

Université de Montréal

**Reality Check: Inferential Confusion and Cognitive Confidence as Core Cognitive Factors  
Across the Obsessive-Compulsive Spectrum**

**Par**

**Catherine Ouellet-Courtois**

Département de psychologie, Faculté des arts et des sciences

Thèse présentée en vue de l'obtention du grade de PhD en psychologie recherche et intervention,  
option clinique, sous la direction de Kieron O'Connor, Ph.D. et la co-direction de Frederick

Aardema, Ph.D.

Août, 2019

© Catherine Ouellet-Courtois, 2019

Université de Montréal  
Département de psychologie, Faculté des arts et des sciences

---

*Cette thèse intitulée*

**Reality Check: Inferential Confusion and Cognitive Confidence as Core Cognitive Factors  
Across the Obsessive-Compulsive Spectrum**

*Présentée par*

**Catherine Ouellet-Courtois**

*A été évaluée par un jury composé des personnes suivantes*

**Serge Sultan**

Président-rapporteur

**Kieron O'Connor**

Directeur de recherche

**Frederick Aardema**

Codirecteur

**François Borgeat**

Membre du jury

**Annie Aimé**

Examinatrice externe

## Résumé

Le trouble obsessionnel-compulsif (TOC) se caractérise par la présence d'obsessions et/ou de compulsions. À la lumière de l'hétérogénéité du TOC et de la présence de styles de pensées et de comportements de type TOC chez des personnes présentant d'autres problèmes de santé mentale, certains ont fait valoir la nécessité de créer une catégorie des troubles du spectre obsessionnel-compulsif et d'identifier les processus cognitifs communs qui sous-tendent ces troubles afin d'élaborer des théories et des traitements plus parcimonieux.

Une tendance générale à douter de ses sens et de ses facultés cognitives semble être le pivot des troubles obsessionnels. Selon l'approche basée sur les inférences, le doute obsessionnel est suscité par un processus de raisonnement erroné, soit la confusion inférentielle (CI). La CI implique (1) une méfiance vis-à-vis des sens et (2) une importance indue accordée aux possibilités imaginaires. La faible confiance cognitive (CC), un processus cognitif similaire, renvoie à une méfiance par rapport à son attention, sa perception et sa mémoire. Cette thèse a visé à étudier la CI et la faible CC en tant que potentiels facteurs cognitifs transdiagnostiques dans le spectre de l'obsessionnalité.

Le premier article constitue une revue systématique avec méta-analyse destinée à évaluer le rôle de la CC pour différents sous-types du TOC et à examiner à quel degré la faible CC est associée aux symptômes du TOC. On a constaté que les individus atteints d'un TOC présentent une plus faible CC que les témoins sains, mais que celle-ci ne semble pas spécifique au TOC. L'article a aussi souligné la nécessité d'employer des tâches idiosyncratiques, ciblant les distorsions de la pensée propres au TOC, afin de bien mesurer la CC.

Dans le cadre du deuxième article, le but a été d'approfondir cette piste de recherche en examinant le rôle commun de la faible CC et de la CI pour les différents sous-types du TOC, en

procédant à des analyses de grappes avec un échantillon de 128 patients atteints d'un TOC. Alors qu'il a été constaté que la faible CC correspondait davantage aux sous-types de vérification et « tout à fait juste », la CI semble pertinente pour un plus large éventail de profils TOC.

Le troisième article examine le rôle de la CI chez les troubles des conduites alimentaires (TCAs) en provoquant la CI expérimentalement. Des participantes atteintes d'un TA ( $n = 18$ ) et des femmes témoins saines ( $n = 18$ ) ont été assignées à l'une des deux conditions expérimentales : pour la condition CI élevée, les participantes ont visionné des vidéos où des séquences clés étaient manquantes, ce qui suscitait la CI; pour la condition CI faible, les participantes ont visionné les vidéos intégrales. Chez le groupe TA assigné à la condition CI élevée, on a observé une tendance à présenter un état de CI post-vidéos supérieur, un recours accru au comportement de neutralisation et, enfin, davantage de symptômes TOC.

En somme, les résultats de cette thèse soulignent la pertinence de la CI et de la faible CC en tant que facteurs cognitifs transdiagnostiques sur le spectre obsessionnel-compulsif.

*Mots-clés* : trouble obsessionnel-compulsif, troubles du spectre obsessionnel-compulsif, troubles alimentaires, confusion inférentielle, confiance cognitive

## Abstract

Obsessive-compulsive disorder (OCD) is a severe mental health disorder that involves obsessions and/or compulsions. In light of the heterogeneity of OCD and of the presence of OCD-like thinking and behaviors in several disorders, some have argued for the necessity of a new category of obsessive-compulsive spectrum disorders. Considering the overlap between various disorders characterized by obsessionality, there is a need for the identification of common cognitive processes that underpin these disorders in order to formulate more parsimonious explanations and treatments for these conditions.

A general tendency to doubt the senses and cognitive faculties appears as central to obsessional disorders. According to the inference-based approach, the obsessional doubt is elicited by a faulty reasoning process known as inferential confusion (IC), that implicates (1) a distrust of the senses, and (2) an investment in imaginary possibilities. A similar construct is low cognitive confidence, which is defined as a distrust of one's attention, perception and memory. The overarching goal of this thesis was to examine IC and low cognitive confidence as potential transdiagnostic cognitive factors across the spectrum of obsessionality.

The first thesis article evaluated the role of cognitive confidence across OCD subtypes and examined the extent to which poor cognitive confidence is associated with OCD symptomatology by conducting a systematic review with a meta-analysis. This article led to the conclusion that individuals with OCD have lower cognitive confidence than healthy controls, but that it is unclear if cognitive confidence is specific to OCD, such that the use of idiosyncratic tasks appears to be required in order to correctly capture cognitive confidence in OCD. The second thesis article furthered this investigation by examining the joint role of low cognitive confidence and IC across OCD subtypes by performing cluster analyses using a sample of 128

individuals with OCD. While cognitive confidence was found to be more relevant to the checking and “just right” subtypes, IC appeared to be relevant to a wider range of OCD profiles.

The third thesis article sought to examine the role of IC in eating disorders by inducing IC experimentally. Female participants with an eating disorder ( $n = 18$ ) and healthy controls participants ( $n = 18$ ) were recruited. Participants were assigned to one of two experimental conditions: in the High IC condition, participants watched videos with key sequences missing – provoking a distrust of the senses and lending more space for the imagination, thus triggering IC. In the Low IC condition, participants watched videos without sequences missing. The eating disorder group assigned to the High IC condition demonstrated a trend for higher levels of state IC, greater neutralization behavior and higher OCD symptoms than those who were assigned to the Low IC condition.

Taken together, the results of the present thesis underline the relevance of IC and cognitive confidence as transdiagnostic cognitive factors across the obsessive-compulsive spectrum.

*Keywords:* obsessive-compulsive disorder, obsessive-compulsive spectrum disorders, eating disorders, inferential confusion, cognitive confidence

## Table of Contents

Résumé.....	ii
Abstract.....	iv
List of Tables.....	vii
List of Figures.....	ix
List of Abbreviations.....	x
Dedication.....	xiii
Acknowledgements.....	xiv
General Introduction.....	1
Article 1: Cognitive Confidence in Obsessive-Compulsive Disorder: A Systematic Review and Meta-Analysis.....	21
Article 2: Cognitive Confidence and Inferential Confusion in Obsessive-Compulsive Disorder: Differences Across Subtypes.....	85
Article 3: Reality Check: An Experimental Manipulation of Inferential Confusion in Eating Disorders.....	124
General Discussion.....	152
References Cited in the Introduction and General Discussion.....	173
Appendix A: Ethics Certificates for Articles 2 and 3.....	ii
Appendix B: Consent Form for Article 3.....	vii

## List of Tables

### Article 1

Table 1: List of reviewed articles in alphabetical order.....	64
Table 2: Experimental studies focusing on cognitive confidence in OCD (across subtypes) .....	69
Table 3: Experimental studies focusing on cognitive confidence in OCD with primary checking.....	73
Table 4: Studies using self-report measures to evaluate cognitive confidence in OCD.....	76
Table 5: Meta-analysis of questionnaire data comparing cognitive confidence in individuals with OCD and healthy controls.....	78
Table 6: Meta-analysis of questionnaire data comparing cognitive confidence in individuals with OCD and clinical controls.....	79

### Article 2

Table 1: Demographic characteristics and OCD-related variables.....	117
Table 2: Means and standard deviations on measures of interest for cognitive confidence clusters.....	118
Table 3: Means and standard deviations on measures of interest for inferential confusion clusters.....	119
Table 4: Correlation matrix between the VOCI subscales, cognitive confidence and inferential confusion.....	120
Table 5: Linear regression analyses of the OBQ-44 subscales as predictors of the MCQ-CC and ICQ-EV.....	121



Article 3

Table 1: Demographic characteristics and scores on variables of interest at baseline.....131

## List of Figures

### Article 1

<i>Figure 1:</i> Four-step flow diagram for article selection (provided by PRISMA).....	81
<i>Figure 2:</i> Funnel plots for risk of bias assessment.....	82
<i>Figure 3:</i> Forest plot of effect sizes for self-report studies comparing cognitive confidence in individuals with OCD and healthy controls.....	83
<i>Figure 4:</i> Forest plot of effect sizes for self-report studies comparing cognitive confidence in individuals with OCD and clinical controls.....	84

### Article 2

<i>Figure 1:</i> Clusters for cognitive confidence as measured with the Metacognitions Questionnaire - Cognitive Confidence Subscale.....	122
<i>Figure 2:</i> Clusters for inferential confusion as measured with the Inferential Confusion Questionnaire-Expanded Version.....	123

### Article 3

<i>Figure 1:</i> State inferential confusion scores.....	137
<i>Figure 2:</i> Proportions (in %) of neutralization behavior for the eating disorder videos.....	139

## **List of Abbreviations**

AC = anxious control

ANOVA = analysis of variance

APA = American Psychiatric Association

BAI = Beck Anxiety Inventory

BDI-II = Beck Depression Inventory-II

CBT = cognitive-behavioural therapy

CC = clinical control

CC = cognitive confidence

Dep = depression

DSM = Diagnostic and Statistical Manual of Mental Disorders

EDE-Q = Eating Disorder Examination - Questionnaire

EDs = eating disorders

ERP = Exposure and Response Prevention

GAD = generalized anxiety disorder

HC = healthy control

HOCI = Hamburg Obsessional Compulsive Inventory

IBA = inference-based approach

IC = inferential confusion

ICQ = Inferential Confusion Questionnaire

ICQ-EV = Inferential Confusion Questionnaire-Expanded Version

MACCS = Memory and Cognitive Confidence Scale

MAEQ = Memory for Actions and Events Questionnaire

MANOVA = multivariate analysis of variance

MARS = Meta-Analysis Reporting Standards

MCQ = Metacognitions Questionnaire

MCQ-CC = Metacognitions Questionnaire – Cognitive Confidence Subscale

MOCI = Maudsley Obsessional-Compulsive Inventory

NJREs = “not just right experiences”

OBQ-44 = Obsessional Belief Questionnaire

OCCWG = Obsessive Compulsive Cognitions Working Group

OCD = obsessive compulsive disorder

OCI-R = Obsessive-Compulsive Inventory Revised

PD = panic disorder

PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-analyses

PMQ = Prospective Memory Questionnaire

PRMQ = Prospective and Retrospective Memory Questionnaire

SCID = Structured Clinical Interview for DSM Disorders

SCZ = schizophrenia

STAI = State-Trait Anxiety Inventory

VOCI = Vancouver Obsessional Compulsive Inventory

Y-BOCS = Yale-Brown Obsessive Compulsive Scale

*“I did not believe the information. Just had to trust imagination.” -Lyrics to Solsbury Hill, Peter Gabriel*

## Dedication

I would like to dedicate my thesis to my supervisor, Kieron O'Connor, whose great body of work will keep on helping those struggling with OCD.

## Acknowledgements

I first and foremost would like to thank my supervisor, Kieron O'Connor. Everyone who knows Kieron can only speak fondly of him, and my experience as a student under his supervision matches his reputation. I am beyond grateful to have had such a humble, passionate, inspiring, funny, and caring supervisor. Thank you for your time, your trust and for all the research opportunities you gave me. I feel particularly lucky to have had a supervisor who cared enough to show up to all the presentations or prize ceremonies he could attend and to arrange meetings whenever needed. Your genuine desire to advance research on OCD spectrum conditions, your devotion to research in this field, as well as your humility and care have truly inspired me. On August 27th, 2019, the research community, your colleagues and students have all lost a valued and appreciated mentor, guide, and friend. Just like so many others, I was very saddened by your departure, but I like to think that you are still somehow living within us, as your ideas and vision are still alive. You've surely passed on to me your passion for research on OCD, and I hope to be able to continue to pass on your values and ideas in my future research as well as in my clinical practice.

I would also like to express my most sincere thanks to Frederick Aardema, who has acted as my co-supervisor after Kieron's passing. Your supervision style and your approach as a mentor are highly reminiscent of Kieron's: you provide reassurance, encouragement, as well as insightful and constructive feedback. Your trusting stance and patience also instill confidence in students. I am reassured to see that Kieron's research and values will remain alive under your watch, and will be fuelled by the same passion for research.

Un grand merci aux Fonds de recherche du Québec – Société et Culture pour leur soutien financier, lequel m'a permis de pleinement profiter de mes années au doctorat.

J'aimerais aussi remercier mes superviseurs à la Clinique universitaire de psychologie (CUP), Nicholas Pesant et Sophie Bergeron. Merci de m'avoir offert d'aussi beaux modèles de transparence, d'authenticité et de bienveillance. Merci de m'avoir aidée à explorer mon monde intérieur de manière sécurisante. Votre regard bienveillant et votre confiance m'ont permis de grandir avec mes clients.

J'aimerais offrir mes remerciements les plus sincères à mes clients à la CUP ainsi qu'à la clinique Change. Merci de m'avoir fait assez confiance pour ouvrir sur vos moments plus sombres, afin que l'on arrive à y mettre de la lumière ensemble. Votre courage et votre résilience continueront de m'inspirer et de m'aider à accueillir mes propres vulnérabilités.

J'aimerais remercier tous les participants qui ont pris part à ma recherche doctorale et sans qui cette thèse n'aurait pas pu être réalisée. Merci aussi aux participants du RCT pour le TOC de m'avoir partagé leur expérience alors que j'étais évaluatrice et qui ont semé chez moi le désir d'approfondir les connaissances sur ce problème de santé mentale.

I am also grateful to Samantha Wilson for our friendship since our undergraduate days at Concordia. You're the only person with whom I can talk about research ideas and giggle for hours straight while getting lost around Berlin or throughout an entire drive to a conference in New York. You're literally the best teammate I've ever had. Merci aussi à mon ami et collègue de stage Jean-François Jodoin pour son écoute, son soutien et son regard positif inconditionnel.

J'aimerais remercier mes meilleurs amis, soit Hubert Lemieux, Guillaume Bondu et Éloïse Choquette, avec qui je peux trouver un équilibre parfait entre les moments de grandes confidences et ceux de débilité aiguë. Je ne serai jamais assez reconnaissante pour notre délire commun et toute l'affection qui nous unit. Merci aussi à ma meilleure amie, Roxanne Nolin,



d'avoir toujours été là, d'avoir toujours cru en moi et de m'avoir accueillie dans sa vie comme si je faisais partie de sa famille.

J'aimerais remercier ma famille, que j'aime plus que tout. Merci à mon père, Stéphane Courtois, d'avoir toujours été un modèle de persévérance, de fiabilité et d'ambition. Merci de m'avoir montré qu'il est possible d'être un universitaire sérieux le jour et un illustre bouffon le soir. Merci à ma mère, Sylvie Ouellet. Tes encouragements, ton réconfort, ton humour (et nos montées de lait partagées!) m'ont toujours aidée à relativiser les choses et à m'apaiser. Merci d'abord et avant tout d'être tellement une maman : c'est par ton amour de mère que j'ai appris à aimer autant. Finalement, j'aimerais remercier du plus profond de mon cœur ma petite sœur, Julie Ouellet-Courtois. Ta sagesse, ta force et ton authenticité ne cesseront jamais de m'inspirer. Depuis que tu es née, tu as toujours été ma petite étoile dans la nuit qui me guide et m'aide à m'ancrer. Ta présence et ton écoute inestimables m'ont aidée tout au long de ma formation en tant que psychologue et chercheuse, mais m'ont aussi aidée à devenir une meilleure humaine.

## **General Introduction**

The present thesis consists of three research articles examining two intertwined constructs, namely inferential confusion and cognitive confidence, across the spectrum of obsessive-compulsive disorders. In a first instance, a description of the phenomenology of obsessive-compulsive disorder (OCD) will be provided along with an account of prevalent theoretical models for the disorder, namely the cognitive appraisal model vs. the inference-based approach (IBA). The latter model postulates that inferential confusion is an important cognitive feature of OCD (O'Connor, Aardema, & Pélissier, 2005a). Inferential confusion refers to a reasoning process whereby the senses are distrusted, such that an undue importance is given to possibility-based information generated by one's imagination. A similar construct is cognitive confidence, which is operationalized as a distrust of one's attention, perception and memory. Both inferential confusion and cognitive confidence have been found to be important cognitive factors in OCD, as they both implicate a tendency to distrust one's senses. Considering the heterogeneity of OCD and the presence of OCD-like symptoms in other disorders, the overarching goal of the present thesis was to investigate the general tendency to distrust the senses across the obsessive-compulsive spectrum, that is across different OCD subtypes as well as in other OCD spectrum disorders, namely eating disorders (Hollander, 1993).

### **Obsessive-Compulsive Disorder**

OCD is a mental health disorder that involves obsessions – defined as distressing, intrusive thoughts – and/or compulsions aimed at offsetting the obsessions or reducing the associated distress (American Psychiatric Association; APA; 2013). The lifetime prevalence of OCD is about 2.3-2.7%, which makes it one of the most common disorders in Western countries (Kessler, Petukhova, Sampson, Zaslavsky, & Wittchen, 2012). In 2001, the World Health

Organization ranked OCD as one of the most incapacitating mental health disorders. OCD can severely reduce quality of life for the individual (Eisen et al., 2006), and can cause a dramatic interference in the lives of significant others (Cicek, Cicek, Kayhan, Uguz, & Kaya, 2013). The presence of obsessions or compulsions that cause distress as well as interference in one's daily life are required for a diagnosis of OCD (APA, 2013). However, more than 95% of individuals with OCD report both obsessions and compulsions on the Yale-Brown Obsessive Compulsive Scale (Y-BOCS), the gold standard measure of OCD symptomatology (Foa & Kozak, 1995; Goodman et al., 1989).

Common obsessions in OCD are persistent doubt that one has not turned off the stove, uncertainty over whether one has locked the door or not, contamination fears or concern over harming significant others. Compulsions can be overt (i.e., performing a certain action) or covert (i.e., performing a mental act; Frost & Steketee, 2002). Examples of common compulsions include checking the stove or door, washing hands, performing rituals according to specific rules, or replacing "bad thoughts" with "good ones". Often, obsessions and compulsions are linked by theme. For instance, individuals who have persistent thoughts about causing a fire may check their stove and other electrical appliances relentlessly, while those with contamination fears may engage in ritualistic hand washing. However, in certain OCD presentations, the link between obsessions and compulsions is not as obvious, such as in the case of an individual with OCD who avoids stepping on lines on the sidewalks to make sure that a loved one doesn't get hurt. Adding to the complexity of the disorder, one individual with OCD can present with several obsessions and compulsions. In fact, although there is one single diagnosis of OCD, the presentations of the disorder can be widely different across individuals. In an effort to regroup OCD into subtypes, studies have employed factor analyses and have provided support for

dimensions of OCD in which obsessions and compulsions load together on similar symptom-based factors and clusters (e.g., Leckman et al., 1997; Summerfeldt, Richter, Antony, & Swinson, 1999; Wu & Carter, 2008).

### **Heterogeneity of OCD and Obsessive-Compulsive Spectrum Disorders**

Considering that OCD can take on many forms, it has been suggested that OCD symptoms should be conceptualized as existing along different dimensions (for an overview see, Mataix-Cols, Rosario-Campos, & Leckman, 2005). Factor analytic methods have revealed the presence of a) contamination fear with washing compulsions; (b) obsessions about responsibility for causing harm or making mistakes with checking compulsions; (c) obsessions about incompleteness or “not just right” feelings with ordering/arranging compulsions; and (d) unacceptable thoughts about sex, religion, and violence along with mental or overt rituals, as distinct symptom domains (Bloch, Landeros-Weisenberger, Rosario, Pittenger, & Leckman, 2008; Leckman et al., 1997; Summerfeldt et al., 1999; Wu & Carter, 2008). Those four factors have been supported by other research employing Bayesian approaches (Schulze, Kathmann, & Reuter, 2018). The grouping of these symptom presentations, and of different obsessions and compulsions, differs drastically across individuals (Pinto et al., 2006), such that individuals with equally severe OCD may share no common symptoms (Bloch et al., 2008; Ferrao et al., 2006). The majority of individuals with OCD report four or more symptom types concomitantly, and the presence of several types of obsessions or compulsions has been found to be related to greater impairment (Ruscio, Stein, Chiu, & Kessler, 2010).

Although obsessionality<sup>1</sup> is necessary for defining OCD, it is not specific to OCD, as it is also present in other mental health disorders. In light of the heterogeneity of OCD and of the presence of obsessionality in various disorders, some have argued for the necessity of a new psychiatric nosology of obsessive-compulsive spectrum disorders (for instance, Bartz & Hollander, 2006; Hollander, 1993; Hollander, Kim, Braun, Simeon, & Zohar, 2009; McElroy, Phillips, & Keck, 1994). This classification is based on the phenomenological similarities between OCD and certain disorders (i.e., obsessional thinking and/or compulsive behaviors), as well as their similarities with regard to neurobiological circuitries, comorbidity, course of the disorder and treatment response. Examples of possible obsessive-compulsive spectrum disorders include body dysmorphic disorder, hypochondriasis, trichotillomania, delusional disorders, and eating disorders. The latter has particularly been receiving research attention, given the striking similarities between OCD and eating disorders. In fact, a breadth of research has explored the overlap between OCD and eating disorders as well as their shared endophenotypes (for example, see Halmi et al., 2003; Treasure, 2006).

