dirty" and "Having an unpleasant image or memory can make me feel dirty inside". The Contamination Sensitivity Scale (CSS) was inspired in some ways by the highly successful Anxiety Sensitivity Index (ASI; Reiss, 1986), and was designed to assess the degree to which an individual may become distressed by feelings of contamination. Sample items include "It scares me when I feel dirty *inside* my body" and "If I cannot get rid of worries about contamination, I am nervous that I might be going crazy". Finally, the Contamination Thought-Action Fusion Scale (CTAF) was developed to assess a proposed fusion between thoughts about contamination and feelings and behaviour associated with contamination, building further on the construct of Thought-Action Fusion (TAF; Shafran, Thordarson, & Rachman, 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".

We hypothesized that the three new scales would have acceptable psychometric properties (including internal consistency as well as convergent, divergent and discriminant validity), and that they would be able to predict other aspects of OCD symptomatology (e.g.,

other symptom types) over and above symptoms of depression, anxiety, OCD beliefs, disgust and traditional (contact-based) contamination-related symptoms of OCD. Finally, we were interested in exploring the nature of the relationships between the new scales and selected existing constructs (e.g., disgust, anxiety sensitivity, OCD beliefs, etc.) proposed to be relevant to contamination fears in OCD.

Methods

Participants

Three groups of participants were recruited to participate in the current study. Participants who met the diagnostic criteria for OCD as a primary or secondary diagnosis ($n = 57$; as determined via the ADIS-IV, see below) were divided into two subgroups for the purposes of determining specificity and internal consistency as well as generating specific normative data; those who reported ANY contamination-related symptoms or concerns (as determined via the ADIS-IV, see below) were assigned to the OCD Contamination sub-group ($n = 30$). Participants who met the diagnostic criteria for OCD, but who did not report any contamination-related symptoms or concerns (via the ADIS-IV) were assigned to the OCD Non-Contamination sub-group ($n = 27$). Participants who met the diagnostic criteria for an anxiety disorder other than OCD were assigned to the Anxious Control group ($n = 24$). A separate unselected sample of undergraduate Student Controls ($n = 410$) was also recruited. Exclusionary criteria for all clinical participants included the presence of psychosis, current mania, and/or substance dependence. An additional exclusionary criterion for those in the anxious control group included the presence of sub-clinical levels of OCD, as determined by the

ADIS-IV. Clinical participants were recruited in Vancouver and Montreal through newspaper and online advertisements and through a registry of individuals interested in research on anxiety disorders; they were offered financial compensation for their participation. Student participants were recruited from undergraduate classes at a large English-speaking university in Montreal; they were offered either course credit or entry in a cash draw for their participation.

The OCD Contamination sub-group was largely comprised of individuals whose primary diagnosis was OCD (76.67%). Proportions of other primary diagnoses among this group included Panic Disorder with Agoraphobia (6.67%), Generalized Anxiety Disorder (GAD, 6.67%), Social Phobia, Major Depressive Disorder and Posttraumatic Stress Disorder (PTSD), each at 3.33%. On average, participants in this group met the criteria for 1.20 (SD = 1.21) comorbid (additional) diagnoses in addition to OCD (which included Panic Disorder with Agoraphobia, Social Phobia, GAD, PTSD, Major Depressive Disorder, Hypochondriasis and Specific Phobia).

The OCD Non-Contamination sub-group was comprised largely of individual's whose primary diagnosis was OCD (62.93%). Proportions of other primary diagnoses among this group included Social Phobia (14.81%), GAD (11.11%), PTSD (7.41%) and Panic Disorder (3.70%). On average, participants in this group met the criteria for 1.44 (SD = 1.12) comorbid (additional) diagnoses in addition to OCD (which included Panic Disorder with and without Agoraphobia, Social Phobia, GAD, PTSD, Major Depressive Disorder and Specific Phobia).

Anxious Controls met the diagnostic criteria for the following primary diagnoses: Social Phobia (41.67%), GAD (33.33%), Panic Disorder with and without Agoraphobia (16.67%), and Specific Phobia and Major Depressive Disorder (at 4.16% each). On average, participants in this group met the criteria for .83 (SD = .76) additional comorbid diagnoses which included Social

Phobia, GAD, Panic Disorder with and without Agoraphobia, Major Depressive Disorder, Specific Phobia, PTSD and Dysthymia.

There were significant differences in age between the groups of participants (see Table 1 for information about participant characteristics). In general, the OCD Contamination and Anxious Control group participants were older than OCD Non-Contamination group participants, who in turn were older than Student group participants $F(3,490) = 146.28, p < .001$. There were also differences in sex distributions within groups ($\chi^2(3) = 48.04, p < .001$) such that the Student group had a far greater percentage of female participants compared to the other three groups.

Measures

Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV; Brown, Di Nardo, & Barlow, 1994). The ADIS-IV is a semi structured diagnostic interview for anxiety disorders and selected other problems (e.g., depression, substance-related disorders). It has been demonstrated to have high inter-rater reliability ($K's = .56 - .85$) and convergent validity (Brown, Di Nardo, Lehman, & Campbell, 2001).

The Vancouver Obsessional Compulsive Inventory – Mental Contamination Scale (VOCI-MC; Rachman, 2005) is a 20-item self-report questionnaire designed to assess symptoms of mental contamination. The items (see above for sample items) are 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 VOCI-MC was developed as a possible additional set of questions to be

added to the administration of the Vancouver Obsessional Compulsive Inventory (VOCI), see below.

The Contamination Sensitivity Scale (CSS; Rachman, 2005) is a 24-item self-report questionnaire used to assess levels of distress associated with feelings of contamination. Items (see above for sample items) are rated on a 5-point Likert scale ranging from 0 (*not at all*) to 4 (*very much*), with higher scores indicating greater distress from contamination.

The Contamination Thought-Action Fusion Scale (CTAF; Rachman, 2005) is a 9-item self-report questionnaire that assesses fusion between thoughts about contamination and feelings and behaviour associated with contamination. Items (see above for sample items) are rated on a 5-point Likert-type scale ranging from 0 (*strongly disagree*) to 4 (*strongly agree*). Higher scores indicate higher levels of contamination thought-action fusion.

The Vancouver Obsessional Compulsive Inventory (VOCI; Thordarson et al., 2004) is a 55-item scale, used to assess a variety of symptoms of OCD, including 6 subscales assessing various symptom clusters. Items are rated on a 5-point Likert-type scale, with higher scores indicating higher symptom severity. The VOCI has excellent internal consistency in student ($\alpha = .96$), community ($\alpha = .90$), OCD ($\alpha = .94$), and clinical control populations ($\alpha = .98$; Thordarson et al., 2004). It also has excellent convergent and divergent validity (Thordarson et al., 2004; Radomsky et al., 2006), and excellent retest reliability in clinical ($r = .96$, mean retest period =

47 days, Thordarson et al., 2004) and student ($r = .91$, mean retest of 30 days, Radomsky et al., 2006) populations.

Obsessional Beliefs Questionnaire – 44 Item Version (OBQ-44; OCCWG, 2005). This 44-item scale is designed to assess beliefs and appraisals unique to obsessions. The measure is comprised of 3 subscales (Responsibility and Threat Overestimation, Perfectionism and Intolerance for Uncertainty, and The Importance of and Control over Thoughts), assessing different clusters of beliefs, with items scored on a 7-point Likert-type scale. The OBQ-44 has excellent internal consistency ($\alpha = .95$), and is significantly correlated with measures of harm impulses ($r = .27$); checking ($r = .37$); and contamination ($r = .29$) in a clinical sample.

Thought-Action Fusion Scale (TAF; Shafran, Thordarson, & Rachman, 1996). The TAF is a 19-item questionnaire assessing a set of cognitive biases related to obsessive compulsive disorder. Items on the TAF are scored on a 5-point Likert-type scale, with higher scores indicating higher levels of cognitive bias. The TAF has been demonstrated to have good internal consistency ($\alpha = .88$), and supports construct validity for thought-action fusion (Rassin, Merckelbach, Muris, & Schmidt, 2001).

The Disgust Scale (DS; Haidt, McCauley, Rozin, 1994) is a 32-item questionnaire comprised of 16 true or false questions, and 16 3-point Likert-type responses to questions related to sensitivity to feelings of disgust. Higher scores on this measure indicate a higher level of disgust sensitivity.