A great deal of research supports the notion that OCD and eating disorders share many similarities, both in terms of their phenomenology and of underlying cognitive processes (for a review, see Bertrand, Bélanger, & O'Connor, 2011). Just as individuals with OCD, individuals with eating disorders display a high level of obsessionality and engage in ritualistic, compulsion-like behaviours. In OCD, individuals experience obsessive, unwanted thoughts and engage in compulsions aimed at reducing anxiety. In eating disorders, individuals also present obsessional

---

<sup>1</sup> Obsessionality does not specifically relate to obsessions, as it is recognizable in both thoughts and acts, in both obsessions and compulsions. Throughout this thesis, the term obsessionality will be used to describe the general tendency to be obsessed with an idea (e.g., that one could be contaminated; that one has to be thin) and/or a behavior (e.g., washing hands; counting calories).

thoughts and compulsions, yet that tap into the realm of body shape and weight. Common eating disorder obsessions are about thinness, body shape, and rumination about food, which are usually followed by ritualistic compulsions such as counting calories, weighing, and compulsive exercising (Fairburn & Harrison, 2003). Shafran, Fairburn, Robinson, and Lask (2004) have found that individuals with eating disorders perform rituals aimed at verifying their body shape or weight and assessing potential weight gain. Subsequent to performing such rituals, more than 75% of these individuals reduced their caloric intake. Notably, it was also found that the frequency of such rituals is positively correlated with weight over-evaluation. This suggests that, just as seen in OCD, the compulsive behaviors (i.e., weight/fat checking) and obsessions (i.e., maintaining a low weight) mutually reinforce each other. This corroborates the idea that OCD and eating disorders both fall on the same obsessive-compulsive spectrum and may be different expressions of a same neurobiological vulnerability (Phillips & Kaye, 2007).

### **Cognitive Models of OCD**

A number of theoretical models have been offered to account for the complexity and heterogeneity of OCD. According to the cognitive-behavioral model of OCD (Salkovskis, 1996; Rachman 1997), also known as the cognitive appraisal model, obsessions arise from the catastrophic interpretation of normal, universal intrusive thoughts as highly threatening (e.g., I've thought about pushing someone in front of the bus, this must mean that I am a murderer), which leads to compulsive behaviors in order to alleviate distress or to prevent negative consequences. Although most individuals in the general population experience unwanted intrusive thoughts that are similar in content to those reported by individuals with OCD (Rachman & de Silva, 1978; Radomsky et al., 2014), those who misinterpret such thoughts as meaningful would be at greater risk of developing OCD (Rachman, 1997). The cognitive

appraisal model of OCD led to the development of the Obsessive Compulsive Cognitions Working Group (OCCWG, 1997; 2003; 2005), which identified OCD maladaptive beliefs involved in the appraisal of intrusive thoughts, namely the tendency to overestimate threat and responsibility, beliefs about the importance of and need to control thoughts, and beliefs about the need for certainty and perfection. The cognitive appraisal model thus posits that these OCD maladaptive beliefs lead to the misinterpretation of normal intrusive thoughts as being significant and dangerous, and thereby to the development of obsessions.

Although the cognitive appraisal model is currently the most acclaimed and advocated model in the field of OCD, it has its own shortcomings. For instance, although the content of intrusive thoughts may be universal (e.g., throwing someone in front of the bus), the model fails to acknowledge that other factors can account for the transition of intrusive thoughts into full-blown obsessions. In fact, although normal intrusive thoughts and obsessions can be similar in content, they differ in terms of emotional investment, vividness, and the context in which they occur (Bouvard, Fournet, Denis, Sixdenier, & Clark, 2017; Julien, O'Connor, & Aardema, 2016; Morillo, Belloch, & García-Soriano, 2007; Moritz & Larøi, 2008; O'Connor, 2002). Further, some studies have found that more than half of OCD samples do not score high on the OCD maladaptive beliefs identified by the OCCWG, which are deemed to bridge universal intrusive thoughts to obsessions (Calamari, Cohen, Rector, Szacun-Shimizu, Riemann, & Norberg, 2006; Polman, O'Connor, & Huisman, 2011; Taylor et al., 2006). In addition, findings are equivocal with regard to the importance of these alleged OCD maladaptive beliefs to individuals with OCD in comparison to other clinical groups (Shams & Milosevic, 2015; Sica, Coradeschi, Sanavio, Dorz, Manchisi, & Novara, 2004; Tolin, Woods, & Abramowitz, 2003).

Furthermore, the appraisal model fails to provide an explanation for the formation of obsessions for certain OCD presentations, such as the “just right” subtype. Individuals with OCD with this subtype (also associated with symmetry/ordering) experience feelings that something is not quite right or incomplete (i.e., “not just right experiences”; NJREs) and this overwhelming sense of doubt leads to repetitive behaviors. Common triggers for the “just right” subtype implicate the senses, which fuel the need to achieve a feeling of completeness to terminate a compulsion (e.g., after touching a book, a person may feel a sudden need to touch it repeatedly until the tension goes away). As such, the underlying motivational factor for compulsions of symmetry and ordering associated with the “just right” subtype seems to be different from that of other forms of OCD, as it involves a need to eliminate a sense of incompleteness rather than a fear of harm or of a catastrophic consequence (McKay et al., 2004). Therefore, the appraisal model fails to account for the development of obsessions related with “just right” experiences.

Cognitive-behavioural therapy (CBT) for OCD is currently considered the treatment of choice for OCD. CBT for OCD was developed in line with the appraisal model and adopts a phobic model of OCD, such that obsessional fears (e.g., contamination fear) are viewed as phobias (e.g., phobia of germs). As such, CBT for OCD employs exposure with response prevention techniques (e.g., having the patient touch a public doorknob without engaging in subsequent washing) in order to extinguish the fear response. The problem with such conceptualization of OCD is that, unlike actual phobias, the object of fear in OCD is based in the imagination and is not grounded in reality. In phobias, the fear is directly tied to the physical presence of the feared object, but in the absence of the feared object, there is no fear. However, in OCD, the opposite mechanism is at play: obsessions only seem to occur when the feared object is not actually there. In other words, it is the imagined possibility of a feared outcome



becoming true that provokes the fear response, while the presence of the actual feared object often produces less anxiety. For instance, a hairdresser with OCD may be afraid of using sharp objects at home out of fear of hurting her significant others, but will use scissors for cutting her customers' hair without feeling anxious. Furthermore, the object of fear in OCD is selective. For example, a man with OCD may avoid touching doorknobs because of his fear of being contaminated by germs, but will handle money without experiencing any anxiety. In fact, for any obsessional fear in OCD, there will be a context in which the individual will not fear certain stimuli, although they tap into their very obsessional fear. In short, as opposed to phobias where feared objects are accessible in reality (e.g., spiders, heights), most of the obsessional fears in OCD are impossible to tackle and reproduce for the purpose of exposure.

On the other hand, IBA offers a different explanation for the development of obsessions as well as a different therapeutic approach to treat OCD, as it attempts to address the shortcomings of the appraisal model as well as the limitations of exposure therapy for OCD. IBA conceptualizes intrusive thoughts as inferences or propositions about reality that are formed and reinforced through faulty inductive reasoning processes, yielding the formation of a faulty inductive narrative that leads to obsessions (O'Connor & Aardema, 2011; O'Connor, 2002). This inductive narrative is triggered by a percept (i.e., internal or external stimuli), which leads to a primary doubting inference (e.g., "Maybe the door is unlocked.") generated by the imagination, while disregarding information provided by the senses (e.g., sound of a "click" when locking the door). This is followed by a secondary inference about feared possible consequences should the primary inference be true (e.g., "If the door is unlocked, I might get robbed."). Thus, this inductive narrative leads the individual to act as if the primary doubting inference was true, and

engage in compulsive behaviors (e.g., check the door). This subjective narrative based on imagined fears reinforces and maintains the obsessional doubt (O'Connor et al., 2005a).

The goal of IBA is to identify the faulty reasoning processes that provide justification for the obsessional doubt. An important assumption of IBA is that if the doubt is eliminated, the other OCD symptoms (i.e., obsessions, compulsions) will disappear (O'Connor, Ecker, Lahoud, & Roberts, 2012). IBA works on modifying faulty reasoning that is based on purely imagined events (e.g., "I imagined a thief getting into my house and stealing all my most valuable belongings, therefore I must check that the door is locked."). Accordingly, IBA also aims to bring the individual back to the world of the senses, as well as to make the individual trust her senses and common sense (O'Connor et al., 2012; O'Connor & Aardema, 2011).

The results of a study suggested that CBT and IBA did not differ significantly in their effectiveness for treating OCD (O'Connor, Aardema, & Pélissier, 2005b). Notably, IBA proved to be more effective in a subset of individuals with OCD, namely those with poor insight, meaning individuals who fail to see that their beliefs and behaviors are irrational and who are more prone to delusional thinking. More recently, another research group in the Netherlands has replicated these findings in a sample of 90 individuals with OCD in a randomized-controlled trial of IBA against CBT (Visser, van Megen, van Oppen, Eikelenboom, Hoogendorn, Kaarsemaker, & van Balkom, 2015). Just like O'Connor and colleagues (2005b), their results indicated that both CBT and IBA are effective treatments for OCD, and that individuals with extremely poor insight benefited more from IBA. Moreover, a series of clinical cases involving patients with OCD who underwent a CBT treatment incorporating IBA elements – as the two treatments are not incompatible – assessed clinically meaningful decreases in obsessional symptoms and beliefs (van Niekerk, Brown, Aardema & O'Connor, 2014). Taken altogether, these findings yield

support for the notion that IBA is an effective treatment for OCD. Although IBA was originally formulated in the context of OCD, it offers a transdiagnostic conceptualization of the obsessional doubt, thus extending its applicability to a range of obsessional disorders, such as eating disorders. Notably, in one clinical trial, IBA was adapted for eating disorders, and it was demonstrated that the treatment produced significant reductions in body image disturbance and eating disorder symptoms (Purcell Lalonde & O'Connor, 2015).

### **Doubting the Senses in OCD**

Since OCD is a highly heterogeneous disorder, the investigation of cognitive processes in OCD, whereby the form and context of the obsession are more relevant than the content, could improve our understanding of the cognitive mechanisms behind OCD subtypes and other obsessive-compulsive spectrum disorders. Historically, OCD has been referred to as “the doubting disease” (Janet & Raymond, 1903), as obsessions almost always begin with an initial doubt. Research has supported the idea that individuals with OCD are more prone to doubt, as they have shown to be more influenced than nonclinical individuals during reasoning tasks when being provided with alternative conclusions (Pélissier & O'Connor, 2002; Pélissier, O'Connor, & Dupuis, 2008). Some have argued that doubt in OCD is reflected by a lack of confidence in one's internal states (e.g., muscle relaxation and tension) or a lack of confidence in one's general knowledge (Dar, Rish, Hermesh, Taub, & Fux, 2000; Lazarov, Dar, Liberman, & Oded, 2012; Lazarov, Dar, Oded, & Liberman, 2010). One specific form of doubt that has been consistently documented in OCD is a general tendency to distrust the senses. For instance, the individual with contamination fear will doubt that his hands are clean and will therefore engage in compulsive handwashing, while the one with obsessions about significant others being harmed will doubt

that he has correctly touched all green objects in the room and will therefore repeat it again to be safe.

**Inferential confusion.** According to the IBA model, a central cognitive factor in OCD is inferential confusion, whereby the individual fails to acknowledge the irrationality of the obsession because of (1) a distrust of the senses and (2) an overreliance on possibility-based information generated by one's imagination. For instance, an individual with OCD who leaves his house and wonders whether he forgot to lock the door will not rely on his senses (e.g., "I heard a click sound.") to decide if he locked the door, but will rely on possibility-based information from his imagination (e.g., "If the door isn't locked I might get robbed."). As a result, this individual will repeatedly check whether the door is locked (i.e., compulsion) because of his initial doubt about whether the door is locked, which reinforces obsessional fears about robbery. Due to inferential confusion, the individual with OCD does not react to what is there right before his eyes, but to what might *possibly* be there, although his senses say otherwise, thus fuelling the obsession-compulsion loop (Aardema, O'Connor, Emmelkamp, Marchand, & Todorov, 2005).

Inferential confusion has been implicated in the onset and maintenance of OCD (O'Connor & Robillard, 1995). Factor analyses on the Inferential Confusion Questionnaire (ICQ) validated that the construct entails two main components, that is a distrust of the senses and a reliance on imagined possibilities (Aardema, Pélissier, O'Connor, & Lavoie, 2009). However, more recent work on a revised version of the ICQ indicated that the ICQ is uni-dimensional (Aardema, Wu, Careau, O'Connor, Julien & Dennie, 2010). Accordingly, O'Connor and colleagues (2005a) explain that both components are difficult to delineate as they go hand in hand, such that distrusting the senses leads to a reliance on possibilities generated by the

imagination, while these imaginary possibilities give credence to the distrust of the senses and the obsessional doubt. A great deal of studies have highlighted the association between inferential confusion and obsessional symptoms (Aardema et al., 2005; Aardema, O'Connor, & Emmelkamp, 2006; Aardema, Wu, Careau, O'Connor, Julien, & Dennie, 2010; Yorulmaz, Gençöz, & Woody, 2010). Aardema, O'Connor, Pélissier, and Lavoie (2009) designed an experimental task in which individuals with OCD were presented with possibility-based or reality-based information. An association was found between investment in possibilities and OCD symptom severity, which was explained by inferential confusion. This finding suggests that inferential confusion contributes to the presence of OCD symptoms. Accordingly, other work has demonstrated that inferential confusion is a significant predictor of obsessional symptoms (Aardema, Moulding, Radomsky, Doron, Allamby, & Souki, 2013; Goods, Rees, Egan, & Kane, 2014; Wu, Aardema, & O'Connor, 2009).

Distrust of the senses, one component of inferential confusion, is defined as “disregarding the senses in favor of going deeper into reality” (O'Connor et al., 2005a) and can account for repetitive actions in OCD. As the individual with OCD attempts to go beyond the senses, any attempt to resolve this doubt in reality (i.e., through compulsions) will be useless, as regardless of how many times one repeats the compulsive act, the imagination will continue to generate explanations as to why the obsessional fear might be true (O'Connor & Robillard, 1995). The tendency to distrust the senses in OCD has been researched and empirically validated, yet the research focus has been on a closely intertwined construct known as cognitive confidence.

**Cognitive Confidence.** In light of the repetitive nature of compulsions and rituals in OCD, several lines of research have examined whether memory distrust may not account for this need to repeat actions. For instance, one study demonstrated that although individuals with OCD

performed as well as non-anxious controls on a task that entailed recalling performed actions, they were more likely to report less confidence in their memory for these events, indicating that they displayed poor memory confidence (Hermans, Martens, De Cort, Pieters, & Eelen, 2003). The data from this study suggested that individuals with OCD's lack of confidence extended beyond the realm of memory and was present on three specific levels, as these individuals displayed less confidence in (1) their memory for actions; (2) their ability to differentiate between actions and their imagination; and (3) their attentional abilities. This research group replicated their results and found again that OCD entails a lower confidence in attention, perception and memory, a phenomenon that was referred to as low *cognitive confidence* (Hermans, Engelen, Grouwels, Joos, Lemmens, & Guido, 2008).

There is mounting evidence for the notion that individuals with OCD have poorer cognitive confidence, yet most of the research has examined more specifically memory confidence in the context of compulsive checking. Rachman's (2002) cognitive theory of compulsive checking postulates that the act of checking increases the doubt rather than alleviating it. It is believed that the increased doubt that results from checking leads to further decline in memory confidence over time, such that compulsive checking is maintained. In support of Rachman's (2002) model, a series of studies employing stove checking tasks have indicated that the more participants checked, the more their memory confidence diminished, although there were no actual changes in memory accuracy (i.e., no memory impairment; Hout & Kindt 2003a; Hout & Kindt 2003b; Hout & Kindt 2004; Coles, Radomsky, & Horng, 2006; Radomsky, Gilchrist, & Dussault, 2006; Radomsky, Dugas, Alcolado, & Lavoie, 2014). Although there has been fewer lines of research examining cognitive confidence in OCD subtypes other than compulsive checking, the evidence so far suggests that the construct is

relevant to other OCD presentations. For instance, Taylor and Purdon (2016) looked at memory and sensory confidence in the context of OCD with contamination fears and compulsive washing and found that the longer participants washed their hands, the greater their sensory confidence diminished, although memory confidence was unchanged. This suggests that different aspects of cognitive confidence may speak to each OCD subtype (e.g., perceptual confidence for OCD with contaminations fears; memory confidence for OCD with primary checking). The investigation of cognitive confidence across OCD subtypes, above and beyond memory confidence in compulsive checking, is therefore warranted.

Poor cognitive confidence is a construct highly similar to distrust of the senses in inferential confusion, as individuals with OCD have difficulties trusting their memory for the action and doubts whether they perceived or attended to a real action (and if they did, did they *correctly* perceive what there was to see?) or whether they only imagined it. However, it is important to note that the two constructs differ conceptually. While distrust of the senses pertains more to a state construct (e.g., “I don’t trust what I see as I turn off the stove.”), low cognitive confidence refers more to trait construct (e.g., “I am usually distracted, so I am not confident in my ability to pay attention when I turn off the stove.”). In addition, distrust of the senses involves doubts directed more toward the outside world (“I don’t trust the information my senses are telling me.”) than towards oneself (“I don’t trust my attention.”). Although inferential confusion and cognitive confidence have some conceptual differences, they both underline a general lack of confidence in both cognitive faculties and senses and are thus two intrinsically intertwined constructs.

### **Inferential Confusion and Cognitive Confidence: Potential Transdiagnostic Cognitive Processes**

The similarities between the obsessions and compulsions of OCD and the "preoccupations" of obsessive-compulsive spectrum disorders (e.g., food, weight and shape in eating disorders) have often been emphasized. These similarities in phenomenology include the individual's relationship to the thought, the behavioural response to the thought, and the associated distress. While the thought content and the theme of the compulsive behaviors may vary across OCD subtypes and across obsessive-compulsive disorders, the cognitive processes at play appear to be the same. According to Harvey and Watkins's (2004) transdiagnostic approach, common maintaining factors contribute to multiple disorders. The examination of these shared factors may improve our understanding of comorbidity and allow us to formulate more parsimonious explanations for their phenomenology. Moreover, the investigation of transdiagnostic cognitive processes may help delineate the mechanisms at play in these disorders and help in the development of novel effective treatments.

Although the concept of inferential confusion and the IBA model were originally formulated in the context of OCD, research indicates that they also apply to other psychopathologies characterized by obsessionality. Inferential confusion has been shown to be relevant to other mental health disorders, namely delusional disorder (Aardema et al., 2005), body dysmorphic disorder (Taillon, O'Connor, Dupuis, & Lavoie, 2013), and hoarding disorder (Blais, Bodryzlova, Aardema, & O'Connor, 2016), and the latter two disorders have been shown to benefit from IBA. All these disorders implicate a distrust of the senses, a reliance on imaginary possibilities and the investment into justifying narratives that defy logic. Therefore, inferential confusion seems to be an important transdiagnostic cognitive target.

Inferential confusion also appears as particularly relevant to eating disorders, given their striking correspondence with OCD. In eating disorders, the expression of this cognitive process



tends to revolve around the themes of body shape and weight. Individuals with eating disorders experience doubt with regard to their body shape or weight (e.g., “Am I fat?”, “Have I gained weight?”), which taps into the construct of body image disturbance. Body image disturbance refers to the way one's body weight or shape is experienced (APA, 2013), and can be expressed as body size over-estimation, body dissatisfaction, over-evaluation of weight and shape for self-esteem, and denial of the consequences of extreme weight loss. In line with the IBA model that states that pathological doubt generates OCD symptoms and behaviors, body image disturbance (i.e., pathological doubt about one's weight or shape) has been found to be implicated in the development of eating disorders symptoms (Rosen, 1992). Taken together, it is possible that body image disturbance is a consequence of inferential confusion endorsement, as it involves a distrust of the senses (e.g., “I doubt what I see in the mirror, I doubt what I feel when I touch my hips.”) along with an overinvestment in the imagination and possibility-based information (e.g., “What if I am fatter than what I may see, what if there is more fat on my hips than what I may feel?”).

Although research examining inferential confusion in eating disorders is scarce to this day, the available evidence highlights that inferential confusion is a concept relevant to eating psychopathology. It was found that, when compared to healthy controls, individuals with eating disorders have a greater tendency to invest into feared possibilities (e.g., maybe I will become fat) and to be influenced by possibility-based information on a reasoning task (Wilson, Aardema, & O'Connor, 2017). This suggests that individuals with eating disorders tend to invest into imaginary possibilities at the expense of reality information. One recent study demonstrated that individuals with eating disorders in fact display higher levels of inferential confusion than healthy controls (Wilson, Aardema, & O'Connor, 2018a). Furthermore, as noted earlier, IBA

adapted for eating disorders produced significant reductions in body image disturbance and eating disorder symptoms in a sample of individuals with eating disorders (Purcell-Lalonde & O'Connor, 2015).

Cognitive confidence has also been found to be relevant to many mental health disorders (Cartwright-Hatton & Wells, 1997), and there has been recent empirical attention devoted to the examination of cognitive confidence in eating disorders. Some findings thus far suggest that individuals with eating disorders, just like those with OCD, are also prone to display poor cognitive confidence (Cooper, Grocutt, Deepak, & Bailey, 2007; Davenport, Rushford, Soon, & McDermott, 2015; McDermott & Rushford, 2011; Olstad, Solem, Hjemdal, & Hagen, 2015; Vann, Strodl, & Anderson, 2014). However, these studies have relied on self-report questionnaires to assess cognitive confidence. On the other hand, one recent study used an experimental design to investigate perceptual confidence in eating disorders following body checking during a mirror task (Wilson, Aardema, & O'Connor, 2018b). It was found that repeated body checking significantly reduced perceptual confidence, which parallels the finding in the OCD literature that compulsive checking decreases memory confidence. In short, research suggests that, just like in OCD, individuals with eating disorders also doubt their senses, namely their attention, perception and memory. As such, inferential confusion and cognitive confidence appear as relevant transdiagnostic factors.

### **Thesis Objectives**

Given the heterogeneity of OCD and the need to find shared cognitive processes, the overarching goal of the present thesis was to examine the relevance of inferential confusion and cognitive confidence as cognitive factors that are transdiagnostic across the spectrum of

obsessionality, that is across OCD subtypes and across other obsessive-compulsive disorders, namely eating disorders.