The scale has good reliability ($\alpha = .81$), and convergent, divergent, and discriminant validity (Haidt et al., 1994).

Anxiety Sensitivity Index (ASI; Reiss et al, 1986). The ASI is a 16-item questionnaire assessing distress associated with the experience of anxiety. Items are scored on a 5-point Likert-type scale, with higher scores indicating higher distress. The ASI has adequate test-retest reliability ($r = .77$), and convergent and divergent validity (Reiss et al., 1986).

The Beck Depression Inventory, Second Edition (BDI-II; Beck, Steer, & Brown, 1996) and The Beck Anxiety Inventory (BAI; Beck & Steer, 1993) are well-established measures of depressive and anxiety symptoms, respectively. Both measures consist of 21 items on 4-point scales concerning physical and psychological symptoms. An excellent internal consistency has been established for scores on the BDI ($\alpha = .91$; Beck, Steer, Ball, & Ranieri, 1996). Similarly high internal consistency was found for the BAI ($\alpha = .92$; Steer, Ranieri, Beck, & Clark, 1993).

Procedure

Upon providing informed consent, clinical participants were administered the ADIS-IV. Clinical interviews were conducted by well-trained graduate-level assistants. A subset of 15% of all interviews conducted was audio recorded and scored by an independent rater for the purposes of assessing diagnostic reliability. Agreement on diagnoses for this subset was 100%. All participants then completed the questionnaires before being debriefed.

Results

Internal consistency

The three new measures had excellent internal consistency across all four groups. Among those in the OCD Contamination, OCD Non-Contamination, Anxious Control and Student Control groups, Cronbach's Alpha's for the VOI-MC were .94, .97, .96 and .93 respectively. For the CSS, these were .90, .94, .91 and .92 respectively; and for the CTAF, these were .96, .96, .95 and .93 respectively.

Convergent validity

Correlations between the three new contamination measures for all four groups are reported in Table 2. In general, there were strong and significant correlations between the VOI-MC and the CSS in all groups, with weaker associations between the CTAF and CSS.

Two of the three new scales were strongly and significantly correlated with the Contamination subscale of the Vancouver Obsessional Compulsive Inventory (VOI) across all three groups; the VOI Contamination Subscale-CTAF correlations in the two clinical groups were not significant. See Table 2.

Divergent validity

With one possible exception, correlations between the three new scales and the BDI were lower (and in many cases, markedly lower) than those with VOI Contamination subscale scores across all participant groups. See Table 2.

Discriminant validity

As can be seen in Table 1, the VOCI-MC and CSS successfully discriminated between those with OCD who reported contamination-related concerns and all other groups of participants. The CTAF appeared only to discriminate between clinical and nonclinical groups.

Predictions of OCD Symptoms by New Measures

Two hierarchical regression analyses were conducted (one in the OCD Group and another in the Student Group) to assess the degree to which the three new scales would predict unique variance in overall OCD symptoms (excluding contamination symptoms). The dependant variable was computed by subtracting the VOCI (Contact) Contamination subscale score from the VOCI Total Score. Given significant differences in age between the groups, age was entered in the first step along with a number of general factors (i.e., ASI, Disgust Sensitivity, BAI, BDI-II). In the second step, we entered OCD cognition variables (i.e., OBQ RT, OBQ PU, OBQ IC, TAF). In the third step, we entered the original VOCI (Contact) Contamination Subscale. In the fourth and final step, we entered the three new contamination subscales.

Among students, all four steps were significant predictors of variance in OCD symptomatology (see Table 3). Examining the fourth and final step, significant predictors of OCD symptomatology were ASI ($B = .23$, $t(396) = 2.74$, $p = .007$), DS ($B = -.31$, $t(396) = -2.29$, $p = .02$), BAI ($B = .42$, $t(396) = 4.13$, $p < .001$), OBQ-RT ($B = .19$, $t(396) = 3.05$, $p = .002$), VOCI Contamination ($B = .84$, $t(396) = 7.26$, $p < .001$), and VOCI-MC ($B = .49$, $t(396) = 5.16$, $p < .001$). No other variables accounted for unique variance in OCD symptomatology.