Given the breath of research on cognitive confidence in OCD, the first part of the present thesis endeavoured to summarize the evidence for this construct across OCD subtypes, that is above and beyond OCD with primary checking, for which there has been specific research attention. A systematic review and meta-analysis were thus conducted in order to synthesize the empirical evidence on cognitive confidence in OCD. More specifically, it aimed to evaluate the extent to which individuals with OCD have poor cognitive confidence when compared to healthy and clinical controls, and to evaluate the extent to which poor cognitive confidence can account for OCD symptomatology.

The second part of the thesis aimed to clarify whether cognitive confidence and inferential confusion differ across OCD subtypes, using cluster analyses performed on data of OCD participants who took part in a randomized-controlled trial at the OCD Spectrum Study Centre. This study received ethical approval from the Research Ethics Board at the Montreal Mental Health University Institute. It also aimed to examine whether greater OCD symptomatology is associated with lower cognitive confidence and higher inferential confusion. Another aim was to examine which OCD beliefs (e.g., inflated responsibility for harm) predict cognitive confidence and inferential confusion.

**Hypotheses.** It was hypothesized that (1) cluster analyses would reveal different OCD profiles with regard to cognitive confidence and inferential confusion; (2) there would be significant positive correlations between OCD symptoms, cognitive confidence (i.e., higher scores indicate lower cognitive confidence) and inferential confusion; (3) participants with OCD symptoms of greater severity, as determined by a median split on a measure of OCD

symptomatology, would display lower cognitive confidence and higher inferential confusion than participants with less severe OCD; and that (4) specific OCD beliefs, as measured by the Obsessional Belief Questionnaire (OBQ-44; OCCWG, 2005), would predict cognitive confidence and inferential confusion.

The third part of the thesis aimed to evaluate susceptibility to inferential confusion in other obsessive-compulsive spectrum disorders, that is eating disorders. An experimental study was conducted in order to reproduce the construct of inferential confusion and to evaluate responses to the experimental induction of inferential confusion in eating disorders. To these ends, inferential confusion was experimentally manipulated in order to examine susceptibility in eating disorders vs. healthy individuals, as well as to examine how this susceptibility is reflected cognitively, emotionally and behaviourally. This study aimed to reproduce the cognitive process of inferential confusion through videos depicting rituals seen in OCD and eating disorders. Past research using a similar research paradigm (i.e., experimentally inducing OCD and eating disorder cognitive distortions), have shown that individuals with eating disorders are equally susceptible to inductions of cognitive distortions involving OCD or eating disorder-related material, suggesting a general susceptibility to obsessive content (Coelho, Ouellet-Courtois, Purdon, & Steiger, 2015). In light of the cognitive overlap between eating disorders and OCD, we aimed to examine if individuals with eating disorders are equally reactive to the inferential confusion induction for an OCD or an eating disorder scenario, or if they are less reactive to the inferential confusion induction for scenarios that don't tap into their specific obsessional content.

In the High Inferential Confusion condition, some key sequences in the videos were missing – thus removing important visual and auditory sensory information, thereby provoking a distrust of the senses and lending more space for imagination. On the other hand, the Low

Inferential Confusion condition consisted of videos where all sequences were clearly depicted, thus leaving very little space for alternative conclusions about what might have happened in the videos. Notably, videos in both conditions were depicting scenarios that speak to OCD and eating disorders, therefore reproducing the construct of inferential confusion in ways that are ecologically valid. Furthermore, a non-clinical, healthy control group was used as a reference, thus allowing to establish a continuum of susceptibility to inferential confusion. This study received ethical approval from the Research Ethics Board at the Montreal Mental Health University Institute. The consent form is provided in Appendix B. Thirty-six women (eating disorders:  $n = 18$ ; healthy controls:  $n = 18$ ) participated in this study. Self-report questionnaires, video presentation and diagnostic evaluations were completed in the laboratory.

**Hypotheses.** It was hypothesized that (1) individuals with eating disorders assigned to the High Inferential Confusion condition would show more cognitive, affective and behavioral reactivity than individuals with eating disorders assigned to the Low Inferential Confusion condition, (2) individuals with eating disorders assigned to the High Inferential Confusion condition would report significantly more cognitive, emotional and behavioral reactivity than healthy controls also assigned to this experimental condition, (3) individuals with eating disorders assigned to the High Inferential Confusion condition would show higher scores on measures of OCD and eating disorder symptoms at the end of the experimental session than individuals with eating disorders assigned to the Low Inferential Confusion condition as well as compared to healthy controls, (4) individuals with eating disorders would report higher scores on the trait inferential confusion measure than would healthy controls, and that scores on this trait measure would be stable across pre-post measurements (thus representing trait vulnerability, as opposed to reactivity to the experimental manipulation).

**Article 1: Cognitive Confidence in Obsessive-Compulsive Disorder: A Systematic Review  
and Meta-Analysis<sup>2</sup>**

Catherine Ouellet-Courtois<sup>ab</sup>, Samantha Wilson<sup>ab</sup> & Kieron O'Connor<sup>ac</sup>

<sup>a</sup>OCD Spectrum Study Center, Montreal Mental Health University Institute

7331 Hochelaga

Montreal (Quebec), Canada

H1N 3V2

<sup>b</sup>Université de Montréal, Psychology Department

<sup>c</sup>Université de Montréal, Psychiatry Department

2900, boul. Édouard-Montpetit

Montreal (Quebec), Canada

H3T 1J4

Correspondence concerning this article should be addressed to Catherine Ouellet-Courtois

Email: [catherine.ouellet-courtois@umontreal.ca](mailto:catherine.ouellet-courtois@umontreal.ca)

Phone: (1) 514 251 4000 ext: 3532

---

<sup>2</sup> This is the accepted version of the following article: Ouellet-Courtois, C., Wilson, S., & O'Connor, K. (2018). Cognitive confidence in obsessive-compulsive disorder: A systematic review and meta-analysis. *Journal of Obsessive-Compulsive and Related Disorders*, 19, 77-86, which has been published in its final form at <https://www.sciencedirect.com/science/article/pii/S2211364918300654>.

## Abstract

A lack of cognitive confidence, defined as a distrust of one's attention, perception and memory, may be implicated in obsessive-compulsive disorder (OCD) and could account for its core symptoms, such as checking and other compulsions. This paper reviews the evidence for lower cognitive confidence in OCD with primary checking and across other OCD subtypes, when compared to clinical and healthy controls (HC). Method: PubMed and PsycINFO databases were searched. A total of 36 studies were retained ( $n = 36$ ). Results: Experimental studies revealed that individuals with OCD present lower cognitive confidence than HC. No clear effect emerged when individuals with OCD were compared to clinical controls, or when individuals with checking symptoms versus those with non-checking symptoms were compared. The same pattern of results emerged from the self-report studies. Self-report studies had sufficient sample size and comparable designs allowing for meta-analyses. When comparing OCD to HC, effects were large. However, when comparing OCD to clinical controls, no significant effect emerged. Conclusions: Individuals with OCD may have lower cognitive confidence than HC, but evidence for the specificity of cognitive confidence to OCD is limited. This review highlights suggestions for future research, namely the use of idiosyncratic tasks.

*Keywords:* Obsessive-Compulsive Disorder; OCD with Primary Checking; Cognitive Confidence; Metacognition

## Cognitive Confidence in Obsessive-Compulsive Disorder: A Systematic Review and Meta-Analysis

Obsessive-compulsive disorder (OCD) is a severe mental health disorder involving obsessions – defined as distressing, intrusive thoughts, images, or urges – and/or compulsions often aimed at offsetting the obsessions or reducing the associated distress (American Psychiatric Association, 2013). OCD compulsions generally consist of repetitive behaviors, which can be overt or covert (Goodman et al., 1989). Compulsive checking is one of the most common types of compulsions (Stein, Rode, Anderson, & Walker, 1997), and presents in various forms, such as checking for safety or for correctness. As opposed to normal verification or so-called “double-checking” in healthy individuals, compulsive checking as seen in OCD is excessive and time-consuming, and thus interferes with functioning and creates distress.

In light of the repetitive nature of compulsions and rituals in OCD (e.g., repeatedly checking whether the door is locked), earlier lines of research hypothesized that individuals with OCD had impaired memory processes (e.g., reduced ability to remember whether they locked the door). However, research on memory in OCD has been highly mixed. While some research has provided support for the idea that individuals with OCD have impaired memory (e.g., Shin, Lee, Kim, & Kwon, 2014; Tuna, Tekcan, & Topçuoğlu, 2005), others have suggested otherwise (e.g., Özdemir, Poyraz, Baş, Erten, & Bayar, 2015; Tolin, Abramowitz, Brigidi, Amir, Street, & Foa, 2001). Notably, it has even been found that individuals with OCD perform better on memory tasks involving stimuli tapping into their obsessional theme (Radomsky & Rachman, 1999). The conclusions of certain reviews on memory in OCD speak to the equivocality of the research (e.g., Muller & Roberts, 2005; Olley, Malhi, & Sachdev, 2007). A meta-analysis of studies conducted on heterogeneous samples of adults and children with OCD suggests that only small differences



of no clinical significance are present between individuals with OCD and healthy controls on verbal memory and working memory tasks (Abramovitch, Abramowitz, & Mittelman, 2013). Taken together, there is limited evidence for the presence of memory deficits amongst individuals with OCD.

Considering the mixed findings pertaining to memory accuracy, several studies examined whether low memory confidence may not affect memory performance in compulsive checkers. In a meta-analytic review of the literature, Woods, Vevea, Chambless, and Bayen (2002) provided compelling support for a meta-memory deficit, that is, a lack of confidence in memory potentially accounting for checking compulsions. The authors concluded their review by stating that the largest effect found indicated a lack of memory confidence in individuals with OCD with primary checking, rather than a memory deficit per se. A more recent systematic review also highlighted the presence of lower memory confidence in OCD presenting with a variety of compulsions, both checking and non-checking (Olley et al., 2007).

In line with this conclusion, Hermans, Martens, De Cort, Pieters, and Eelen (2003) found that although individuals with OCD performed as well as non-anxious controls on a task that entailed recalling performed actions, they were more likely to report less confidence in their memory for these events, a phenomenon that they referred to as low cognitive confidence. It was demonstrated that this lower cognitive confidence extended beyond the realm of memory. Individuals with OCD displayed less confidence in (1) memory for actions; (2) ability to differentiate between actions and their imagination (i.e., reality monitoring); and (3) attentional abilities. Hermans and colleagues replicated these results (Hermans et al., 2008), again demonstrating that the construct of cognitive confidence in OCD is not limited to memory. Cognitive confidence was originally put forth in the context of the metacognitive model, where

metacognition refers to the beliefs and theories that individuals hold about their own cognitions. Metacognition has become an important construct in cognitive theories of anxiety disorders, namely in the metacognitive theory of OCD. Maladaptive metacognitions, such as a lack of cognitive confidence, are purported to maintain psychological disorders and distress (Wells, 2000).

Cognitive confidence has received a great deal of empirical attention in the field of OCD in general, but more particularly as an explanation for compulsive checking. According to Rachman's (2002) cognitive theory of compulsive checking, checking begins due to uncertainty, but rather than alleviating it, the act of checking actually increases the uncertainty. The model postulates that the increased doubt caused by checking impedes memory confidence over time, and that such distorted beliefs about memory may play a role in maintaining compulsive checking. Rachman's (2002) model has been supported by many studies. In a series of experiments, van den Hout and Kindt (2003a, 2003b, 2004) have employed a task with a virtual gas stove in a sample of undergraduate students without OCD symptoms. After performing repeated virtual checks, participants had to rate their memory regarding the task as well as their confidence in their performance. It was found that the more participants checked, the more their memory confidence decreased, although their actual memory accuracy generally remained intact. The same pattern of results was replicated in other nonclinical samples using a task involving a real stove in a laboratory kitchen (Coles, Radomsky, & Horng, 2006; Radomsky, & Alcolado, 2010; Radomsky, Gilchrist, & Dussault, 2006). Altogether, these studies shed light on a mechanism whereby repeated checking leads to decreased memory confidence, which might generalize to OCD individuals with primary checking.

Although compulsive checking is one of the most common OCD subtypes, OCD is a very

heterogeneous disorder that can involve different types of obsessions and compulsions, both within and across individuals (Radomsky & Taylor, 2005). Some authors have suggested that OCD symptoms exist along different dimensions (Mataix-Cols, Rosario- Campos, & Leckman, 2005). Although individuals can present with more than one obsession/compulsion, there is a tendency for these individuals to have an obsession/compulsion that is more prominent. In fact, factor analyses have supported the existence of checking, washing and other rituals as separate symptom domains that can help in identifying OCD subtypes (Wu & Carter, 2008). While the research focus has been on the examination of memory confidence in OCD with primary checking, it is also possible that confidence in other cognitive domains may be affected for other OCD subtypes (e.g., low perception confidence in OCD with obsessions with symmetry).

### **Objectives**

Considering the clinical relevance of cognitive confidence in OCD, we endeavoured to summarize the empirical evidence for the presence of low cognitive confidence in this disorder. In order to examine cognitive confidence across the spectrum of obsessionality, studies evaluating this construct across clinical and analogue samples as well as using both clinical and nonclinical control groups were reviewed. The objectives of the present review were fivefold: (1) to provide a thorough qualitative summary of the studies that examined the cognitive confidence hypothesis in OCD; (2) to offer a quantitative summary of the body of studies with similar designs; (3) to review the evidence for the cognitive confidence hypothesis in OCD with primary checking, as well as in OCD in general, in order to see if the cognitive confidence hypothesis applies to OCD with primary checking as well as to other OCD subtypes; (4) to review the evidence for the effect of repeated checking on cognitive confidence, (5) to evaluate the extent to which poor cognitive confidence is associated with OCD symptomatology. These findings may

contribute to a better understanding of problematic cognitive processes at play in OCD. This review was reported according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines (Moher, Liberati, Tetzlaff, Altman, & Prisma Group, 2009) as well as the Meta-Analysis Reporting Standards (MARS; Cooper, 2011), and is registered in the PROSPERO database (CRD42016045906)<sup>3</sup>.

## **Method**

### **Search Strategy**

We searched the PsycINFO and PubMed electronic databases. The search strategy included the following keywords: “obsessive-compulsive disorder” AND “cognitive confidence” OR “metacognition”. The reference lists of retained articles were scrutinized for additional relevant publications. We ran this search again prior to the final analyses and new studies were retrieved for inclusion. The last search was performed on the 15 of September 2017. Please refer to the PRISMA flow diagram (Figure 1).

### **Study Eligibility Criteria**

To be included in the review, articles had to: a) be written in English, b) be published in academic peer-reviewed journals, c) be quantitative studies, d) include a comparison group, e) involve participants aged 18 and over. There were no publication period restrictions. We included all types of quantitative studies (experimental, cross-sectional, and prospective studies), only qualitative studies were excluded. Only full-text journal articles were considered for this review – dissertations, abstracts and book chapters were not included. Studies were eligible for

---

<sup>3</sup> Amendments were made to the original version of this protocol, which also entailed the examination of cognitive confidence in eating disorders. However, considering the scant amount of research in this area (only six eligible studies were found) and in the interest of conciseness, this population group was removed.

the review if they involved samples of individuals with OCD, as diagnosed with either DSM-IV or DSM-5 criteria, or analogue samples of individuals with OCD. In line with the recommendations outlined by Abramowitz and colleagues (2014), we decided to include analogue samples, as the results derived from such samples allow to examine processes across a range of obsessive-compulsive behaviors. In fact, the differences in OCD symptoms in analogue and clinical OCD samples appear to be quantitative but not qualitative, as the same OCD phenomena are revealed. However, we did not include undergraduate or other non-clinical samples that involved no comparators (e.g., no sample division of low vs. high scoring of OCD symptoms). Authors were contacted in cases of missing data and such instances are all specified in text or footnotes. All eligible studies were included in the systematic review, and studies that were similar enough to combine were included in a meta-analysis ( $N = 36$ ; Table 1).

### **Data Collection**

Titles and abstracts of articles retrieved using the search strategy and those obtained from the articles' reference lists were screened independently by two reviewers (first two authors) to identify eligible studies. The full text of retained articles was independently assessed for eligibility by these two reviewers. Any disagreement between the two reviewers regarding eligibility was resolved through discussion with the last author of the review. The two reviewers extracted the data independently. A standardized data extraction form was used to compile the data from the included articles. Extracted information included: study identification information (authors, publication year), sample characteristics (diagnosis and sample size), participant eligibility criteria, study methodology (study setting, intervention and control condition characteristics, measures used, study design, measurement time points), main study results, study

limitations and information for assessment of the risk of bias. Any discrepancies were identified and resolved through discussion with the last author.

### **Quality Assessment**

The quality of studies was assessed by the two reviewers independently, and any disagreement was resolved through discussion with the last author. Hawker, Payne, Kerr, Hardey, and Powell's (2002) scale was used to critically appraise the quality of included studies. An individual grade was assigned to each study based on these criteria (maximum score = 36). Quality scores for each study are provided in the results tables.

### **Data Synthesis**

Considering the heterogeneity of study designs, stimuli, measures of cognitive confidence as well as outcomes for the experimental studies, a systematic review was performed. On the other hand, several studies employed questionnaires to assess cognitive confidence, and these studies were all homogeneous, using similar cross-sectional designs. The questionnaire-based studies were therefore subjected to a meta-analysis. In summarizing the evidence regarding cognitive confidence in OCD, we took into consideration the study design (cross-sectional vs. experimental), quality and quantity of individual studies and consistency of findings (e.g., Did all studies find a significant difference between OCD and control groups? Was the direction of the effect the same?). Factors influencing cognitive confidence that consistently emerged from the literature were also included in the review.

## **Results**

### **Quality Assessment**

The criteria for robustness by Hawker and colleagues (2002) were applied to each study. Despite some methodological flaws, the overall quality of the 36 studies (*total mean score =*

30.14;  $SD = 3.21$ ;  $range = 23-36$ ) was rated as fair or good, considering that the maximum possible score is 36. Overall the obtained total scores were consistent across studies (as indicated by the small standard deviations). Major methodological flaws are highlighted in our review of the studies.

### **Cognitive Confidence in OCD**

Several studies employed experimental tasks in order to assess cognitive confidence (or memory confidence only) across OCD subtypes (Table 2). A few studies investigated confidence for verbal memory. Using non-OCD related word stimuli, three studies found no significant differences in both memory task performance for non-OCD related words and memory confidence between OCD and healthy control participants (Moritz, Jacobsen, Willenborg, Jelinek, & Fricke, 2006; Moritz, Kloss, Vitzthum von Eckstaedt, & Jelinek, 2009a; Zitterl, Urban, Linzmayer, Aigner, Demal, Semler, & Zitterl-Eglseer, 2001). This pattern of results suggests that it may be harder to capture lower memory confidence with the use of non-OCD semantic stimuli. In line with this idea, Karadag, Oguzhanoglu, Ozdel, Atesci, and Amuk (2005) found that, after exposing individuals with OCD and healthy controls to neutral and OCD-related sentences, the OCD group was significantly less confident in their performance for both neutral and OCD-related sentences than healthy controls, although there were no differences between groups in actual recognition performance. However, when examining memory confidence for neutral vs. contamination-themed sentences, Foa, Amir, Gershuny, Molnar, & Kozak (1997) found no significant differences in both memory performance and confidence between individuals with OCD with contamination fears and nonclinical controls.

Besides, several studies have shown that the nature of the stimuli has a significant impact on nonverbal memory and overall cognitive confidence in OCD. Three studies have employed

idiosyncratic stimuli, where participants had to identify objects or actions relevant to their OCD, and found that there were no differences between healthy control and OCD groups with regard to task performance, but that cognitive confidence was lower in the OCD group for idiosyncratic stimuli (Hermans et al., 2003; Hermans et al., 2008; Tolin et al., 2001). Again suggesting that the use of OCD-related material is necessary to correctly assess lower cognitive confidence, it was found that OCD individuals with primary washing or cleaning showed no memory deficit as well as no poor memory confidence compared to healthy controls on a task involving actions non-related to OCD (Moritz, Ruhe, Jelinek, & Naberl 2009b). However, Merckelbach and Wessel (2000) did find lower memory confidence in a sample of individuals with OCD, when compared to healthy controls, after they performed an action task with neutral, non-OCD items. Taken altogether, several research lines point to the importance of using material tapping into OCD-related themes in order to capture low memory confidence.

**The effect of repeated checking across OCD subtypes.** Although certain studies did not examine cognitive confidence in samples of OCD individuals with primary checking specifically, they still investigated the effect of repeated checking. In the experiment by Tolin and colleagues (2001), OCD, anxious controls, and healthy control participants performed, over repeated trials, a recall task for objects that they had previously identified as safe, OCD-unsafe, or neutral and had to rate their confidence in their memory. It was found that, for participants with OCD only, the memory confidence for unsafe objects gradually decreased over repeated trials. On the other hand, in the study by Hermans and colleagues (2008), individuals with OCD, clinical controls, and nonclinical controls were asked to perform a set of actions repeatedly – actions that were either neutral, OCD-relevant, or idiosyncratic compulsive actions, and to rate their confidence in their perception, attention, and memory. It was found that the effect of



repeated checking only lowered confidence *attention* in the OCD group, and this effect appeared to be stronger for the idiosyncratic compulsive actions. However, memory and perceptual confidence in all three groups remained unchanged as a result of repeated checking. Research by Dek, van den Hout, Engelhard, Giele, and Cath (2015) further examined the effect of repeated checking on overall cognitive confidence using a virtual stove checking task (with relevant and irrelevant checking conditions) in individuals with OCD as well as healthy controls. It was found that, compared to irrelevant checking (checking non-stove virtual stimuli), repeated relevant checking (checking a virtual stove) led to reduced memory confidence in both OCD and non-clinical controls, without affecting memory accuracy. Moreover, no differences were found between OCD participants and healthy controls in cognitive confidence before the checking task, yet individuals with OCD provided overall lower ratings of confidence in memory than nonclinical controls *after* completing the relevant checking task. This suggests that individuals with OCD may be more susceptible to have their memory confidence affected by repeated checking. In short, these studies suggest that repeated checking is more likely to reduce cognitive confidence in individuals with OCD, and under circumstances where the task performed is idiosyncratic.

**The role of perceived responsibility for harm.** Besides examining the relevance of the stimuli used (i.e., OCD-themed or not), some lines of research have investigated the role of perceived responsibility for harm in reducing cognitive confidence. Moritz and colleagues (2007) asked individuals with OCD and healthy controls to remember information related to a neutral scenario versus a high responsibility scenario. The results indicated that individuals with OCD showed lower memory confidence as compared to controls, subsequent only to recalling information pertaining to a high responsibility scenario, although the scenario was unrelated to

OCD concerns. In order to see if the association between low cognitive confidence and perceived responsibility only holds in the context of OCD themes, Cougle, Salkovskis, and Wahl (2007) compared memory confidence in non-OCD scenarios with high or low responsibility versus OCD-relevant scenarios (with almost all scenarios related to checking) with high or low responsibility on a self-report questionnaire. It was found that OCD participants with primary checking showed lower memory confidence in the high responsibility OCD-relevant scenarios, compared to both anxious and non-clinical controls, as well as compared to participants with non-checking OCD. Considering that most of the scenarios pertained to OCD with primary checking, the fact that OCD participants with primary checking presented the lowest cognitive confidence scores provides additional evidence that low memory confidence in OCD may be idiosyncratic, and that perceived responsibility can exacerbate memory confidence.

These results were corroborated by Boschen and Vuksanovic (2007), who asked participants with OCD as well as nonclinical controls had to complete a checking task, which entailed either checking a computer-based stove or checking a set of virtual light bulbs, to which a responsibility component was added. More specifically, in the responsibility condition, participants were told that another participant would receive a mild electric shock each time they did not completely turn off a stove or light on the computer checking task. Although no differences in memory accuracy were found between groups, the results indicated that the OCD group showed lower memory confidence than the control group and that the responsibility condition led to even lower memory confidence in the OCD group for the stove checking condition only. Furthermore, repetitive checking exacerbated memory confidence in both OCD and control groups. Notably, the results indicated that both memory confidence and perceived responsibility predicted the urge to check the stovetop. Again, these results are in line with the

idea that perceived responsibility, in the context of idiosyncratic OCD situations, leads to lower cognitive confidence.

This notion was supported by Taylor and Purdon (2016), who examined both memory and sensory confidence in the context of contamination OCD with compulsive washing in an analogue sample of undergraduate students with high or low contamination fears. Participants were asked to manipulate an allegedly contaminated sponge and were assigned to either a low or high responsibility condition. Participants were then allowed to wash their hands and wash duration was recorded along with ratings of memory and sensory confidence. It was found that wash duration was not predicted by trait memory confidence, indicating that trait memory confidence is less important in the context of washing than it is in checking. Moreover, it was found that, for participants with high contamination fears assigned to the high responsibility condition, longer wash duration was associated with lower sensory—but not memory confidence. This again suggests that when there is an inflated sense of responsibility, individuals with OCD tendencies, such as contamination fears, may be more susceptible to show low cognitive confidence.

**Summary of findings.** Our examination of the research on cognitive confidence across OCD subtypes is rather conclusive. Of the 14 experimental studies that were identified, 10 of them support the notion that individuals with OCD have lower memory or cognitive confidence. A finding that has repeatedly emerged from the experimental studies is that individuals with OCD display lower memory confidence than healthy controls (Dek et al., 2015; Hermans et al., 2003; Hermans et al., 2008; Karadag et al., 2005; Merckelbach & Wessel, 2000; Moritz et al., 2007; Tolin et al., 2001; Zitterl et al., 2001), although four studies—with three from the same research group—did not find such differences (Foa et al., 1997; Moritz et al., 2006; Moritz,

Kloss, et al., 2009; Moritz et al., 2009b). Notably, the memory confidence hypothesis was supported by three studies comparing individuals with OCD to clinical controls (Boschen & Vuksanovic, 2007; Hermans et al., 2008; Tolin et al., 2001).

Three experimental studies more closely examined other components of cognitive confidence than memory. Both of the studies by Hermans and colleagues (2003, 2008) found that individuals with OCD have lower overall cognitive confidence than healthy individuals, with the latter also indicating lower cognitive confidence in OCD when compared to clinical controls. Further support for the cognitive confidence hypothesis also comes from Taylor and Purdon (2016), who found evidence for lower sensory confidence in individuals with high contamination fears.

It is quite striking to see that, of the eight studies that employed OCD-relevant tasks or semantic stimuli (Dek et al., 2015; Foa et al., 1997; Hermans et al., 2003; Hermans et al., 2008; Karadag et al., 2005; Taylor & Purdon, 2016; Tolin et al., 2001), only the study by Foa and colleagues (1997) did not provide support for the cognitive confidence hypothesis in OCD, and even this study might have lacked ecological validity as it only entailed the presentation of OCD-related sentences. This suggests that the use of idiosyncratic tasks and material might be required to capture cognitive processes at play in OCD, such as low cognitive confidence. Along the same lines, all studies that examined the role of perceived responsibility for harm (Boschen & Vuksanovic, 2007; Cogle et al., 2007; Moritz et al., 2007; Taylor & Purdon, 2016) unequivocally found that a sense of perceived responsibility lowers cognitive confidence for individuals with OCD.

### **Cognitive Confidence in OCD with Primary Checking**

Several studies have looked at memory/cognitive confidence in OCD individuals with

primary checking (Table 3), as memory distrust may account for checking compulsions, as postulated by Rachman (2002). Two studies have investigated memory performance and confidence for semantic stimuli. Macdonald, Antony, MacLeod, and Richter (1997) asked OCD individuals with primary checking, individuals with non-checking OCD as well as healthy controls to perform a recognition memory task – involving a list of non-OCD related words as stimuli – followed by confidence ratings of their performance. The results indicated that although all groups performed the same on the memory task, OCD individuals with primary checking provided lower confidence ratings than both individuals with non-checking OCD and healthy controls. On the other hand, Tuna, Tekcan, and Topçuoglu (2005) considered the relevance of the emotional valence of the stimuli employed, but found no indication of a memory bias for threat-related material. More specifically, semantic memory for word pairs of different emotional valence (neutral, contamination-threat and checking-threat) was examined in OCD individuals with primary checking, individuals with sub-clinical checking-OCD and nonclinical controls. The results indicated that participants with checking-OCD recalled and recognized fewer words, regardless of valence, than participants with subclinical checking-OCD and nonclinical controls (with the two latter groups showing no significant differences). OCD participants with primary checking also showed lower confidence than the two other groups, which could account for their poorer performance, although confidence ratings were not found to predict later recognition performance. Confidence was also uninfluenced by word valence.

Cuttler and Graf (2007) examined confidence in *prospective* memory in an analogue sample of undergraduate students with low, medium, or high checking symptoms. Participants completed two prospective memory tasks not tapping into OCD-related material, and had to rate their confidence in their performance. Overall, all groups performed similarly on the prospective

memory tasks and presented with equal levels of memory confidence. Similarly, Tekcan, Topcuoglu, and Kaya (2007) also failed to find support for lower memory confidence in OCD. OCD individuals with primary OCD, individuals with non-checking OCD and non-clinical controls were administered a multiple-choice test (i.e., recognition) consisting of general knowledge questions, and were asked to rate their confidence in their answer for each question both before and after answering it. The results indicated that all groups performed equally well on the test and that all groups were as confident in their ability to remember information in the future (i.e., prospective memory), and in their answers on the test questions (i.e., confidence in recognition memory). However, it is questionable whether this study reflects actual confidence in memory rather than confidence in one's general knowledge. Furthermore, both studies by Cuttler and Graf (2007) and Tekcan and colleagues (2007) did not use OCD-related stimuli, which might have compromised the validity of the tasks.

However, other lines of research did not use OCD-relevant task or material, and yet provided support for the memory confidence hypothesis. Harkin and Kessler (2009) examined working memory and confidence in an analogue sample of individuals with low vs. high checking symptoms and found that the memory of participants with high checking symptoms was less accurate than those with low checking symptoms in the presence of a distractor, suggesting that individuals with high checking symptoms find it more difficult to ignore irrelevant cues. Accordingly, it was also found that individuals with high checking symptoms reported lower confidence in their performance than those with low checking symptoms, but only subsequent to trials where a misleading distractor was present. However, the authors were not able to replicate these results in another sample.

Three studies investigated *reality monitoring* in OCD with primary checking, which is to differentiate between memories for thoughts and memories for perceptions (Johnson & Raye, 1981). In the context of OCD with primary checking, reality monitoring deficits could manifest themselves as a difficulty distinguishing whether one has turned off the stove in reality versus only imagined turning it off. Using non-OCD actions<sup>4</sup> as stimuli, Ecker and Engelkamp (1995) found that OCD participants with primary checking did not show any general free recall or recognition deficit, but that they were less confident in their memory than non-OCD low checking individuals, yet as confident as non-OCD high checking individuals. Using a similar task involving stimuli unrelated to OCD, McNally and Kohlbeck (1993) found that both OCD participants with primary checking and those with non-checking OCD tended to express less confidence in their ability to remember whether they had performed or imagined an action compared to healthy controls, although no differences in performance on the tasks were assessed between groups. On the other hand, research by Constans, Foa, Franklin, and Mathews (1995) did not provide support for the memory confidence hypothesis, although OCD-relevant material was employed. OCD individuals with primary checking and non-clinical controls were asked to carry out both actual and imaginary actions, that were either OCD-related or neutral. No differences were found on memory confidence ratings between the groups, nor were there differences between OCD-related and neutral actions. Interestingly, the recall of OCD

---

<sup>4</sup> It is however possible that Ecker and Engelkamp (1995) might have used OCD-relevant material because one of the example items described was “to turn off the stove”. Nevertheless, it remains unclear if all stimuli were OCD-related, as the authors mentioned using a paradigm by Cohen (1981), which entailed the use of items unrelated to OCD, such as to “open a book”. Moreover, Ecker and Engelkamp (1995) reported no assessment of the responses to the experimental stimuli of participants with checking symptoms.

participants was superior to controls, but only for OCD-related actions. However, it is important to note that the sample size was small, reducing the power to detect significant effects.

Finally, two studies have examined memory confidence in a context that directly captures checking compulsions – that is by employing an in vivo stove checking task. Ashbaugh and Radomsky (2007) examined memory confidence following a laboratory stove checking task in an analogue sample of individuals with high and low checking symptoms. The results indicated that there were no differences between participants with low and high checking symptoms for both memory accuracy and memory confidence. In fact, it was found that memory confidence decreased in both participants with low and high checking symptoms after repeated checking. These results were replicated by Radomsky, Dugas, Alcolado, and Lavoie (2014), who also examined the effects of checking on memory confidence in a sample of OCD individuals with primary checking and nonclinical undergraduates. Participants were required to turn on and off a real stove in a laboratory kitchen. Next, half of the participants were asked to check the stove 19 times (i.e., relevant checking), while the other half had to check a kitchen faucet 19 times (i.e., irrelevant checking). The results demonstrated that memory accuracy for OCD and nonclinical participants did not differ. Moreover, it was found that following repeated relevant checking, both OCD and nonclinical participants reported decreases in memory confidence, but that those who completed the repeated irrelevant checking did not. The results from the two studies support the idea that memory confidence is negatively affected by repeated checking in both individuals with high and low checking symptoms, and especially under circumstances that hold significance.

**Summary of findings.** With regard to the literature on cognitive confidence in OCD with primary checking, 10 experimental studies were retained, out of which six gave at least partial



support for the hypothesis that individuals with OCD have lower memory confidence. Of the three studies that used an analogue sample of OCD with primary checking, two provided some evidence that those with high checking symptoms have lower memory confidence than those with low checking symptoms (Ashbaugh & Radomsky, 2007; Harkin & Kessler, 2009), while one indicated no differences between individuals with low, medium, and high checking symptoms in terms of prospective memory confidence (Cuttler & Graf, 2007). Of the six studies in which memory confidence was compared in OCD with primary checking and healthy controls, three found that OCD individuals with primary checking had lower memory confidence than healthy controls (MacDonald et al., 1997; McNally & Kohlbeck, 1993; Tuna et al., 2005), while three failed to find such differences (Constans et al., 1995; Radomsky et al., 2014; Tekcan et al., 2007). These later results go counter to expectations, especially considering that both Constans and colleagues (1995) and Radomsky and colleagues (2014) employed OCD-relevant tasks. On the other hand, as touched upon earlier, the results by Tekcan and colleagues (2007) should be interpreted with caution as it is questionable if the task employed in their study truly assessed recognition memory and confidence. Four studies entailed a comparison of memory confidence in OCD with primary checking and non-checking OCD (Hermans et al., 2003; MacDonald et al., 1997; McNally & Kohlbeck, 1993; Tekcan et al., 2007), out of which only one found that OCD individuals with primary checking exhibited lower memory confidence (MacDonald et al., 1997). Finally, the study by Ecker and Engelkamp (1995) revealed that both OCD individuals with primary checking and high checking individuals without OCD showed lower memory confidence than non-checking psychiatric patients. These equivocal findings put into question the memory confidence hypothesis in OCD with primary checking, although the heterogeneity of tasks may account for these mixed findings.

## Questionnaire-based Research on Cognitive Confidence in OCD

Also informative is the questionnaire-based research examining cognitive confidence in OCD when compared to other clinical groups or nonclinical individuals (Table 4). It is of note that no questionnaire-based study looked at cognitive confidence in the context of OCD with primary checking specifically, besides one study by Cuttler and Graf (2007) and one by Hermans and colleagues (2003).

The general finding taken from the experimental studies, that individuals with OCD present lower cognitive confidence than healthy controls, is in line with the results from the questionnaire-based studies. In fact, the large majority of studies utilising questionnaires found that individuals with OCD present lower cognitive confidence than healthy controls (Barahmand, 2009; Bortolon et al., 2014<sup>5</sup>; Cartwright-Hatton & Wells, 1997; Cogle et al., 2007; Cucchi, Bottelli, Cavadini, Ricci, Conca, Ronchi, & Smeraldi, 2012; Cuttler & Graf, 2007; Hermans et al., 2003; Hermans et al., 2008; Mavrogiorgou, Bethge, Luksnat, Nalato, Juckel, & Brüne, 2016; Moritz, Peters, Laroi, & Lincoln, 2010; Önen, Uğurlu, & Çayköylü 2013; Solem, Borgejordet, Hæseth, Hansen, Håland, & Bailey, 2015), with only two studies not finding any significant differences (Chik, Calamari, Rector, & Riemann, 2010; García-Montes, Pérez-Álvarez, Balbuena, Garcelán, & Cangas, 2006), and another failing to find significant differences after controlling for OCD symptom severity (Nedeljkovic & Kyrios, 2007).

On the other hand, the questionnaire-based studies present more mixed results regarding the comparison of OCD individuals to other clinical groups, with three studies suggesting that lower cognitive confidence is specific to OCD (Bortolon et al., 2014; Cogle et al., 2007;

---

<sup>5</sup> Supplementary data was obtained from the authors, and independent sample t-tests were performed in order to compare scores between groups on the cognitive confidence scale of the Metacognition Questionnaire.

Hermans et al., 2008) and seven studies suggesting no differences in terms of cognitive confidence between individuals with OCD and those with other psychiatric problems (Barahmand, 2009; Bucarelli & Purdon, 2016; Cartwright-Hatton & Wells, 1997; Chik et al., 2010; Cucchi et al., 2012; Garcia-Montes et al., 2006; Moritz et al., 2010).

### **Association Between Poor Cognitive Confidence and OCD Symptomatology**

Seventeen of the studies included in the review involved an examination of the association between memory or cognitive confidence and OCD symptoms, thereby providing insight into the clinical relevance of the construct to OCD. Moritz and colleagues (2009a) did not find significant associations between memory confidence for non-OCD related words and OCD symptoms, as measured with the Yale-Brown Obsessive Compulsive Scale (Y-BOCS; Goodman et al., 1989), in a sample of individuals with OCD. Similarly, Moritz and colleagues (2009b) found no correlations between memory confidence for performed actions and scores on the Obsessive-Compulsive Inventory Revised (OCI-R; Foa, Huppert, Leiberg, Langner, Kichic, Hajcak, & Salkovskis; 2002) and the Y-BOCS. However, a significant negative correlation between confidence and the resistance scale of the Y-BOCS was found. Moritz and colleagues (2007) also found no significant associations between OCD symptoms, as measured with the Y-BOCS and the Hamburg Obsessional Compulsive Inventory (HOI; Klepsch, Zaworka, Hand, Lünenschloss, & Jauernig, 1991), and memory confidence for information related either to a neutral or a high responsibility scenario (unrelated to OCD concerns) in a sample of individuals with OCD. Corroborating these results, Zitterl and colleagues (2001) found no significant association between Y-BOCS scores and memory confidence. Finally, Karadag and colleagues (2005) also found no association between memory confidence for neutral and OCD-related sentences and OCD symptoms, as measured with the Y-BOCS, in a sample of individuals with

OCD. It is however interesting to note that trait anxiety scores, as measured with the State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, & Lushene, 1970) were negatively correlated with confidence levels.

Measuring cognitive confidence using the Meta-Cognitions Questionnaire (MCQ; Cartwright-Hatton & Wells, 1997), and the Meta-Cognitions Questionnaire-Short Version (MCQ-30; Wells & Cartwright-Hatton, 2004), where greater scores indicate lower cognitive confidence, three studies found no significant correlations between cognitive confidence and OCD symptoms as measured with the Y-BOCS (Mavrogiorgou et al., 2016; Moritz et al. 2010; Solem et al., 2015) in individuals with OCD. Chik and colleagues (2010) also found no association between cognitive confidence and Y-BOCS scores in a collapsed sample of individuals with OCD and anxious controls. On the other hand, Cucchi and colleagues (2012) found, also using the Y-BOCS, that lower cognitive confidence was associated with higher OCD symptoms.

**OCD with primary checking.** In the study by Macdonald and colleagues (1997), a significant negative correlation was found between the total score on the Maudsley Obsessive Compulsive Inventory (MOCI; Hodgson & Rachman, 1977) and confidence ratings for performance on a memory task in a sample of OCD individuals with primary checking, individuals with non-checking OCD as well as healthy controls, suggesting that higher OCD symptomatology is associated with lower memory confidence. However, no significant correlation was found between the Y-BOCS total score and confidence ratings for the two clinical groups. In their examination of confidence in recall, recognition and future memory performance in a sample of OCD individuals with primary checking, Tuna and colleagues (2005) found that OCD symptom severity as measured with the MOCI was negatively associated with

participants' confidence in their recall performance as well as their ability to recognize currently unrecalled information (i.e., the greater the severity, the lower the confidence). This association was found for neutral, contamination-related or checking-related words. Similarly, Tekcan and colleagues (2007) found a negative association between OCD symptom severity, as indicated by the Y-BOCS, and confidence in future performance on a recognition test in a sample of OCD individuals with primary checking. Cuttler and Graf (2007) found a significant positive association between prospective and retrospective memory failures and checking symptoms in an analogue sample of individuals with high, medium, and low checking symptoms (i.e., the more memory failures and distrust, the more checking symptoms). Notably, participants with high checking symptoms reported greater prospective and retrospective memory failures than both those with low and medium checking symptoms. On the other hand, secondary analyses from the study by Karadag and colleagues (2005) revealed that the confidence levels of participants with OCD with primary checking, as determined by the MOCI, were not significantly different from those of participants with other OCD subtypes. Counter to the memory confidence hypothesis, Moritz and colleagues (2006) found that the severity of checking compulsions was positively correlated with memory confidence (i.e., the more compulsions, the better the memory confidence).

Two studies shed light on the nature of the association between cognitive confidence and checking. Boschen and Vuksanovic (2007) found that memory confidence and perceptions of responsibility for harm were predictors of the urge to check in a community sample of individuals with OCD. Accordingly, Hermans and colleagues (2008) also found that the cognitive confidence subscale of the MCQ was the only scale predicting higher checking symptoms, as measured by the Padua Inventory Revised (Burns, Keortge, Fornea, &

Sternberger, 1996).

Altogether, these results suggest that there is a negative association between cognitive confidence and checking symptoms, but the evidence for an association between cognitive confidence and general OCD symptoms is scarce.

### **Meta-Analysis of Psychometric Data**

As the questionnaire-based studies entailed continuous data scales to evaluate cognitive confidence, a meta-analysis was performed to supplement our qualitative analysis. Only studies where mean scores on the questionnaires for each group were available (either obtained from the article or from the authors) were included in this quantitative analysis. To ensure the reliability and validity of our results, we also only included in the meta-analysis studies with clinical samples and excluded studies with analogue samples (of which there were only a few). These analyses were carried out using the software Review Manager (RevMan V.5.3; Cochrane Collaboration). As recommended by the Cochrane Collaboration, we used the standardized mean difference as a summary measure. Study effect sizes are reported using Cohen's *d* (Cohen, 1992). Cohen's *d* effect sizes were defined as small ( $\leq 0.49$ ), medium (0.50 and 0.79), and large ( $\geq 0.80$ ). A positive Cohen's *d* effect size represents a greater score in the OCD group compared to the control groups, with greater scores indicating lower cognitive confidence. A random effects meta-analysis was conducted. Quantification of the effect of heterogeneity was assessed by means of  $I^2$ , which ranges from 0% to 100%.

### **Risk of Bias Assessment**

Statistically significant results are more likely to be published. Publication bias was assessed using the Egger's test for asymmetry of the funnel plots (Figure 2). For studies comparing self-reported cognitive confidence in individuals with OCD to healthy controls, we

found an indication for asymmetry ( $t = 3.96, df = 9, p < .01$ ). However, we used the Duval and Tweedie's trim and fill measure to yield an effect size estimate adjusted for the funnel plot asymmetry. This adjusted effect was similar to the original effect and the core finding remained intact ( $d = .63$ ). Furthermore, the Failsafe  $N$  calculation using the Rosenthal approach indicated that a very large amount of studies ( $N = 435$ ) would be required to invalidate the effect size we obtained.

For studies examining cognitive confidence in individuals with OCD as compared to clinical controls, the Egger's test indicated no asymmetry ( $t = .22, df = 8, p = .23$ ). The adjusted effect using the Duval and Tweedie's trim and fill measure was essentially the same as the original effect ( $d = .14$ ).

Therefore, we concluded that it is unlikely that a publication bias affected our results of the psychometric data for cognitive confidence.

### **Cognitive Confidence in OCD Compared to Healthy Controls**

Pooling the data from the studies comparing self-reported cognitive confidence in individuals with OCD to healthy controls produced an overall large effect size of .80 (95% confidence interval = .59 to 1.01;  $p < .001$ ) indicating higher scores in the OCD group (Figure 3). The result is based on 11 cross-sectional studies, as displayed in Table 5. The weighted pooled effect size is based on a random effect meta-analysis ( $X^2 = 18.78, p < .05, I^2 = 47\%$ ).