In the OCD group, each step emerged as a significant predictor, but only steps 1, 2 and 4 were associated with the significant F change (see Table 3). In the final step, significant predictors of OCD symptomatology were age ($B = .61$, $t(43) = 3.01$, $p = .005$), BAI ($B = .72$, $t(43) = 2.64$, $p = .01$), BDI (trend; $B = -.53$, $t(43) = -1.70$, $p = .098$), OBQ-PC ($B = .54$, $t(43) = 3.00$, $p = .005$), TAF ($B = .58$, $t(43) = 2.79$, $p = .008$), VOCI-MC ($B = .63$, $t(43) = 2.88$, $p = .006$) and CSS (trend; $B = -.43$, $t(43) = -1.71$, $p = .096$). No other variables accounted for unique variance in OCD symptomatology.

Relationships between Mental Contamination, OCD Symptoms and Beliefs

Correlations between the three new mental contamination measures and OCD symptoms (as measured by the VOCI) and beliefs (as measured by the OBQ-44 and TAF scales) for the OCD group are reported in Table 4. Particularly strong relationships emerged between the VOCI-MC and the VOCI total ($r = .78$) and VOCI Contamination ($r = .70$) scores, between the CSS and VOCI Contamination ($r = .74$) scores, and between the CTAF and TAF ($r = .74$) scores. In terms of beliefs, OBQ Responsibility/Threat and OBQ Importance/Control over Thoughts beliefs were significantly related with each new mental contamination scale; whereas only the VOCI-MC was significantly correlated with beliefs about Perfectionism/Intolerance for Uncertainty.

Discussion

This study aimed to develop our knowledge of the nature and cognitive components of mental contamination by developing three measures to assess the construct. Three new scales were developed – one to assess mental contamination (VOCI-MC), one to assess contamination

sensitivity (CSS) and one to assess thought-action fusion associated with contamination (CTAF). Our first hypothesis, that the three new scales would have acceptable psychometric properties, was supported. All three new measures had excellent internal consistency in excess of .93 across the different groups of participants i.e., OCD Contamination, OCD Non-Contamination, Anxious Control and Student Control groups. The significant correlations between the measures suggested they had good convergent validity, and almost all the measures were strongly and significantly correlated with the Contamination subscale of the Vancouver Obsessional Compulsive Inventory (VOCI) but they were not strongly associated with depression scores providing evidence of divergent validity. Importantly, the VOCI-MC and CSS discriminated between those with OCD contamination related concerns and the other groups although the CTAF appeared only to discriminate between clinical and nonclinical groups. The findings supported the hypothesis that the measures would predict other aspects of OCD symptomatology (e.g., other symptom types) over and above existing measures. The exploration of the nature of the relationships between the new scales and existing measures of OCD symptoms, OCD beliefs, disgust, and anxiety sensitivity showed strong associations.

These findings have important implications for our understanding of contamination in general and mental contamination in particular. The results unequivocally demonstrate that mental contamination is a coherent concept and that it is measurable. Its associations with existing measures of contamination indicate that while the associations are strong, they are not so high as to indicate duplication. The data indicate that the VOCI-MC provides specific, new information about contamination that occurs in the absence of contact. Previous measures of

contamination have all focused exclusively on contact contamination and have overlooked the strong clinical phenomenon of mental contamination.

The ability of the VOCI-MC and CSS scales to discriminate between those with contamination-based OCD and other forms is particularly welcome. Its specificity will allow clinicians to have some confidence that the scale is able to distinguish between this form of OCD and others. It is unsurprising that CTAF does not have this degree of specificity; the construct of thought-action fusion itself is not specific to OCD but occurs across anxiety disorders (Abramowitz, Whiteside, Lynam & Kalsy, 2003) and this appears to be true as well for the more specific contamination thought-action fusion.

Unlike other tests of OCD, the VOCI-MC is not blurred by associations with general distress, especially depression and anxiety. The 'purity' of this mental contamination scale, if confirmed, will be an advantage and could help guide clinicians as to the primary problem that warrants therapeutic priority.