### **Cognitive Confidence in OCD Compared to Clinical Controls**

In contrast, the pooled data from the questionnaire-based studies comparing cognitive confidence in individuals with OCD to different clinical controls (i.e., anxious controls, schizophrenia patients and mixed clinical controls) produced a small and non-statistically significant effect size of .16 (95% confidence interval = -.01 to .34;  $p = 0.07$ ). As Figure 4

shows, it seems that the comparison of the OCD and schizophrenia groups has particularly obscured the overall effect, with the effect of this analysis crossing the “line of no effect” and indicating no differences between these two groups. Subgroup effects are reported in Table 6. Figure 4 also suggests that the OCD group did present with higher scores than both anxious and mixed clinical controls, although the effects for both subgroup comparisons were not statistically significant ( $ps > .05$ ). The overall result is based on eight cross-sectional studies, of which two studies allowed for more than one comparison between groups, as showed in Table 5. The weighted pooled effect size is based on a random effect meta-analysis ( $X^2 = 12.25, p > 0.20, I^2 = 27\%$ ).

### **Discussion**

We synthesized studies examining cognitive confidence in OCD, using both experimental and questionnaire-based cross-sectional designs. Differences in experimental designs, experimental stimuli and experimental tasks allowed for a systematic review, but not for a quantitative analysis. However, considering that a significant amount of studies used questionnaires to assess cognitive confidence and employed similar designs, a meta-analysis of self-report studies was performed. A total of 36 studies were deemed eligible and together suggest the following conclusions.

Our examination of the research on cognitive confidence across OCD subtypes is quite conclusive. The vast majority of experimental studies we reviewed provided support for the cognitive or memory confidence hypothesis in OCD. A finding that has repeatedly emerged from these studies is that individuals with OCD display lower cognitive confidence when compared to healthy controls. The general finding is in line with the results from the questionnaire-based studies. In fact, the large majority of studies utilising questionnaires found that individuals with



OCD present lower cognitive confidence than healthy controls, as only two studies did not find any significant differences. Accordingly, the meta-analysis indicated an overall large effect size for the difference between the OCD and healthy control groups. On the other hand, the questionnaire-based studies present more mixed results regarding the comparison of OCD individuals to other clinical groups, with most of these studies suggesting no differences in terms of cognitive confidence between individuals with OCD and those with other psychiatric problems. In line with this pattern of equivocal results, the meta-analysis yielded a small and non-statistically significant effect size for this group comparison. Again, it is important to keep in mind that these questionnaires measure cognitive confidence as a trait that spreads across life events (e.g., confidence in one's general memory), rather than disorder-specific situations (e.g., memory for having locked the door), and therefore may not fully capture cognitive confidence in the context of OCD. Further putting into question the specificity of cognitive confidence to OCD is the fact that none of the studies that examined the association between cognitive confidence and OCD symptoms found a significant correlation. However, most of those studies examined memory confidence strictly, which might be more relevant in the context of OCD with primary checking than in other OCD subtypes. In line with this notion, all studies that examined the association between checking-OCD symptom severity and memory confidence found evidence for a negative correlation.

Furthermore, it is possible that not only individuals with OCD, but also those with other anxiety disorders hold negative beliefs about their memory, which causes them to engage in compulsive checking. The mixed findings in our comparison of OCD to other clinical groups could be explained by the fact that dysfunctional beliefs are often transdiagnostic across anxiety disorders (McEvoy, & Mahoney, 2013). In addition, it is possible that not all individuals with

OCD hold negative beliefs about their memory, but that other beliefs, such as a perceived sense of responsibility, may underlie or interact with checking compulsions. According to Rachman's (2002) theory of compulsive checking, checking occurs when one experiences a sense of personal responsibility for preventing harm. The model suggests that over time, checking behaviour further increases the sense of personal responsibility, as well as perceptions of the probability and severity of the harm, which paradoxically leads to further checking. In support of Rachman's (2002) model, all studies that examined the role of inflated responsibility indicated that a sense of perceived responsibility lowers cognitive confidence for individuals with OCD. This is in line with other research that has highlighted that personal beliefs about responsibility is an important factor predicting OCD symptoms, and this across OCD subtypes (Ashbaugh, Gelfand, & Radomsky, 2006; Parrish & Radomsky, 2006; Radomsky, Rachman & Hammond, 2001). Furthermore, it is quite remarkable to see that of all studies that employed OCD-relevant tasks or stimuli, only one failed to provide support for the cognitive confidence hypothesis in OCD. This highlights the importance of employing idiosyncratic tasks and material in the investigation of cognitive confidence in OCD. Taken together, the studies we reviewed suggest that the cognitive confidence hypothesis is more likely to be confirmed in the context of OCD-specific tasks that tap into one's sense of perceived responsibility, and when individuals with OCD are compared to nonclinical controls.

### **Cognitive Confidence in OCD with Primary Checking**

Most studies we reviewed that were conducted on samples of OCD individuals with primary checking examined the memory hypothesis specifically, with the exception of three studies that also investigated reality monitoring. Taken together, these studies yielded equivocal results that do not confirm nor disconfirm the memory confidence hypothesis in OCD with

primary checking. The heterogeneity in methodology should not be understated, with the reviewed studies using either non-OCD semantic stimuli, non-OCD relevant tasks, OCD-relevant semantic stimuli and OCD-relevant tasks. Such discrepancy in methodology could account for these mixed findings, notably considering that only four of the 10 studies used material or tasks with some ecological validity for OCD. Our meta-analysis of the self-report data did not allow for further clarification of differences in cognitive confidence between OCD individuals with primary checking and those with non-checking OCD, considering that no questionnaire-based study systematically compared these two groups, besides one study by Cuttler and Graf (2007) and one by Hermans and colleagues (2003) – the former providing support for the memory confidence hypothesis in OCD with primary checking and the latter not. However, it is interesting to see that all studies that investigated the association between memory confidence and symptoms in OCD individuals with primary checking did find a significant negative association (i.e., the more symptoms, the less memory confidence), especially considering that this association was not found in general OCD, all subtypes confounded.

One consistent finding in the checking literature we reviewed is that, consistent with Rachman's (2002) model, memory confidence decreases over repeated checking in nonclinical controls, clinical controls and individuals with OCD. This mechanism has been previously assessed in nonclinical undergraduate samples (Coles et al., 2006; Radomsky, & Alcolado, 2010; Radomsky et al., 2006; van den Hout & Kindt, 2003, 2004) and therefore seems to reflect a normal process that is unspecific to OCD. However, it is also possible that there is an underlying initial obsessional doubt that is reinforced by compulsive behaviors, such as checking, that further increase obsessional doubt, leading to a vicious cycle of more checking and doubting. In line with this notion, the research by Ashbaugh and Radomsky (2007) suggests that individuals

with high checking symptoms might start off with a greater vulnerability to display low memory confidence than those with low checking symptoms. Although repeated checking seems to contribute to memory distrust in all individuals, it remains unclear what makes the individual with OCD check in the first place. For instance, why does the individual with OCD doubt that the stove is off although s/he is standing right in front of it?

Different theories, which are not incompatible with the cognitive confidence hypothesis, have been proposed. For instance, the inference based approach (IBA; O'Connor, Aardema, & Pélissier, 2005) postulates that a central cognitive factor in OCD is inferential confusion, whereby the individual fails to acknowledge the irrationality of the obsession because of (1) a distrust of the senses and (2) an overreliance on possibility-based information generated by one's imagination. According to the IBA model, the individual with OCD would doubt that the stove is off due to an over-reliance on possibilities supporting the idea that the stove might still be on, and a distrust of what s/he sees or hears as s/he turns off the stove knobs. Other authors have argued that the doubt in OCD is more general, as it would go above and beyond a distrust of the senses or a lack of cognitive confidence and would regard an overall lack of confidence in one's internal states (e.g., muscle relaxation and tension) or a lack of confidence in one's general knowledge (Dar, Rish, Hermesh, Taub, & Fux, 2000; Lazarov, Dar, Liberman, & Oded, 2012; Lazarov, Dar, Oded, & Liberman, 2010). In order to test out these different theories as well as to shed light on the mechanisms at play in compulsive checking and on the contribution of cognitive or memory confidence to checking behavior, our review suggests that more studies using idiosyncratic stimuli are needed. Notably, the research from Taylor and Purdon (2016) looking at OCD with contamination fears suggested that wash duration was associated with lower sensory-confidence, suggesting that the link between repeated rituals and decreased

confidence does not only apply to checking. The effect of repeated actions on cognitive confidence warrants further examination.

### **Strengths and Limitations**

Some limitations should be taken into consideration. First, the assessment of cognitive confidence lacked ecological validity in most studies. In fact, few studies have employed threat-relevant, idiosyncratic stimuli, thus making it more difficult to assess the true expression of cognitive confidence in the context of OCD. Second, most experimental studies had small sample sizes, which could have reduced statistical power, limiting the ability to detect significant effects. In addition to small samples, most studies failed to specify the OCD subtypes present in their samples. As some lines of research suggest, it seems that some OCD subtypes might respond differently to certain stimuli (e.g., contamination-related vs. accident-related; Radomsky & Rachman, 2004), and have greater cognitive vulnerability with regard to a given cognitive domain (e.g., poorer perceptual confidence vs. memory confidence; Taylor & Purdon, 2016). Accordingly, it is important to note that most of the OCD research that we reviewed has examined memory confidence specifically, while other aspects of cognitive confidence (i.e., perception and attention) have not received as much research attention. The other components of cognitive confidence, namely attention and perception, will require more precise operationalization in order to be properly assessed. New measurements are warranted for a more comprehensive assessment of cognitive confidence, especially considering that different cognitive components may affect each OCD subtype differently (e.g., perceptual confidence for OCD with contaminations fears).

Furthermore, most studies failed to take into account levels of comorbid depression and anxiety, as well as other possible comorbidities that may colour susceptibility to lower cognitive

confidence. For instance, research has shown that both individuals with OCD and individuals with depression report greater subjective cognitive impairments than healthy controls (Moritz, Kuelz, Jacobsen, Kloss, & Fricke, 2006). Despite these findings, the effects of these variables were controlled for in very few studies. Individuals with OCD typically have more comorbid depression and/or anxiety disorders (Ruscio, Stein, Chiu, & Kessler; 2010) than healthy controls, and both may affect cognitive confidence. Accordingly, it would have been interesting to analyze symptom severity as a moderator of low cognitive confidence in our meta-analysis of the psychometric data. However, the lack of power due to the small number of studies included in our meta-analysis would have not allowed for meaningful conclusions and precluded the use of moderator analyses. The issue of overall symptom severity should be attended to in future research.

One strength of the present review is that it builds upon previous work by compiling the large number of studies investigating the cognitive confidence hypothesis conducted in the last two decades since the publication of a previous review touching on this topic (e.g., Woods et al., 2002). This highlights the increasing research interest in cognitive confidence. Furthermore, we reviewed evidence for cognitive confidence in OCD in a comprehensive way, as we combined experimental and psychometric data, thus allowing for a more global picture of the construct, and reviewed both clinical and analogue studies, thereby allowing for an examination across the spectrum of obsessionality. We provided a thorough description of the designs of the different studies, highlighting the heterogeneity in the study designs employed to evaluate the construct of cognitive confidence.

### **Clinical Implications**

From a behavioural point of view, reduced cognitive confidence can have the same

functional impact as an actual memory or perceptual deficit. After individuals with OCD have checked the stove, they might have a clear memory representation of the action and have no trouble perceiving what there is to see, but may lack confidence in their memory for their action or their perception of the stove. This lack of confidence can lead to repetitive behaviors such as checking, thereby maintaining the disorder.

It is important to note that different cognitive components may apply to each OCD subtype (e.g., perceptual confidence for OCD individuals with contamination fears and compulsive washing). In fact, the early focus on OCD individuals with primary checking in the investigation of memory deficits and memory confidence is rooted in the clinical observation that “unlike checking, there is no obvious reason why memory problems should be of aetiological significance with respect to other obsessional symptoms” (Tallis, Pratt, & Jamani, 1999, p. 165). Other researchers have also noted that individuals with OCD presenting with different compulsions rarely say that they are washing their hands over and over again because they don't recall having washed them, however, they do report having trouble remembering whether they checked the stove or not (Radomsky et al., 2001). In line with this notion, the study by Taylor and Purdon (2016) demonstrated that, for individuals with contamination fears, wash duration was associated with lower sensory—but not memory—confidence. Such findings underline the need to systematically investigate the different components of cognitive confidence for different OCD subtypes, above and beyond those with checking compulsions.

Cognitive therapies of OCD structured to address dysfunctional beliefs would be more effective if they would target the specific belief endorsed by the patient (e.g., that they cannot trust their perception that their hands are clean). Notably, in a recent study, OCD participants with primary checking who received two weekly 1-hour therapy sessions aimed at targeting

maladaptive beliefs about memory as they relate to their checking behavior showed significant reductions in checking symptoms post-treatment, as compared to waitlist controls (Alcolado & Radomky, 2016). In light of the heterogeneity of OCD and the specificity of obsessions, treatment outcome variability could be greatly diminished by addressing dysfunctional cognitions, such as low cognitive confidence, in a way tailored to the patient's obsessions and compulsions.

### **Conclusions and Directions for Future Research**

This review found that lower cognitive confidence appears to be more pronounced when OCD individuals are compared to healthy controls than when they are compared to clinical control groups. This finding suggests that the cognitive or memory distrust that was reported in previous studies using healthy control groups only provides preliminary evidence and does not provide support for the specificity of low cognitive confidence in OCD. With regard to the memory confidence hypothesis in OCD with primary checking specifically, conclusive findings have also not been forthcoming. However, the investigation of cognitive confidence in OCD is complex and needs to go beyond non-OCD relevant tasks (e.g., presentation of word stimuli) and questionnaires. Future research tailoring experimental tasks and self-report measures to OCD subtypes that also take into account beliefs about responsibility, thereby making all stimuli as idiosyncratic as possible, would address a significant gap in the current literature.

### **Acknowledgements**

We would like to thank C.-E. G. for his help with the statistical analyses.

### **Competing Interests**

All authors have no competing interests to declare.

### **Role of Funding Sources**



This work was supported by the Fonds de recherche du Québec - Société Culture (FRQSC) [grant number 198679], the Fonds de recherche du Québec – Santé (FRQS) [grant number 33663], and the Canadian Institutes of Health Research (CIHR) [grant number 93556]. FRQSC, FRQS and CIHR all had no role in the study design, collection, analysis or interpretation of the data, writing the manuscript, or the decision to submit the paper for publication.

### **Contributors**

The first author conducted literature searches, designed the review, wrote the protocol, read and rated the articles reviewed, performed the statistical analyses and drafted the manuscript. The second author revised the protocol, read and rated the articles reviewed and revised the manuscript. The third author supervised all aspects of the research. All authors contributed to and have approved the final manuscript.

## References

- Abramovitch, A., Abramowitz, J. S., & Mittelman, A. (2013). The neuropsychology of adult obsessive-compulsive disorder: a meta-analysis. *Clinical Psychology Review, 33*, 1163-1171. DOI:10.1016/j.cpr.2013.09.004
- Abramowitz, J. S., Fabricant, L. E., Taylor, S., Deacon, B. J., McKay, D., & Storch, E. A. (2014). The relevance of analogue studies for understanding obsessions and compulsions. *Clinical Psychology Review, 34*, 206-217. DOI: 10.1016/j.cpr.2014.01.004
- Alcolado, G. M., & Radomsky, A. S. (2016). A novel cognitive intervention for compulsive checking: Targeting maladaptive beliefs about memory. *Journal of Behavior Therapy and Experimental Psychiatry, 53*, 75-83. DOI: 10.1016/j.jbtep.2015.02.009
- American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (DSM-5®). *American Psychiatric Pub.*
- Ashbaugh, A. R., & Radomsky, A. S. (2007). Attentional focus during repeated checking influences memory but not metamemory. *Cognitive Therapy and Research, 31*, 291-306. DOI: 10.1007/s10608-006-9087-9
- Ashbaugh, A. R., Gelfand, L. A., & Radomsky, A. S. (2006). Interpersonal aspects of responsibility and obsessive compulsive symptoms. *Behavioural and Cognitive Psychotherapy, 34*, 151-163. DOI:10.1017/S1352465805002699
- Cartwright-Hatton, S., & Wells, A. (1997). Beliefs about worry and intrusions: The Meta-Cognitions Questionnaire and its correlates. *Journal of Anxiety Disorders, 11*, 279-296. DOI:10.1016/S0887-6185(97)00011-X

- Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*, 155. DOI: 10.1037/0033-2909.112.1.155
- Cohen, R. L. (1981). On the generality of some memory laws. *Scandinavian Journal of Psychology*, *22*, 267-281.
- Cooper, H. (2011). *Reporting research in psychology: How to meet journal article reporting standards*. American Psychological Association.
- Dar, R., Rish, S., Hermesh, H., Taub, M., & Fux, M. (2000). Realism of confidence in obsessive-compulsive checkers. *Journal of Abnormal Psychology*, *109*, 673-678. DOI: 10.1037/0021-843X.109.4.673
- Foa, E. B., Amir, N., Gershuny, B., Molnar, C., & Kozak, M. J. (1997). Implicit and explicit memory in obsessive-compulsive disorder. *Journal of Anxiety Disorders*, *11*, 119-129. DOI: 10.1016/S0887-6185(97)00001-7
- Foa, E. B., Huppert, J. D., Leiberg, S., Langner, R., Kichic, R., Hajcak, G., & Salkovskis, P. M. (2002). The Obsessive-Compulsive Inventory: development and validation of a short version. *Psychological Assessment*, *14*, 485. DOI: 10.1037//1040-3590.14.4.485
- Goodman, W. K., Price, L. H., Rasmussen, S. A., Mazure, C., Fleischmann, R. L., Hill, C. L., ... & Charney, D. S. (1989). The Yale-Brown obsessive compulsive scale: I. Development, use, and reliability. *Archives of General Psychiatry*, *46*, 1006-1011.
- Hawker, S., Payne, S., Kerr, C., Hardey, M., & Powell, J. (2002). Appraising the evidence: reviewing disparate data systematically. *Qualitative Health Research*, *12*, 1284-1299.
- Hermans, D., Engelen, U., Grouwels, L., Joos, E., Lemmens, J., & Pieters, G. (2008). Cognitive confidence in obsessive-compulsive disorder: distrusting perception,

- attention and memory. *Behaviour Research and Therapy*, 46, 98-113. DOI: 0.1177/1049732302238251
- Hermans, D., Martens, K., De Cort, K., Pieters, G., & Eelen, P. (2003). Reality monitoring and metacognitive beliefs related to cognitive confidence in obsessive–compulsive disorder. *Behaviour Research and Therapy*, 41, 383-401. DOI: 10.1016/S0005-7967(02)00015-3
- Hodgson, R. J., & Rachman, S. (1977). Obsessional-compulsive complaints. *Behaviour Research and Therapy*, 15, 389-395. [https://doi.org/10.1016/0005-7967\(77\)90042-0](https://doi.org/10.1016/0005-7967(77)90042-0)
- Johnson, M. K., & Raye, C. L. (1981). Reality monitoring. *Psychological Review*, 88, 67. DOI: 10.1037/0033-295X.88.1.67
- Klepsch, R., Zaworka, W., Hand, I., Lünenschloss, K., & Jauernig, G. (1991). Derivation and validation of the Hamburg Obsession/Compulsion Inventory—Short Form (HOCS—S): First results. *Psychological Assessment: A Journal of Consulting and Clinical Psychology*, 3, 196. DOI: 10.1037/1040-3590.3.2.196
- Lazarov, A., Dar, R., Liberman, N., & Oded, Y. (2012). Obsessive-compulsive tendencies and undermined confidence are related to reliance on proxies for internal states in a false feedback paradigm. *Journal of Behavior Therapy and Experimental Psychiatry*, 43, 556-564. DOI:10.1016/j.jbtep.2011.07.007
- Lazarov, A., Dar, R., Oded, Y., & Liberman, N. (2010). Are obsessive–compulsive tendencies related to reliance on external proxies for internal states? Evidence from biofeedback-aided relaxation studies. *Behaviour Research and Therapy*, 48, 516-523. DOI: 10.1016/j.brat.2010.02.007

- Mataix-Cols, D., do Rosario-Campos, M. C., & Leckman, J. F. (2005). A multidimensional model of obsessive-compulsive disorder. *American Journal of Psychiatry*, *162*, 228-238. DOI: 10.1176/appi.ajp.162.2.228
- Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Prisma Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Medicine*, *6*, e1000097. DOI: 10.1371/journal.pmed.1000097
- Moritz, S., Kuelz, A. K., Jacobsen, D., Kloss, M., & Fricke, S. (2006). Severity of subjective cognitive impairment in patients with obsessive-compulsive disorder and depression. *Journal of Anxiety Disorders*, *20*, 427-443. DOI: 10.1016/j.janxdis.2005.04.001
- Muller, J., & Roberts, J. E. (2005). Memory and attention in obsessive-compulsive disorder: a review. *Journal of Anxiety Disorders*, *19*, 1-28. DOI: 10.1016/j.janxdis.2003.12.001
- Nedeljkovic, M., & Kyrios, M. (2007). Confidence in memory and other cognitive processes in obsessive-compulsive disorder. *Behaviour Research and Therapy*, *45*, 2899-2914. DOI: 10.1016/j.brat.2007.08.001
- Olley, A., Malhi, G., & Sachdev, P. (2007). Memory and executive functioning in obsessive-compulsive disorder: a selective review. *Journal of Affective Disorders*, *104*, 15-23. DOI: 10.1016/j.jad.2007.02.023
- Özdemir, A., Poyraz, C. A., Baş, T. Ö., Erten, E., & Bayar, R. (2015). Neuropsychological performance in obsessive-compulsive disorder: A comparison with bipolar disorder and healthy controls. *Journal of Obsessive-Compulsive and Related Disorders*, *7*, 29-34. DOI: 10.1016/j.jocrd.2015.09.001

- Parrish, C. L., & Radomsky, A. S. (2006). An experimental investigation of responsibility and reassurance: Relationships with compulsive checking. *International Journal of Behavioral Consultation and Therapy*, 2, 174. DOI: 10.1037/h0100775
- Radomsky, A. S., & Alcolado, G. M. (2010). Don't even think about checking: Mental checking causes memory distrust. *Journal of Behavior Therapy and Experimental Psychiatry*, 41, 345-351. DOI: 10.1016/j.jbtep.2010.03.005
- Radomsky, A. S., & Rachman, S. (1999). Memory bias in obsessive-compulsive disorder. *Behaviour research and Therapy*, 37, 605-618. DOI: 10.14288/1.0088610
- Radomsky, A. S., & Rachman, S. (2004). The importance of importance in OCD memory research. *Journal of Behavior Therapy and Experimental Psychiatry*, 35, 137-151. DOI: 10.1016/j.jbtep.2004.04.005
- Radomsky, A. S., Rachman, S., & Hammond, D. (2001). Memory bias, confidence and responsibility in compulsive checking. *Behaviour Research and Therapy*, 39, 813-822. DOI: 10.1016/S0005-7967(00)00079-6
- Radomsky, A. S., & Taylor, S. (2005). Subtyping OCD: Prospects and problems. *Behavior Therapy*, 36, 371-379. DOI: 10.1016/S0005-7894(05)80119-4
- Ruscio, A. M., Stein, D. J., Chiu, W. T., & Kessler, R. C. (2010). The epidemiology of obsessive-compulsive disorder in the National Comorbidity Survey Replication. *Molecular Psychiatry*, 15, 53. DOI: 10.1038/mp.2008.94
- Burns, G. L., Keortge, S. G., Formea, G. M., & Sternberger, L. G. (1996). Revision of the Padua Inventory of obsessive compulsive disorder symptoms: distinctions between worry, obsessions, and compulsions. *Behaviour Research and Therapy*, 34, 163-173.