The ability of the three new scales (with emphasis on the VOCI-MC) to predict unique variance in OCD symptomatology over and above anxiety, depression, anxiety sensitivity, disgust sensitivity, OCD beliefs, thought-action fusion AND traditional contact contamination symptoms is in our view not unremarkable. Although the amount of variance predicted was small (i.e., 2.4% in the student sample, 3.5% in the OCD sample), we feel that the new measures capture an important and meaningful element not previously measured in standard OCD self-report scales. The original VOCI captures both established domains of symptomatology (e.g., checking, obsessions, etc.), but also characteristics and features of OCD which tend not to be assessed by other standard OCD measures (e.g., hoarding, 'just right' symptoms,

indecisiveness). That the new mental contamination measures were such robust predictors of these leads us to recommend the use, especially of the VOCI-MC in both research and clinical applications in which contamination-related phenomenology is of interest.

The strong relationships seen between the three new measures and other OCD-relevant symptoms and constructs (seen in Table 4) are indicative of the degree to which mental contamination is solidly placed within domains of interest associated with OCD. The strong relationships with contact contamination are not surprising; but, robust correlations with ‘just right’ symptoms, obsessions, responsibility, the importance of/control over thoughts and thought-action fusion highlight domains worthy of future study as they relate to the experience of mental contamination. Consistent with Radomsky and Elliott (2009) and with Elliott and Radomsky (2013), they also highlight possible targets of treatment, particularly since there are established techniques designed to change a wide range of OCD beliefs. In addition, working with images, whether via imaginal exposure (Rosa-Alcázar et al., 2008) or preferably via other imagery-related techniques (see Hackmann, Bennet-Levy & Holmes, 2011) may be particularly helpful when the experience of contamination-related feelings is associated with upsetting images. We hope that the new scales will help to refine cognitive analyses of contamination-related phenomenology and associated compulsions and that these in turn will be used to foster an acceptable and effective treatment for those struggling with contamination-related concerns.

Recently, the term ‘compulsive washing’ has been used interchangeably with the fear of contamination. It is important that the two terms and concepts should remain distinct. Not all those with contamination fear engage in compulsive washing but instead they may neutralize

their fears idiosyncratically (e.g., by swallowing water, by praying for spiritual purity, or by conjuring a mental shield; Coughtrey, Shafran, Lee & Rachman, 2013). Similarly, some people may engage in compulsive washing not because they fear contamination but because otherwise it doesn't feel 'right'.

This study is not without its limitations. The study was not powered to detect differences between those with contact-contamination based OCD and mental contamination based OCD. Indeed, there was no other measure available to assess differences between these, and as such, this aspect of convergent/construct validity was not assessed. It will likely be concerning to some that the internal consistencies reported in this manuscript are quite high, indicating the possible redundancy of items in the new measures. Although this may well be a good argument from a statistical perspective, it is less tenable clinically. Since mental contamination concerns can be highly idiographic in nature, we recommend maintaining all scale items, so as not to miss out on possible elements of an individual's contamination fear. It will also be important to assess the stability of the new scales via retest reliability calculations; without this, their use in treatment research should be cautious. Undergraduate controls were unselected and did not complete diagnostic interviews; as such the group does not represent a 'pathology-free' sample. Although this does provide for more conservative estimates of many of the psychometric properties reported above, it is also a limitation of the study. The strengths of the current work lie in that the measures were theoretically derived and have clinical utility. Each measure takes less than 10 minutes to complete, is easy to score (scale scores are simply the sum of all item scores) and interpret, and is useful to detect the presence and nature of mental contamination for a given individual. This is important because if mental

contamination is overlooked it can impede treatment or even preclude it. It is worth considering the inclusion of the VOCI Mental Contamination Scale in all assessments of OCD.

Further research is warranted to establish the sensitivity and specificity of the scales and whether they can reliably be used as a measure of therapeutic change. Examinations of relationships between the new measures and treatment status, disorder duration and/or with alternate measures of severity may well be useful. In addition, their inclusion in studies of contamination-related phenomenology is recommended. The scales are available for public use free of charge from any of the authors; we hope that they are valuable for a range of clinical and research endeavours.