- Shin, N. Y., Lee, T. Y., Kim, E., & Kwon, J. S. (2014). Cognitive functioning in obsessive-compulsive disorder: a meta-analysis. *Psychological medicine*, *44*, 1121-1130.  
DOI: 10.1017/S0033291713001803
- Spielberger, C. D. (1989). *State-Trait Anxiety Inventory: Bibliography* (2nd ed.). Palo Alto, CA: Consulting Psychologists Press.
- Stein, M. B., Forde, D. R., Anderson, G., & Walker, J. R. (1997). Obsessive-compulsive disorder in the community: an epidemiologic survey with clinical reappraisal. *American Journal of Psychiatry*, *154*, 1120-1126. DOI: 10.1176/ajp.154.8.1120
- Tallis, F., Pratt, P., & Jamani, N. (1999). Obsessive compulsive disorder, checking, and non-verbal memory: a neuropsychological investigation. *Behaviour Research and Therapy*, *37*, 161-166. DOI: 10.1016/S0005-7967(98)00075-8
- The Cochrane Collaboration. *RevMan Analyses*. [Computer program], Review Manager (RevMan) 4.2. England: Oxford, 2003.
- Tolin, D. F., Abramowitz, J. S., Brigidi, B. D., Amir, N., Street, G. P., & Foa, E. B. (2001). Memory and memory confidence in obsessive-compulsive disorder. *Behaviour Research and Therapy*, *39*, 913-927. DOI: 10.1016/S0005-7967(00)00064-4
- Tuna, Ş., Tekcan, A. I., & Topçuoğlu, V. (2005). Memory and metamemory in obsessive-compulsive disorder. *Behaviour Research and Therapy*, *43*, 15-27. DOI: 10.1016/j.brat.2003.11.001
- Van den Hout, M., & Kindt, M. (2003a). Repeated checking causes memory distrust. *Behaviour Research and Therapy*, *41*, 301-316. DOI:10.1016/S0005-7967(02)00012-8.

- Van den Hout, M. A., & Kindt, M. (2003b). Phenomenological validity of an OCD-memory model and the remember/know distinction. *Behaviour Research and Therapy*, *41*, 369–378. DOI:10.1016/S0005-7967(02)00097-9
- Van den Hout, M., & Kindt, M. (2004). Obsessive-compulsive disorder and the paradoxical effects of perseverative behaviour on experienced uncertainty. *Journal of Behavior Therapy and Experimental Psychiatry*, *35*, 165-181. DOI:10.1016/j.jbtep.2004.04.007.
- Wells, A. (2000). *Emotional disorders and metacognition: Innovative cognitive therapy*. Chichester, UK: Wiley.
- Wells, A., & Cartwright-Hatton, S. (2004). A short form of the metacognitions questionnaire: properties of the MCQ-30. *Behaviour Research and Therapy*, *42*, 385-396. DOI: 10.1016/S0005-7967(03)00147-5
- Woods, C. M., Vevea, J. L., Chambless, D. L., & Bayen, U. J. (2002). Are compulsive checkers impaired in memory? A meta-Analytic review. *Clinical Psychology: Science and Practice*, *9*, 353-366. DOI: 10.1093/clipsy.9.4.353
- Wu, K. D., & Carter, S. A. (2008). Further investigation of the Obsessive Beliefs Questionnaire: Factor structure and specificity of relations with OCD symptoms. *Journal of Anxiety Disorders*, *22*, 824-836. DOI: 10.1016/j.janxdis.2007.08.008



Table 1. List of reviewed articles in alphabetical order

---

1. Ashbaugh, A. R., & Radomsky, A. S. (2007). Attentional focus during repeated checking influences memory but not metamemory. *Cognitive Therapy and Research, 31*, 291-306. DOI: 0.1007/s10608-006-9087-9
2. Barahmand, U. (2009). Meta-cognitive profiles in anxiety disorders. *Psychiatry Research, 169*, 240-243. DOI: 10.1016/j.psychres.2008.06.029
3. Bortolon, C., Larøi, F., Stephan, Y., Capdevielle, D., Yazbek, H., Boulenger, J. P., Gely-Nargeot, M. C., & Raffard, S. (2014). Further insight into the role of metacognitive beliefs in schizophrenia and OCD patients: Testing a mediation model. *Psychiatry Research, 220*, 698-701. DOI: 10.1016/j.psychres.2014.07.081
4. Boschen, M. J., & Vuksanovic, D. (2007). Deteriorating memory confidence, responsibility perceptions and repeated checking: comparisons in OCD and control samples. *Behaviour Research and Therapy, 45*, 2098-2109. DOI: 10.1016/j.brat.2007.03.009
5. Bucarelli, B., & Purdon, C. (2016). Stove checking behaviour in people with OCD vs. anxious controls. *Journal of Behavior Therapy and Experimental Psychiatry, 53*, 17-24. DOI: 10.1016/j.jbtep.2016.03.005
6. Cartwright-Hatton, S., & Wells, A. (1997). Beliefs about worry and intrusions: The Meta-Cognitions Questionnaire and its correlates. *Journal of Anxiety Disorders, 11*, 279-296. DOI: 10.1016/S0887-6185(97)00011-X
7. Chik, H. M., Calamari, J. E., Rector, N. A., & Riemann, B. C. (2010). What do low-dysfunctional beliefs obsessive-compulsive disorder subgroups believe? *Journal of Anxiety Disorders, 24*, 837-846. DOI: 10.1016/j.janxdis.2010.06.006

8. Constans, J.I., Foa, E.B., Franklin, M.E., Mathews, A. (1995). Memory for actual and imagined events in OC checkers. *Behavior Research and Therapy*, 33, 665-671. DOI: 10.1016/0005-7967(94)00095-2
9. Cogle, J. R., Salkovskis, P. M., & Wahl, K. (2007). Perception of memory ability and confidence in recollections in obsessive-compulsive checking. *Journal of Anxiety Disorders*, 21, 118-130. DOI: 10.1016/j.janxdis.2006.03.015
10. Cucchi, M., Bottelli, V., Cavadini, D., Ricci, L., Conca, V., Ronchi, P., & Smeraldi, E. (2012). An explorative study on metacognition in obsessive-compulsive disorder and panic disorder. *Comprehensive Psychiatry*, 53, 546-553. DOI: 10.1016/j.comppsy.2011.09.008
11. Cuttler, C., & Graf, P. (2009). Checking-in on the memory deficit and meta-memory theories of compulsive checking. *Clinical Psychology Review*, 29, 393-409. DOI: 10.1016/j.cpr.2009.04.003
12. Dek, E. C., van den Hout, M. A., Engelhard, I. M., Giele, C. L., & Cath, D. C. (2015). Perseveration causes automatization of checking behavior in obsessive-compulsive disorder. *Behaviour Research and Therapy*, 71, 1-9. DOI: 10.1016/j.brat.2015.05.005
13. Ecker, W. & Engelkamp, J. (1995). Memory for actions in obsessive-compulsive disorder. *Behavioral and Cognitive Psychotherapy*, 23, 349-371. DOI: 10.1017/S1352465800016477
14. García-Montes, J. M., Pérez-Álvarez, M., Balbuena, C. S., Garcelán, S. P., & Cangas, A. J. (2006). Metacognitions in patients with hallucinations and obsessive-compulsive disorder: The superstition factor. *Behaviour Research and Therapy*, 44, 1091-1104. DOI: 10.1016/j.brat.2005.07.008
15. Harkin, B., & Kessler, K. (2009). How checking breeds doubt: Reduced performance in a simple working memory task. *Behaviour Research and Therapy*, 47, 504-512. DOI: 10.1016/j.brat.2009.03.002

16. Hermans, D., Engelen, U., Grouwels, L., Joos, E., Lemmens, J., & Pieters, G. (2008). Cognitive confidence in obsessive-compulsive disorder: distrusting perception, attention and memory. *Behaviour Research and Therapy*, *46*, 98-113. DOI: 10.1016/j.brat.2007.11.001
17. Hermans, D., Martens, K., De Cort, K., Pieters, G., & Eelen, P. (2003). Reality monitoring and metacognitive beliefs related to cognitive confidence in obsessive–compulsive disorder. *Behaviour Research and Therapy*, *41*, 383-401. DOI: 10.1016/S0005-7967(02)00015-3
18. Karadag, F., Oguzhanoglu, N., Ozdel, O., Atesci, F. C., & Amuk, T. (2005). Memory function in patients with obsessive compulsive disorder and the problem of confidence in their memories: A clinical study. *Croatian Medical Journal*, *46*, 282-287.
19. Macdonald, P. A., Antony, M. M., MacLeod, C. M., & Richter, M. A. (1997). Memory and confidence in memory judgements among individuals with obsessive compulsive disorder and non-clinical controls. *Behaviour Research and Therapy*, *35*, 497-505. DOI: 10.1016/S0005-7967(97)00013-2
20. Mavrogiorgou, P., Bethge, M., Luksnat, S., Nalato, F., Juckel, G., & Brüne, M. (2016). Social cognition and metacognition in obsessive–compulsive disorder: an explorative pilot study. *European Archives of Psychiatry and Clinical Neuroscience*, *266*, 209-216. DOI: 10.1007/s00406-016-0669-6
21. McNally, R.J. & Kohlbeck, P.A. (1993). Reality monitoring in obsessive-compulsive disorder. *Behavior Research and Therapy*, *31*, 249-253. DOI: 10.1016/0005-7967(93)90023-N
22. Merckelbach, H. & Wessel, I. (2000). Memory for actions and dissociation in obsessive-compulsive disorder. *Journal of Nervous and Mental Disease*, *188*, 846-848.

23. Moritz, S., Jacobsen, D., Willenborg, B., Jelinek, L., & Fricke, S. (2006). A check on the memory deficit hypothesis of obsessive-compulsive checking. *European Archives of Psychiatry and Clinical Neuroscience*, 256, 82-86. DOI: 10.1007/s00406-005-0605-7
24. Moritz, S., Kloss, M., Vitzthum von Eckstaedt, F., & Jelinek, L. (2009a). Comparable performance of patients with obsessive-compulsive disorder (OCD) and healthy controls for verbal and nonverbal memory accuracy and confidence: Time to forget the forgetfulness hypothesis of OCD? *Psychiatry Research*, 166, 247-253. DOI:10.1016/j.psychres.2008.02.006
25. Moritz, S., Peters, M. J., Larøi, F., & Lincoln, T. M. (2010). Metacognitive beliefs in obsessive-compulsive patients: a comparison with healthy and schizophrenia participants. *Cognitive Neuropsychiatry*, 15, 531-548. DOI: 10.1080/13546801003783508
26. Moritz, S., Ruhe, C., Jelinek, L., & Naber, D. (2009b). No deficits in nonverbal memory, metamemory and internal as well as external source memory in obsessive-compulsive disorder (OCD). *Behaviour Research and Therapy*, 47, 308-315. DOI: 10.1016/j.brat.2009.01.004
27. Moritz, S., Wahl, K., Zurowski, B., Jelinek, L., Hand, I., & Fricke, S. (2007). Enhanced perceived responsibility decreases metamemory but not memory accuracy in obsessive-compulsive disorder (OCD). *Behaviour Research and Therapy*, 45, 2044-2052. DOI: 10.1016/j.brat.2007.03.003
28. Nedeljkovic, M., & Kyrios, M. (2007). Confidence in memory and other cognitive processes in obsessive-compulsive disorder. *Behaviour Research and Therapy*, 45(12), 2899-2914. DOI: 10.1016/j.brat.2007.08.001
29. Önen, S., Uğurlu, G. K., & Çayköylü, A. (2013). The relationship between metacognitions and insight in obsessive-compulsive disorder. *Comprehensive Psychiatry*, 54, 541-548. DOI: 10.1016/j.comppsy.2012.11.006

30. Radomsky, A. S., Dugas, M. J., Alcolado, G. M., & Lavoie, S. L. (2014). When more is less: Doubt, repetition, memory, metamemory, and compulsive checking in OCD. *Behaviour Research and Therapy*, *59*, 30-39. DOI: 10.1016/j.brat.2014.05.008
31. Solem, S., Borgejordet, S., Haseth, S., Hansen, B., Håland, Å., & Bailey, R. (2015). Symptoms of health anxiety in obsessive-compulsive disorder: relationship with treatment outcome and metacognition. *Journal of Obsessive-Compulsive and Related Disorders*, *5*, 76-81. DOI: 10.1016/j.jocrd.2015.03.002
32. Taylor, J., & Purdon, C. (2016). Responsibility and hand washing behaviour. *Journal of Behavior Therapy and Experimental Psychiatry*, *51*, 43-50. DOI: 10.1016/j.jbtep.2015.12.005
33. Tekcan, A. I., Topçuoğlu, V., & Kaya, B. (2007). Memory and metamemory for semantic information in obsessive-compulsive disorder. *Behaviour Research and Therapy*, *45*, 2164-2172. DOI: 10.1016/j.brat.2006.10.002
34. Tolin, D. F., Abramowitz, J. S., Brigidi, B. D., Amir, N., Street, G. P., & Foa, E. B. (2001). Memory and memory confidence in obsessive-compulsive disorder. *Behaviour Research and Therapy*, *39*, 913-927. DOI: 10.1016/S0005-7967(00)00064-4
35. Tuna, S., Tekcan, A. I., & Topçuoğlu, V. (2005). Memory and metamemory in obsessive-compulsive disorder. *Behaviour Research and Therapy*, *43*, 15-27. DOI: 10.1016/j.brat.2003.11.001
36. Zitterl, W., Urban, C., Linzmayer, L., Aigner, M., Demal, U., Semler, B., & Zitterl-Eglseer, K. (2001). Memory deficits in patients with DSM-IV obsessive-compulsive disorder. *Psychopathology*, *34*, 113-117. DOI: 10.1159/000049292
-

Table 2. Experimental studies focusing on cognitive confidence in OCD (across subtypes)

Study	Sample type	Sample size	Outcome variable	Task	Results	Quality	Main findings	Association with symptom severity
Boschen & Vuksanovic, 2007	Community	OCD = 14 HC = 40	Memory (recall) confidence	Checking task  Conditions: 1) High vs. Low responsibility  2) Relevant vs. Irrelevant checking	OCD < HC	33	1. Repeated checking lowered memory confidence in both OCD and HC groups. 2. The OCD group evinced greater decreases in confidence than the HC group in the relevant checking condition only. 3. Effect of responsibility on memory confidence in the OCD group only.	Memory confidence and perceptions of responsibility were predictors of the urge to check.
Taylor & Purdon, 2016	Undergraduate	High contamination fears = 37 Low contamination fears = 43	Memory (for actions) and sensory confidence	Washing task  Conditions: High vs. Low responsibility	High contamination fears < Low contamination fears	31	1. Repetitive washing was associated with decreased sensory (but not memory) confidence in the high contamination fears groups in the high responsibility condition only.	NA
Dek et al., 2015	Clinical	OCD = 48 HC = 48	Memory (recall) confidence	Checking task  Conditions: Relevant vs. Irrelevant checking  Defamiliarization vs. no defamiliarization	OCD < HC	33	1. Cognitive confidence decreased in both groups following repeated checking, but decreased more in the OCD group. This effect was only found in the relevant checking condition. 2. No difference in cognitive confidence before the checking task. 3. No effect of defamiliarization on confidence.	NA
Foa et al., 1997	Clinical	OCD = 15 HC = 15	Memory (recognition) confidence	Sentence recognition  Conditions: Contamination vs. Neutral	OCD = HC	27	1. Both groups had less confidence for items with contamination content.	NA
Hermans et al., 2008	Clinical	OCD = 16 HC = 16 CC = 16	Memory (for actions), attention and perceptual confidence	Checking task  Conditions:	OCD < CC OCD < HC	35	1. The OCD group had less confidence overall than the CC and HC groups. This effect was	NA

				Non-specific compulsive action vs. Ideographically selected compulsive action vs. Neutral action			greater for ideographically selected as compared to neutral actions, for memory and perceptual confidence. 2. The OCD group had lower attentional confidence regardless of type of action. 2. Repeated checking elicited further decreases in attentional confidence for the OCD group only, but this effect was not observed for memory or perceptual confidence.	
Hermans et al., 2003	Clinical	OCD = 17 HC = 17	Reality monitoring confidence	Reality monitoring task  Conditions: Non-specific compulsive action vs. Ideographically selected compulsive action vs. Neutral action	OCD < HC	31	1. The OCD group had lower confidence than the HC group for irrelevant and neutral actions only. 2. Secondary analyses found no differences in cognitive confidence between OCD checkers and OCD noncheckers.	NA
Karadag et al., 2005	Clinical	OCD = 32 HC = 31	Memory (recognition) confidence	Sentence task  Conditions: OCD-relevant vs. Neutral content	OCD < HC	31	1. OCD participants exhibited lower memory confidence than HC for both OCD-related and neutral sentences. 2. Secondary analyses found no differences in confidence between OCD checkers and OCD noncheckers.	1. No correlation between Y-BOCS scores and memory confidence. 2. Negative correlation between memory confidence and anxiety (STAI) scores.
Merckelbach & Wessel, 2000	Clinical	OCD = 19 HC = 16	Reality monitoring confidence	Reality monitoring task	OCD < HC	24	1. OCD participants were less confident than HC in their ability to remember whether they had imagined or performed an action. 2. Secondary analyses found no differences in confidence between OCD checkers and OCD noncheckers.	Negative correlation between dissociation and confidence.
Moritz et al., 2006	Clinical	OCD = 27 HC = 51	Memory (recognition) confidence	Word recognition task	OCD = HC	29	No differences between OCD and HC in memory confidence.	Positive correlation between checking compulsions (HOCl

				Conditions: Positive vs. Negative vs. Neutral				checking scores) and memory confidence.
Moritz, Kloss, et al., 2009	Clinical	OCD = 43 HC = 46	Memory (recognition) confidence	Verbal and non-verbal memory task	OCD = HC	29	No differences between OCD and HC in memory confidence.	No correlation between memory confidence and Y-BOCS scores.
Moritz et al., 2007	Clinical	OCD = 28 HC = 28	Memory (recognition) confidence	Word recognition task  Conditions: High vs. Low responsibility	OCD < HC	33	1. The OCD group had lower confidence than the HC group in the high responsibility condition only.	No correlation between confidence and HOCS scores.
Moritz, Ruhe, et al., 2009	Clinical	OCD = 32 HC = 32	Memory (for actions) confidence	Reality monitoring task  Conditions: Instructions were Verbal vs. Non-verbal vs. Novel	OCD = HC	31	1. There were no differences between groups in terms of memory confidence, even when correctness of responses is taken into account. 2. The OCD group had greater memory confidence for novel attributions, while the HC group had greater memory confidence for old attributions.	No correlations between memory confidence and OCI-R and Y-BOCS (except for negative correlation between confidence and resistance scale of the Y-BOCS).
Tolin et al., 2001	Clinical	OCD = 14 AC = 14 HC = 14	Memory (recall) confidence	Object recall task  Conditions: Unsafe vs. Safe vs. Neutral (ideographically rated)	OCD < AC; HC	30	1. The OCD group had higher confidence for 'unsafe' objects at time 1, lower confidence than the HC group at time 4, and lower confidence than the AC and HC group at time 5. 2. The OCD group had lower confidence for 'safe' objects as compared to the HC group. 3. No difference between groups for 'neutral' objects. 4. Secondary analyses found differences in confidence between OCD checkers and OCD noncheckers for unsafe objects at time 6 only.	NA



Zitterl et al., 2001	Clinical	OCD = 27 HC = 27	Memory (recall) confidence	Verbal and non-verbal memory task	OCD < HC	28	Participants with OCD reported lower memory confidence than the HC group.	No correlation between Y-BOCS scores and confidence.
----------------------	----------	---------------------	-------------------------------	--------------------------------------	----------	----	--	---

*Note.* AC = anxious controls; CC = clinical controls; HC = healthy control; OCD = obsessive compulsive disorder; HOCl = Hamburg Obsessional Compulsive Inventory; OCI-R = Obsessive- Compulsive Inventory Revised; STAI = State-Trait Anxiety Inventory; Y-BOCS = Yale-Brown Obsessive Compulsive Scale.