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Table 1 – Participant characteristics

	OCD Contamination (n = 30)	OCD Non- contamination (n = 27)	Anxious controls (n = 24)	Student controls (n = 410)
Age	36.13 ^a (10.99)	43.81 ^b (14.86)	38.13 ^a (14.45)	22.45 ^c (4.48)
Sex (% female)	56.7% ^a	44.4% ^a	62.5% ^a	86.3% ^b
VOCI-MC	30.57 ^a (19.29)	15.85 ^b (19.17)	14.13 ^{bc} (15.92)	8.34 ^c (9.64)
CSS	58.60 ^a (15.46)	45.95 ^b (18.84)	36.05 ^{bc} (15.99)	30.80 ^c (15.54)
CTAF	11.50 ^a (10.94)	9.56 ^a (10.10)	9.46 ^a (9.86)	5.12 ^b (6.58)
VOCI Total	98.23 ^a (47.25) ^a	77.93 ^{ab} (41.69)	60.79 ^b (38.69)	28.72 ^c (29.24)
VOCI Contamination	30.60 ^a (11.78)	11.26 ^b (11.92)	9.25 ^b (9.34)	6.77 ^b (8.32)
OBQ-44 Total	183.10 ^a (64.15)	178.70 ^a (51.98)	167.75 ^a (49.01)	124.98 ^b (43.06)
TAF	29.27 ^a (21.43)	23.44 ^a (18.95)	21.17 ^{ab} (14.90)	14.39 ^b (12.86)
DS	22.35 ^a (5.84)	19.02 ^{ab} (5.70)	22.27 ^{ab} (18.96)	18.72 ^b (5.43)
ASI	28.60 ^a (17.48)	27.19 ^a (16.55)	32.08 ^a (12.21)	14.92 ^b (10.76)
BAI	19.60 ^a (15.09)	24.37 ^a (14.96)	27.12 ^a (13.07)	9.15 ^b (8.56)
BDI-II	17.23 ^a (11.61)	21.15 ^a (12.47)	22.54 ^a (12.88)	8.67 ^b (7.75)

Note. VOCI-MC, Vancouver Obsessional Compulsive Inventory – Mental Contamination Scale; CSS, Contamination Sensitivity Scale; CTAF, Contamination Thought-Action Fusion Scale; VOCI, Vancouver Obsessional Compulsive Inventory; OBQ-44, Obsessional Beliefs Questionnaire – 44

Item Version; OBQ-44 RT, Responsibility and Threat Overestimation; OBQ-44 PU, Perfectionism and Intolerance for Uncertainty; OBQ-44 IC, The Importance of and Control over Thoughts; TAF, Thought-Action Fusion Scale; DS, Disgust Sensitivity Scale; ASI, Anxiety Sensitivity Index; BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory-II.

Values within the same row sharing the same superscript are not significantly different from each other p 's < .025. This slight correction to the p value as well as Tukey tests were chosen given the high number of comparisons reported; these were employed rather than the standard Bonferroni (1935) correction, given the relatively small n 's in the OCD sub-groups.

Table 2 – Interrelationships between the VOICI-MC, CSS and CTAF and associations with other measures.

	VOICI-MC	CSS	CTAF
CSS		-	-
OCD	.69***		
Anxious Control	.87***		
Student Control	.61***		
CTAF			-
OCD	.45***	.34	
Anxious Control	.34	.35	
Student Control	.45***	.58***	
VOICI Contamination subscale			
OCD	.70***	.74***	.34
Anxious Control	.76***	.70***	.57
Student Control	.61***	.67***	.56***
DS			
OCD	.53***	.45	.39
Anxious Control	.06	-.06	.64***
Student Control	.29***	.46***	.28***
ASI			
OCD	.59***	.57***	.35
Anxious Control	.61	.66	.45
Student Control	.57***	.52***	.35***
BDI			
OCD	.38	.18	.31
Anxious Control	.12	-.16	-.003
Student Control	.41***	.33***	.29***

Note. VOCI-MC, Vancouver Obsessional Compulsive Inventory – Mental Contamination Scale; CSS, Contamination Sensitivity Scale; CTAF, Contamination Thought-Action Fusion Scale; VOCI, Vancouver Obsessional Compulsive Inventory; DS, Disgust Sensitivity Scale; ASI, Anxiety Sensitivity Index; BDI, Beck Depression Inventory-II. Given the number of analyses conducted, α was set to .001 (Bonferroni, 1935) .

*** $p < 0.001$.

Table 3 - Summary of regressions for the OCD and Student groups

	Student (n = 410)						OCD (n = 57)					
	B(p)	SE B	β	R ² adj	ΔR^2	$\Delta F(p)$	B(p)	SE B	β	R ² adj	ΔR^2	$\Delta F(p)$
Step 1				.467	.473	72.43(<.001)				.687	.718	23.43(<.001)
Age	.027(.89)	.187	.005				.059(.79)	.221	.021			
ASI	.856(<.001)	.095	.402				.913(.004)	.302	.408			
DS	.344(.033)	.160	.081				.754(.16)	.533	.121			
BAI	.757(<.001)	.129	.283				1.136(.001)	.310	.457			
BDI	.265(.050)	.135	.090				-.014(.97)	.349	-.005			
Step 2				.571	.107	25.42(<.001)				.782	.102	5.99(.001)
OBQ RT	.283(<.001)	.073	.223				.265(.29)	.247	.162			
OBQ PU	.067(.25)	.058	.057				.433(.026)	.187	.255			
OBQ IC	.092(.39)	.108	.046				-.208(.49)	.297	-.106			
TAF	.276(.001)	.083	.155				.571(.006)	.196	.321			
Step 3				.668	.096	117.39(<.001)				.782	.005	1.06(.309)
VOCI	1.099(<.001)	.101	.400				.221(.31)	.215	.088			
CONT												
Step 4				.690	.024	10.51(<.001)				.812	.035	3.20(.034)
VOCI MC	.493(<.001)	.096	.208				.630(.006)	.219	.344			
CSS	-.021(.75)	.067	-.014				-.426(.10)	.249	-.202			
CTAF	.248(.11)	.248	.153				.308(.39)	.353	.089			

Note. Significant predictors are in bold. DS, Disgust Sensitivity Scale; ASI, Anxiety Sensitivity Index; BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory-II; OBQ RT, Responsibility and Threat Overestimation; OBQ PU, Perfectionism and Intolerance for Uncertainty; OBQ IC, The Importance of and Control over Thoughts; TAF, Thought-Action Fusion Scale; VOCI CONT, Vancouver Obsessional Compulsive Inventory - Contamination subscale; VOCI-MC, Vancouver Obsessional Compulsive Inventory - Mental Contamination Scale; CSS, Contamination Sensitivity Scale; CTAF, Contamination Thought-Action Fusion Scale.

Table 4 – Relationships between Mental Contamination Scales, OCD Symptoms and OCD Beliefs among participants diagnosed with OCD

	VOCI-MC	CSS	CTAF
VOCI Total	.78***	.66***	.55***
VOCI Checking	.54***	.45***	.39
VOCI Obsessions	.57***	.41	.66***
VOCI Contamination	.70***	.74***	.34
VOCI Hoarding	.31	.37	.21
VOCI 'Just Right'	.61***	.39	.34
VOCI Indecisiveness	.52***	.37	.42***
OBQ-44 Total	.59***	.45***	.51***
OBQ-44 RT	.58***	.45***	.48***
OBQ-44 PU	.45***	.31	.31
OBQ-44 IC	.60***	.48***	.64***
TAF	.50***	.43***	.74***

Note. VOCI-MC, Vancouver Obsessional Compulsive Inventory – Mental Contamination Scale; CSS, Contamination Sensitivity Scale; CTAF Contamination Thought-Action Fusion Scale; VOCI, Vancouver Obsessional Compulsive Inventory; OBQ-44, Obsessional Beliefs Questionnaire - 44 Item Version; OBQ-44 RT, Responsibility and Threat Overestimation; OBQ-44 PU, Perfectionism and Intolerance for Uncertainty; OBQ-44 IC, The Importance of and Control over Thoughts; TAF,

Thought-Action Fusion Scale; ASI, Anxiety Sensitivity Index. Given the high number of comparisons conducted, α was set to .001 (Bonferroni, 1935).

*** $p < .001$