Table 3. Experimental studies focusing on cognitive confidence in OCD with primary checking

Study	Sample type	Sample size	Outcome variable	Task	Results	Quality	Main findings	Association with symptom severity
Ashbaugh & Radomsky, 2007	Undergraduate	High checkers = 28 Low checkers = 106  Identified with the VOICI	Memory (for action) confidence	Checking task  Conditions: Peripheral vs. Central	High < Low	31	1. High checkers had lower memory confidence following a single check (this effect disappeared when controlling for depression). 2. Memory confidence decreased in both groups after repeated checking. 3. Peripheral focus led to greater memory confidence, particularly for the High checkers group.	NA
Cuttler & Graf, 2007	Undergraduate	High checkers = 45 Medium checkers = 41 Low checkers = 40  Identified with the Padua Inventory	Memory (prospective) confidence	Event- and time-cued prospective memory tasks	High = Medium = Low	29	1. No group differences in subjective ratings of prospective memory confidence for either the event-cued or time-cued prospective memory task.	No correlation between the checking subscale of the Padua Inventory and prospectivememory confidence.
Harkin & Kessler, 2009	Undergraduate	High checkers = 20 Low checkers = 20  Identified with the VOICI	Memory (working memory) confidence	Working memory task  Conditions: No misleading distractor vs. Misleading distractor	High < Low	30	1. Lower confidence was observed in the high checking group as compared to the low checking group for trials with misleading distractor only. 2. This effect was not replicated when comparing low and high checkers on the same working memory task, but only with trials with misleading distractors.  3. This effect was also not replicated when comparing participants with the most extreme checking scores (very high vs. very low).	NA
Constans et al., 1995	Clinical	OCD checkers = 12 HC = 7	Memory (recall) confidence	Reality monitoring task	OCD = HC	22	1. No differences in memory confidence between groups.	NA

		Identified with a diagnostic interview					2. Type of action (OCD-relevant or neutral) did not affect memory confidence.	
Ecker & Engelkamp, 1995	Clinical	OCD checkers = 24 CC high checkers = 24 CC low checkers = 48  Identified with the MOCI	Memory (recall and recognition) confidence	Recall and recognition tasks  Conditions: Encoding instruction modalities – motor vs. motor- imaginal vs. visual imaginal vs. subvocal verbal rehearsal	OCD = CC High < CC Low	29	1. OCD checkers and CC high checkers had lower confidence than CC low checkers in all instruction modalities.  2. Memory confidence in OCD checkers and CC high checkers did not differ.	NA
MacDonald et al., 1997	Clinical	OCD checkers = 10 OCD non-checkers = 10 HC = 10  Identified with the SCID	Memory (recognition) confidence	Word task	OCD checkers < OCD non-checkers; HC	26	1. OCD checkers had lower confidence than both OCD non-checkers and HC groups (effect reached statistical significance only when these comparison groups were combined). 2. There were no differences in confidence between OCD non-checkers and HC.	Negative correlation between confidence and the MOCI total score, but not the Y-BOCS.
McNally & Kohlbeck, 1993	Clinical	OCD checkers = 12 OCD non-checkers = 12 HC = 12  Identified with the MOCI	Reality monitoring confidence and recognition memory confidence	Recognition memory task  Reality monitoring task  Conditions: 1) Stimulus - Word vs. Drawing 2) Activity - Trace vs. Imagine vs. Look	OCD checkers; OCD non-checkers < HC	27	1. OCD non-checkers were less confident than the HC group for drawing-trace and word-trace items. 2. OCD checkers and OCD non-checkers were less confident than the HC group for word-imagine items. 3. No differences between groups for confidence ratings on performance on the item recognition task.	NA
Radomsky et al., 2014 (Study 1)	Clinical	OCD checkers = 30 HC = 30  Identified with the VOICI	Memory (for actions) confidence	Checking task  Conditions: Relevant vs. Irrelevant	OCD = HC	32	1. Memory confidence decreased in both groups following repeated checking. 2. Memory confidence only decreased in the relevant checking condition.	NA
Tekcan et al., 2007	Clinical	OCD checkers = 25 OCD non-checkers = 16 HC = 27	Memory (prospective and recognition) confidence	General knowledge task (Confidence in future memory performance and Confidence in	OCD checkers = OCD non-checkers = HC	29	1. OCD checkers were less confident in their memory than the OCD non-checkers and HC groups.	Negative correlations between Y-BOCS scores and prospective

		Identified with the MOCI		recognition accuracy)				memory confidence.
Tuna et al., 2005	Clinical	OCD checkers = 17 Subclinical checkers = 16 HC = 15  Identified with the MOCI	Recognition memory (prospective) confidence	Word pairs  Conditions: Neutral-Neutral vs. Neutral-Contamination vs. Neutral-Checking	OCD checkers < HC OCD checkers = Subclinical checkers	28	1. OCD checkers were less confident than the HC group in their future recognition memory performance.	Negative correlation between MOCI total score and confidence.

*Note.* OCD = obsessive compulsive disorder; HC = healthy control; CC = clinical controls; MOCI = Maudsley Obsessional-

Compulsive Inventory; SCID = Structured Clinical Interview for DSM Disorders; VOCI = Vancouver Obsessional Compulsive

Inventory; Y-BOCS = Yale-Brown Obsessive Compulsive Scale.

Table 4. Studies using self-report measures to evaluate cognitive confidence in OCD

Study	Sample type	Sample size	Measure	Results	Quality	Association with symptom severity
Cogle, Salkovskis, & Wahl, 2007	Community	OCD checkers = 39 OCD noncheckers = 20 AC = 22 HC = 69	MAEQ	OCD checkers > OCD noncheckers > AC; HC	29	NA
Moritz, Peters, Laroi, & Lincoln, 2010	Community	OCD = 55 SCZ = 39 HC = 49	MCQ-30	OCD; SCZ > HC	31	No correlation between the “cognitive confidence” subscale of the MCQ-30 and the subscales of the Y-BOCS (self-report version).
Cuttler & Graf, 2007	Undergraduate	High checkers = 45 Medium checkers = 41 Low checkers = 40	PMQ & PRMQ	High checkers > Medium checkers; Low checkers	29	Positive correlations between prospective and retrospective memory confidence (PMQ and PRMQ scores) and the checking subscale of the Padua Inventory.
Barahmand, 2009	Clinical	OCD = 60 GAD = 60 Dep = 60 HC = 60	MCQ	OCD; GAD; Dep > HC	25	NA
Bortolon et al., 2014	Clinical	OCD = 39 SCZ = 30 HC = 30	MCQ	OCD > SCZ; HC	23	NA
Bucarelli & Purdon, 2016	Clinical	OCD = 35 AC = 18	MACCS	OCD = AC	29	NA
Cartwright-Hatton & Wells, 1997 (Study 7)	Clinical	OCD = 17 GAD = 32 CC = 14 HC = 30	MCQ	OCD; GAD > HC	24	NA
Chik, Calamari, Rector, & Riemann, 2010	Clinical	OCD = 88 AC = 43 HC = 48	MCQ-30	OCD = AC = HC	32	No correlation between the “cognitive confidence” subscale of the MCQ-30 and Y-BOCS (self-report version) total score when controlling for obsessive beliefs (OCD and AC groups combined).

Cucchi et al., 2012	Clinical	OCD = 114 PD = 119 HC = 101	MCQ	OCD; PD > HC	32	Positive correlations between the “cognitive confidence” subscale of the MCQ and the “obsessions”, “indecisiveness”, “avoidance”, and total score of the Y-BOCS.
Garcia-Montes, Perez-Alvarez, Soto Balbuena, Perona Garcelan, & Cangas, 2006	Clinical	OCD = 23 SCZ = 59 CC = 26 HC = 20	MCQ	OCD = CC; HC; SCZ	30	NA
Hermans et al., 2008	Clinical	OCD = 16 CC = 16 HC = 16	MCQ	OCD > CC > HC	35	“Cognitive confidence” was the only subscale of the MCQ found to be a predictor of checking as measured by the Padua Inventory Revised.
Hermans, Martens, De Cort, Pieters, & Eelen, 2003	Clinical	OCD = 17 HC = 17	MCQ	OCD > HC	31	NA
Mavrogiorgou et al., 2016	Clinical	OCD = 20 HC = 20	MCQ-30	OCD > HC	31	No correlations between the Y-BOCS and the MCQ-30 in the OCD group.
Nedeljkovic & Kyrios, 2007 (Study 2)	Clinical	OCD = 16 HC = 31	MACCS	OCD > HC OCD = HC for the memory confidence subscale when controlling for OCD symptom severity	31	NA
Onen, Ugurlu, & Caykoylu, 2013	Clinical	OCD = 100 HC = 50	MCQ-30	OCD > HC		NA
Solem, Borgejordet, Haseth, Hansen, Haland, & Bailey, 2015	Clinical	OCD = 313 HC = 382	MCQ-30	OCD > HC		The “cognitive confidence” subscale of the MCQ-30 was positively correlated with the Y-BOCS total score in the HC group only.

*Note.* OCD = obsessive compulsive disorder; GAD = generalized anxiety disorder; Dep = depression; SCZ = schizophrenia; PD = panic disorder; HC = healthy control; CC = clinical control; AC = anxious control; MCQ = Metacognitions Questionnaire; MACCS = Memory and Cognitive Confidence Scale; MAEQ = Memory for Actions and Events Questionnaire; PMQ = Prospective Memory

Questionnaire; PRMQ = Prospective and Retrospective Memory Questionnaire; Y-BOCS = Yale-Brown Obsessive Compulsive Inventory.

Table 5. Meta-Analysis of questionnaire data comparing cognitive confidence in individuals with OCD and healthy controls

Study	OCD			Healthy Controls			Effect Size	Confidence Interval	P-value
	<i>M</i>	<i>SD</i>	N	<i>M</i>	<i>SD</i>	N			
Chik, Calamari, Rector, & Riemann, 2010	12.73	5.69	38	10.56	5.57	48	.38	-.05 .81	.083
Cartwright-Hatton & Wells, 1997	21.4	7.8	17	15.5	4.2	30	1.01	.38 1.64	.002
Cucchi et al., 2012	21.91	7.02	114	18.48	6.54	101	.50	.23 .77	<.001
Garcia-Montes et al. 2006	21.47	7.8	23	17.3	7.8	20	.52	-.09 1.14	.100
Moritz, Peters, Laro, & Lincoln 2010	12.11	4.81	55	9.73	3.38	49	.56	.17 .96	.006
Onen, Ugurly, Caykoylu, 2013	15.16	4.15	43	11.82	4	50	.81	.39 1.24	<.001
Bortolon et al., 2014	23.6	6.85	45	17.97	5.28	30	.89	.40 1.37	<.001
Mavrogiorgou et al., 2016	12.25	5.33	20	8.45	2.21	20	.91	.26 1.57	.007
Hermans, Martens, De Cort, Pieters, & Eelen, 2003	22.47	5.75	17	15.47	4.33	17	1.34	.59 2.10	<.001
Hermans et al., 2008	22.5	6.9	16	13.63	3.69	16	1.56	.76 2.37	<.001
Nedeljkovic & Kyrios, 2007	96.06	23.76	16	61.35	23.77	31	1.44	.76 2.11	<.001
<b>Total (95% CI)</b>	-	-	404	-	-	412	.80	.59 1.01	<.001
Heterogeneity:	Tau <sup>2</sup> = .06	Chi <sup>2</sup> = 18.78	df= 10	p < .04	I <sup>2</sup> = 47%				

Test for overall effect:  $Z = 7.45$   $p < .001$

Note.  $\text{Chi}^2$  is used as a measure of heterogeneity.

Table 6. Meta-Analysis of questionnaire data comparing cognitive confidence in individuals with OCD and clinical controls

Study	OCD			Clinical Controls			Effect Size	Confidence Interval	P-value	
	<i>M</i>	<i>SD</i>	N	<i>M</i>	<i>SD</i>	N				
<b>OCD vs. AC</b>										
Bucarelli & Purdon, 2016	97.52	16.9	35	92.83	18.82	18	.26	-.31	.83	.38
Cartwright-Hatton & Wells, 1997	21.4	7.8	17	22.8	8	32	-.17	-.76	.42	1.43
Chik, Calamari, Rector, & Riemann, 2010	12.73	5.69	38	12.07	4.49	43	.13	-.31	.57	.57
Cucchi et al., 2012	21.91	7.02	114	20.19	7.12	119	.24	-.02	.50	.08
<i>Subtotal (95% CI)</i>			204			212	.18	-.02	.37	
Heterogeneity:	Tau <sup>2</sup> = .00	Chi <sup>2</sup> = 1.74	<i>df</i> = 3	<i>p</i> = .63	I <sup>2</sup> = 0%					
Test for overall effect:	Z = 1.77	<i>p</i> = .08								
<b>OCD vs. SCZ</b>										
Bortolon et al., 2014	23.6	6.85	45	19.73	6.34	30	.58	.10	1.05	.02
Garcia-Montes et al., 2006	21.47	7.8	23	24.5	13.6	59	-.24	-.73	.24	1.68
Moritz, Peters, Laroi, & Lincoln, 2010	12.11	4.81	55	12.92	4.49	39	-.17	-.58	.24	1.59
<i>Subtotal (95% CI)</i>			123			128	.05	-.45	.55	
Heterogeneity:	Tau <sup>2</sup> = .14	Chi <sup>2</sup> = 7.31	<i>df</i> = 2	<i>p</i> = .03	I <sup>2</sup> = 73%					
Test for overall effect:	Z = .19	<i>p</i> = .85								
<b>OCD vs. Mixed CC</b>										
Cartwright-Hatton & Wells, 1997	21.4	7.8	17	18.2	7.1	14	.42	-.30	1.13	.25
Garcia-Montes et al., 2006	21.47	7.8	23	19.65	7.78	26	.23	-.33	.79	.43



Hermans et al., 2008	22.5	6.9	16	18.75	4.12	16	.64	-.07	1.36	.09
<i>Subtotal</i> (95% CI)			56			56	.40	.02	.77	
Heterogeneity:	Tau <sup>2</sup> = .02	Chi <sup>2</sup> = .80	df = 2	p = .67	I <sup>2</sup> = 0%					
Test for overall effect:	Z = 2.06	p = .04								
<b>Total</b> (95% CI)	-	-	383	-	-	396	.16	-.01	.34	
Heterogeneity:	Tau <sup>2</sup> = .02	Chi <sup>2</sup> = 12.25	df = 9	p = .20	I <sup>2</sup> = 27%					
Test for overall effect:	Z = 1.80	p = .07								
Test for subgroup differences:	Chi <sup>2</sup> = 1.45	df = 2	p = .49	I <sup>2</sup> = 0%						

*Note.* Chi<sup>2</sup> is used as a measure of heterogeneity; OCD = obsessive compulsive disorder; AC = anxious controls; SCZ = schizophrenia; CC = clinical controls.

Figure 1. Four-step flow diagram for article selection (provided by PRISMA).



**PRISMA 2009 Flow Diagram**

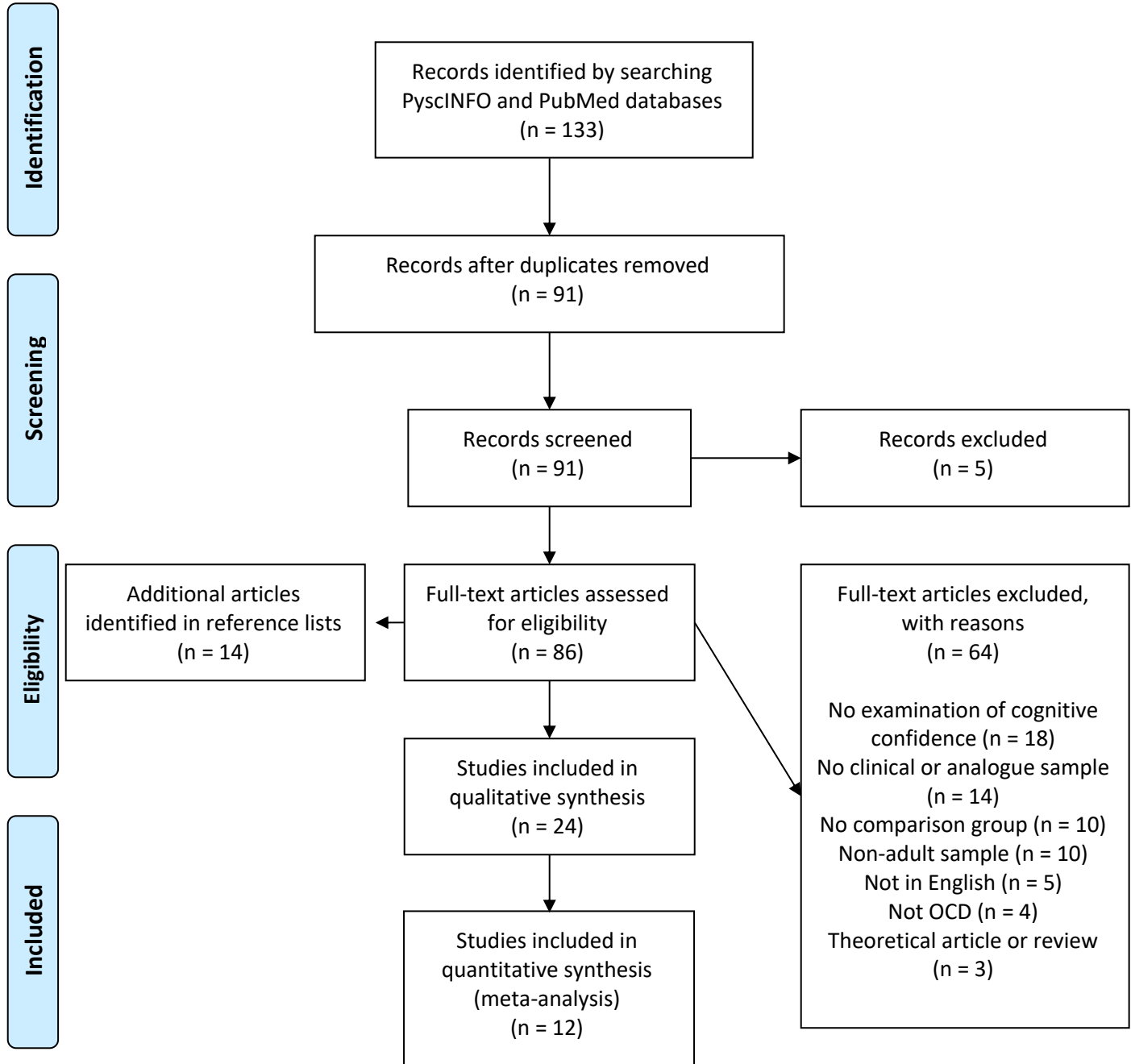


Figure 2. Funnel plots for risk of bias assessment.

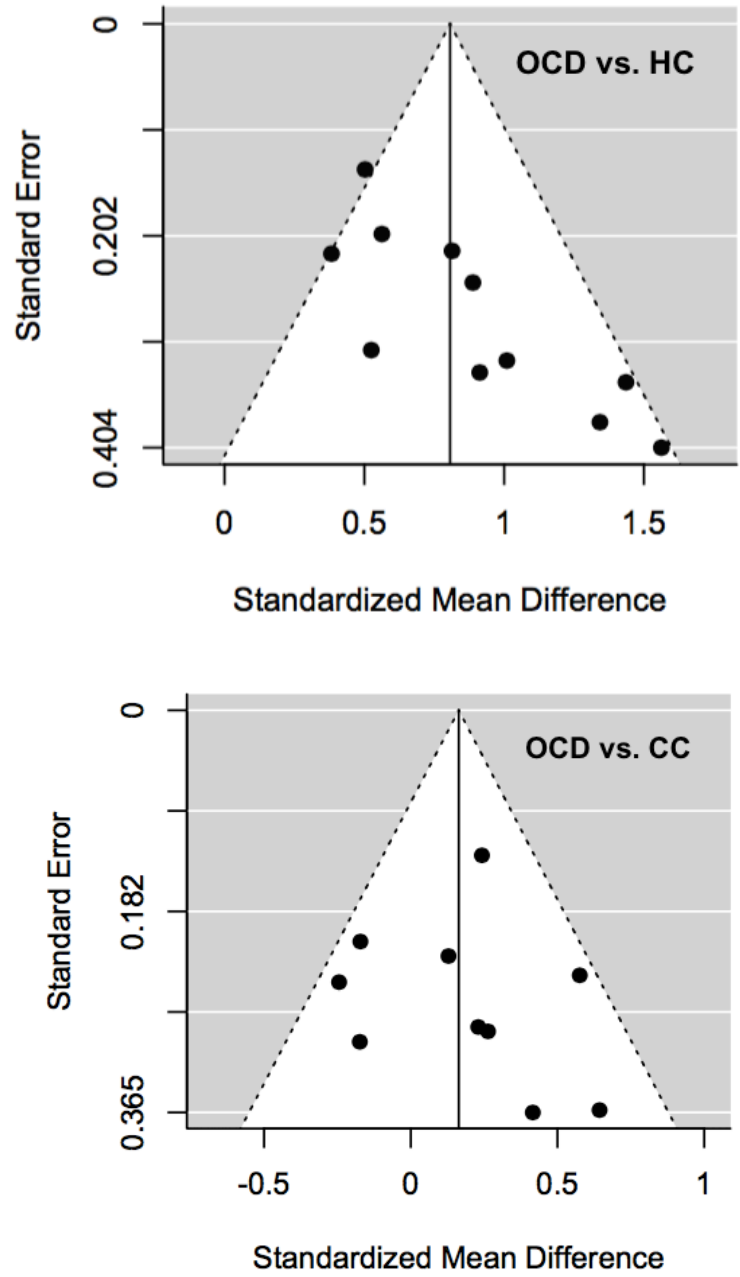
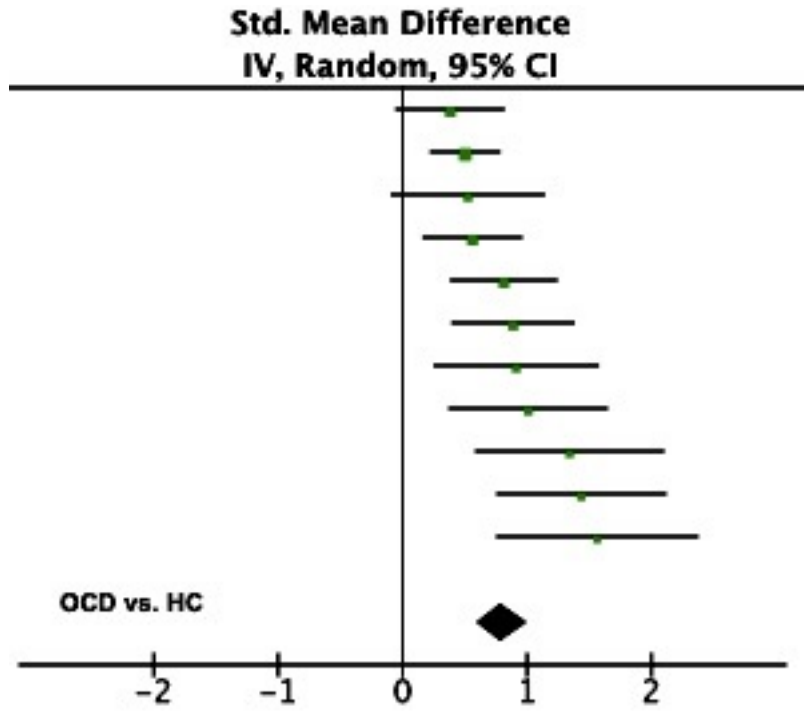
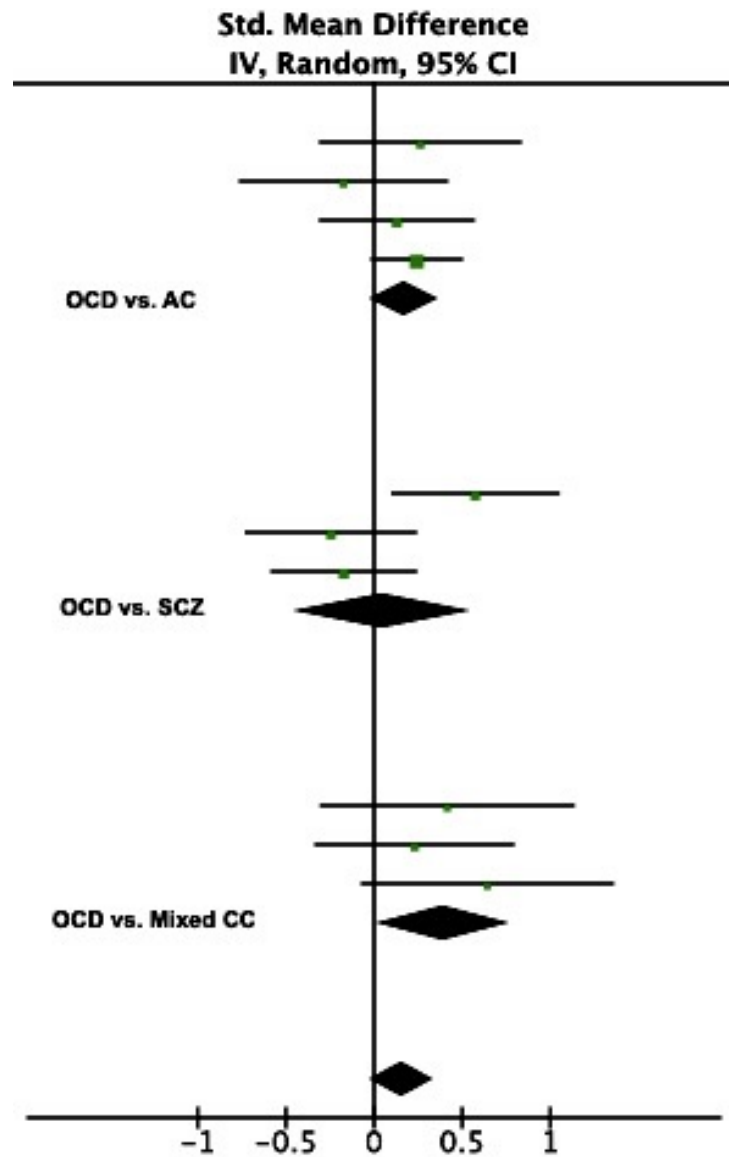


Figure 3. Forest plot of effect sizes for self-report studies comparing cognitive confidence in individuals with OCD and healthy controls.



Note. OCD = obsessive compulsive disorder; HC = healthy controls.

Figure 4. Forest plot of effect sizes for self-report studies comparing cognitive confidence in individuals with OCD and clinical controls.



Note. OCD = obsessive compulsive disorder; AC = anxious controls; SCZ = schizophrenia; CC = clinical controls.

**Article 2: Cognitive Confidence and Inferential Confusion in Obsessive-Compulsive Disorder: Differences Across Subtypes<sup>6</sup>**

Catherine Ouellet-Courtois<sup>ab</sup> & Kieron O'Connor<sup>ac</sup>

<sup>a</sup>OCD Spectrum Study Center, Montreal Mental Health University Institute

7331 Hochelaga

Montreal (Quebec), Canada

H1N 3V2

<sup>b</sup>Université de Montréal, Psychology Department

<sup>c</sup>Université de Montréal, Psychiatry Department

2900, boul. Édouard-Montpetit

Montreal (Quebec), Canada

H3T 1J4

Correspondence concerning this article should be addressed to Catherine Ouellet-Courtois

Email: [catherine.ouellet-courtois@umontreal.ca](mailto:catherine.ouellet-courtois@umontreal.ca)

Phone: (1) 514 251 4000 ext: 3532

---

<sup>6</sup> This manuscript is under review for publication in the *International Journal of Cognitive Therapy*.

## Abstract

A lack of cognitive confidence (CC), defined as a distrust of one's attention, perception and memory, is implicated in obsessive-compulsive disorder (OCD) and could account for its core symptoms. The early research focus has been on CC in the context of checking OCD, yet research suggests that the construct may also apply to other OCD subtypes. A closely intertwined construct also implicated in OCD is inferential confusion (IC), whereby a distrust of the senses leads to an investment into imaginary possibilities. This study aimed to examine CC, as measured with the Metacognitions Questionnaire (MCQ-65), as well as IC, across OCD subtypes. A total of 128 participants with OCD completed the Vancouver Obsessional Compulsive Inventory, which was used to create OCD subtypes, the MCQ-65 and the Inferential Confusion Questionnaire – Expanded Version. TwoStep cluster analyses for CC revealed two clusters: (1) low CC/high checking/higher OCD symptoms; (2) high CC/low checking/lower OCD symptoms. The analyses for IC resulted in three clusters: (1) average IC/high “just right”/high contamination/low obsessionality; (2) high IC/ high “just right”/high obsessionality; and (3) low IC/low obsessionality/low checking. Results are discussed in terms of the heterogeneity of OCD, which highlight the need to tailor research paradigms and treatment targets to different OCD presentations.

*Keywords:* Obsessive-Compulsive Disorder; Cognitive Confidence; Inferential Confusion; OCD Subtypes

## Cognitive Confidence and Inferential Confusion in Obsessive-Compulsive Disorder: Differences Across Subtypes

Obsessive-compulsive disorder (OCD) is characterized by obsessions – defined as distressing, intrusive thoughts, images, or impulses – and/or compulsions that are often performed in order to eliminate the obsessions or to reduce anxiety (American Psychiatric Association, 2013). OCD is a highly heterogeneous disorder, yet it is often characterized by a need to repeat mental acts or behaviors. In fact, OCD compulsions generally consist of repetitive behaviors, such as counting, touching or tapping objects in a particular way, or performing mental rituals, such as mentally repeating a prayer over and over again until it "feels right" (Goodman et al., 1989). One of the most common types of compulsions is compulsive checking (Stein, Rode, Anderson, & Walker, 1997). Compulsive checking can serve different purposes, such as checking for safety (e.g., checking the stove), or checking for correctness (e.g., checking that no mistakes have been made at work). Compulsions consist of an attempt to alleviate distress, but this distress reduction negatively reinforces the compulsive behavior.

Several lines of research have examined potential memory impairment in OCD in order to explain repetitive behaviors, such as compulsions and rituals. However, research on memory in OCD has been equivocal (Abramovitch, Abramowitz, & Mittelman, 2013; Muller & Roberts, 2005; Olley, Malhi, & Sachdev, 2007), suggesting that other cognitive processes as opposed to a memory deficit may fuel compulsive and repetitive behaviors in OCD. Notably, a recent review of the literature underlined that alleged memory deficits in OCD seem to be better explained by OCD beliefs, such as a lack of confidence in memory (Ouimet, Ashbaugh, & Radomsky, 2019). In line with this conclusion, Rachman's (2002) cognitive theory of compulsive checking contends that the act of checking increases the uncertainty rather than alleviating it. It further



posits that the increased doubt that results from checking leads to further decline in memory confidence over time, thereby maintaining compulsive checking.

### **The Cognitive Confidence Hypothesis**

As a reaction to the postulation that individuals with OCD engage in repetitive behaviors because of memory deficits, for which there has been mixed evidence, several lines of research have explored the role of memory confidence. For instance, research by Hermans, Martens, De Cort, Pieters, and Eelen (2003) has supported the memory confidence hypothesis, as it was found that although individuals with OCD displayed no memory deficits when compared to healthy controls, they reported less confidence in their memory. In addition, it was demonstrated that not only individuals with OCD showed less confidence in their memory, but they also displayed a greater distrust of their perception and attention (Hermans et al., 2003; Hermans, Engelen, Grouwels, Joos, Lemmens, & Pieters, 2008). These researchers identified this more comprehensive cognitive process as low *cognitive confidence*.

A great amount of research has examined the construct of cognitive confidence in OCD, especially in the context of compulsive checking. A series of studies employing stove checking tasks have supported Rachman's (2002) model of compulsive checking, namely by showing that the more participants checked, the more their memory confidence diminished, although there were no actual changes in memory accuracy (Van den Hout & Kindt, 2003a; Van den Hout & Kindt, 2003b; Van den Hout & Kindt, 2004; Coles, Radomsky, & Horng, 2006; Radomsky, Gilchrist, & Dussault, 2006; Radomsky, Dugas, Alcolado, & Lavoie, 2014). Research has also examined the cognitive confidence hypothesis in OCD subtypes other than compulsive checking. For instance, Taylor and Purdon (2016) have examined both memory and sensory confidence in the context of OCD with contamination fears and compulsive washing. It was found that, the

longer participants washed their hands, the more their sensory -- but not memory -- confidence diminished. This suggests that OCD subtypes might respond differently to certain stimuli (e.g., contamination-related vs. checking-related), and have greater cognitive vulnerability with regard to a given cognitive domain (e.g., poorer perceptual confidence vs. memory confidence). Moreover, it is possible that different cognitive components may affect each OCD subtype differently (e.g., perceptual confidence for OCD with contaminations fears). Notably, a recent systematic review of the literature on cognitive confidence in OCD called for the need to investigate cognitive confidence across OCD subtypes, above and beyond memory confidence in compulsive checking (Ouellet-Courtois, Wilson, & O'Connor, 2018).

The construct of cognitive confidence was first developed in the context of the metacognitive model, where maladaptive beliefs that individuals hold about their own cognitions, such as a lack of cognitive confidence, are thought to underpin mental health problems (Wells, 2000). The Metacognitions Questionnaire (MCQ; Cartwright-Hatton & Wells, 1997) measures different metacognitive domains, and includes a cognitive confidence subscale (MCQ-CC), where higher scores indicate lower cognitive confidence. Hermans and colleagues (2008) found that individuals with OCD scored higher on the MCQ-CC than both clinical and healthy controls. Notably, regression analyses indicated that the MCQ-CC was a significant predictor of checking behavior, but of no other OCD behavior (e.g., washing), suggesting a unique link between checking behavior and cognitive confidence. However, Hermans and colleagues (2003) found no differences between participants with low vs. high checking symptoms on the MCQ-CC. Notably, a systematic review and meta-analysis of studies on cognitive confidence in OCD revealed that both experimental and self-report studies indicated no differences in cognitive confidence between OCD participants with checking symptoms versus

those with non-checking symptoms (Ouellet-Courtois et al., 2018). It therefore remains unclear if cognitive confidence, as measured with the MCQ-CC, is specific to checking or whether it applies as well to other OCD subtypes. In fact, the research from Taylor and Purdon (2016) suggests that other OCD subtypes (i.e., OCD with contamination fears) may also present low levels of cognitive confidence.

### **Distrust of the Senses in Inferential Confusion**

Another construct similar to cognitive confidence and that is also characteristic of OCD is distrust of the senses, one of the two components of inferential confusion. More specifically, inferential confusion is a central cognitive construct in OCD according to the Inference-Based Approach (IBA), which postulates that individuals with OCD (1) distrust their senses (e.g., “I don’t trust my memory for having turned off the stove”) and (2) over-rely on possibilities generated by their imagination (e.g., “The stove might still be on and the house will burn down”); O’Connor, Aardema, & Pélissier, 2005). O’Connor and colleagues (2005) explain that both components are difficult to delineate as they go hand in hand, such that a distrust of the senses leads to a reliance on possibilities generated by the imagination, while these feared imaginary possibilities encourage a distrust of the senses and reinforce obsessional doubt. Accordingly, factor analyses on the Inferential Confusion Questionnaire (ICQ) have indicated that inferential confusion is unidimensional (Aardema, Wu, Careau, O’Connor, Julien, & Dennie, 2010). There is strong evidence indicating an association between inferential confusion and OCD symptoms (Aardema et al., 2005a; Aardema, O’Connor, & Emmelkamp, 2006; Aardema, Wu, Careau, O’Connor, Julien, & Dennie, 2010; Yorulmaz, Gençöz, & Woody, 2010), and that inferential confusion predicts OCD symptoms (Aardema, Moulding, Radomsky, Doron, Allamby, & Souki, 2013; Goods, Rees, Egan, & Kane, 2014; Wu, Aardema, & O’Connor, 2009).

A distrust of the senses is core to both low cognitive confidence and inferential confusion, suggesting that the two constructs may be intrinsically intertwined. However, as noted elsewhere, the two constructs differ conceptually (O'Connor, Ouellet-Courtois, & Aardema, 2018). While inferential confusion pertains more to a state construct (e.g., "I don't trust what I see and hear as I am locking the door"), low cognitive confidence rather refers to a trait construct (e.g., "I have a bad memory, so I'll probably forget whether I've locked the door or not"). Moreover, inferential confusion involves doubts directed more toward the outside world ("I don't trust the information my senses are telling me, I don't trust the information that is out there"), while cognitive confidence is more directed towards oneself ("I don't trust my cognitive faculties"). Although inferential confusion and cognitive confidence have some conceptual differences, they both underline a general lack of confidence in both cognitive faculties and senses. Therefore, the joint investigation of low cognitive confidence and inferential confusion may prove to be helpful in capturing a comprehensive portrait of the tendency to distrust one's senses and cognitive faculties in OCD.

### **Objectives and Hypotheses**

Although cognitive confidence has received a great deal of empirical attention, no research has systematically investigated its presence across OCD subtypes. In fact, the review by Ouellet-Courtois and colleagues (2018) called for the need to systematically examine cognitive confidence across different OCD subtypes, above and beyond those with checking compulsions. In this study, we therefore aimed to compare cognitive confidence as well as inferential confusion across different OCD presentations using cluster analysis. As we were interested in exploring how these constructs relate to different OCD presentations, we conducted a SPSS

TwoStep cluster analysis. The TwoStep procedure is meant to provide a tool that determines the number of clusters based on categorical and/or continuous data (Norusis, 2010), as opposed to hierarchical cluster analyses, which require theory-driven decisions about the number of clusters prior to conducting the analyses. Considering the exploratory nature of our examination of cognitive confidence and inferential confusion across OCD subtypes, the SPSS TwoStep cluster approach seemed most appropriate.

The goals of the present study were threefold. First, we aimed to examine whether cognitive confidence and inferential confusion differ across OCD subtypes, in order to see if the cognitive confidence hypothesis applies as well to other OCD subtypes as it appears to relate to checking. Second, we aimed to examine whether greater OCD symptomatology is associated with lower cognitive confidence and higher inferential confusion. Third, considering that beliefs related to OCD, such as an inflated responsibility for harm, appear to affect cognitive confidence (for a review, see Ouimet et al., 2019), we also examined which OCD beliefs predict cognitive confidence and inferential confusion.

It was hypothesized that (1) cluster analyses will reveal different OCD profiles with regard to cognitive confidence and inferential confusion; (2) there would be significant positive correlations between OCD symptoms, cognitive confidence (i.e., higher MCQ-CC scores indicate lower cognitive confidence) and inferential confusion; (3) participants with OCD symptoms of greater severity, as determined by a median split on a measure of OCD symptomatology, would display lower cognitive confidence and higher inferential confusion than participants with less severe OCD; and that (4) specific OCD beliefs, as measured by the Obsessional Belief Questionnaire (OBQ-44; Obsessive Compulsive Cognitions Working Group, 2003; 2005), would predict cognitive confidence and inferential confusion.

## Method

### Participants

A total of 128 participants (males = 63; females = 65) with a primary diagnosis of OCD were recruited from the OCD Spectrum Study Centre at the Montreal Mental Health University Institute (please refer to Table 1 for means and standard deviations for demographic variables and questionnaires). All participants took part in a randomized-controlled trial of cognitive therapies for OCD, and the data analyzed in this study consists of baseline data collected in the context of this trial. Participants met diagnostic criteria for OCD (Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition [DSM-IV-TR]; American Psychiatric Association, 2000) and were assessed before undergoing treatment. The Structured Clinical Interview for DSM-IV (SCID; Spitzer, Williams, Gibbon, & First, 1997) was used to establish diagnoses and the severity of OCD symptoms was rated using the Yale-Brown Obsessive Compulsive Scale (Y-BOCS; Goodman et al., 1989). Exclusion criteria included (1) current substance abuse; (2) current or past schizophrenia; (3) current or past bipolar disorder; (3) current or past organic mental disorder; (3) comorbid diagnosis on axis I or II requiring treatment that could significantly affect compliance with the current treatment plan.

### Measures

**Obsessional Belief Questionnaire (OBQ-44; Obsessive Compulsive Cognitions Working Group, 2003; 2005).** This 44-item scale is commonly used to assess beliefs and appraisals specific to OCD. The measure includes three subscales that assess different types of beliefs (Responsibility for Harm and Threat Overestimation, Perfectionism and Intolerance for Uncertainty, and The Importance of and Control Over Thoughts), with items scored on a 7-point Likert-type scale.

**Yale-Brown Obsessive-Compulsive scale (Y-BOCS;** Goodman et al., 1989). This 10–item clinician-rated scale assesses the severity of obsessions and compulsions independent of the type or number of symptoms. Each item is rated from 0 (no symptoms) to 4 (extreme symptoms), yielding a total possible score range from 0 to 40. The scale includes questions about the amount of time the patient spends on obsessions, how much impairment or distress they experience, and how much resistance and control they have over these thoughts. The same types of questions are asked about compulsions (e.g., time spent, interference, etc.). This measure was used to evaluate OCD severity.

**Vancouver Obsessional Compulsive Inventory (VOCI;** Thordarson et al., 2004). The VOCI is a 55-item self-report questionnaire that assesses OCD symptoms along a 5-point scale from “not at all” to “very much”. The measure contains six subscales, including checking, contamination, obsessions, hoarding, “just right”, and indecisiveness. This measure was used to determine four OCD subtypes: checking OCD, contamination OCD, ordering and arranging OCD (“just right”) and obsessional OCD (often involves obsessions of a sexual, religious, aggressive or somatic nature; sample items include : “I am often upset by my unwanted thoughts of using a sharp weapon”; “I repeatedly experience the same upsetting thought or image about death; I repeatedly experience upsetting and unwanted immoral thoughts”). However, the hoarding and indecisiveness subscales were not utilized to classify subtypes in the interest of parsimony, and as previous research has identified four OCD symptom domains that correspond to the four aforementioned subtypes (Bloch, Landeros-Weisenberger, Rosario, Pittenger, & Leckman, 2008; Leckman et al., 1997; Summerfeldt, Richter, Antony, & Swinson, 1999; Wu & Carter, 2008; Schulze, Kathmann, & Reuter, 2018). The VOCI has excellent convergent and divergent validity (Thordarson et al., 2004).

**Beck Anxiety Inventory (BAI; Beck & Steer, 1990).** The BAI is a 21-item self-report questionnaire that lists symptoms of anxiety. Participants are asked to rate how much each symptom has bothered them in the past week. The symptoms are rated on a four-point scale, ranging from “not at all” (0) to “severely” (3). The instrument has excellent internal consistency ( $\alpha = .92$ ) and high test–retest reliability ( $r = .75$ ; Beck & Steer, 1990). This measure was used to have an index of general trait anxiety.

**Beck Depression Inventory-II (BDI-II; Beck, Steer, Ball, & Ranieri, 1996).** This is a 21-item self-report questionnaire measuring the severity of depression. Each item is rated on a 4-point Likert-scale ranging from 0 to 3. The total score, ranging from 0 to 63, is computed by adding the item scores, with higher scores reflecting more severe depressive symptomatology. This measure was utilized to have a depression index.

**Metacognitions Questionnaire 65-items (MCQ-65; Cartwright-Hatton & Wells, 1997).** This measure contains five subscales measuring five dimensions of metacognition including: 1) positive beliefs about worry; 2) negative beliefs about worry concerning uncontrollability and danger; 3) cognitive confidence; 4) beliefs about the need to control thoughts; and 5) cognitive self-consciousness. Higher scores on this measure indicate more problematic metacognitions. This scale has demonstrated good internal consistency, convergent validity and moderate test–retest reliability. For the purpose of this study, only scores on the cognitive confidence subscale (MCQ-CC) were used.

**Inferential Confusion Questionnaire-Expanded Version (ICQ-EV; Aardema et al., 2010).** This is a 30-item self-report questionnaire measuring two factors, namely (1) an individual’s tendency to distrust his/her senses and (2) a tendency to rely on one’s imagination. Items are rated on a 6-point Likert scale ranging from “strongly disagree” to “strongly agree”.



Internal consistency has been shown to vary between  $\alpha = .96 - .97$  in non-clinical samples (Aardema et al., 2010).

## **Procedure**

In the context of the aforementioned randomized-controlled trial, participants provided informed consent and completed a battery of questionnaires and interviews during their baseline assessment. For the purpose of the present study, anonymized data were extracted for the measures outlined above, which were completed by the participants at baseline, as well demographic information (i.e., age, gender, level of education, and ethnicity). This project received ethical approval from the ethics committee at the mental health hospital where the study was conducted.

## **Results**

### **Hypothesis 1: Differences in Cognitive Confidence and Inferential Confusion Across OCD**

#### **Subtypes**

To create profiles of individuals with OCD who are more susceptible to display low cognitive confidence, TwoStep cluster analyses were performed, using the VOCI subscales (i.e., checking, contamination, obsessions, and “just right”) and the MCQ-CC as continuous variables. The analyses yielded a two-cluster model of fair cluster quality with a size ratio of 1.74. The smallest cluster size was of 36.5% ( $n = 46$ ), while the largest cluster size was of 63.5% ( $n = 80$ ). An examination of the cluster predictors revealed that the clusters were essentially created based on the VOCI *checking* subscale. The “*just right*” VOCI subscale was the second most important predictor of cluster assignment. The clusters that emerged revealed two profiles: the first cluster revealed higher MCQ-CC scores (lower cognitive confidence) and higher scores on all VOCI subscales, with particularly higher scores on the *checking* and “*just right*” subscales than in the

second cluster, again underlining that cluster membership was mostly determined by these two variables. The second cluster presented an almost identical pattern as the first cluster in terms of the respective weight of each VOCI subscales, yet with much lower scores on the *checking* subscale than in the first cluster. Moreover, scores on all VOCI subscales were much lower in the second cluster, along with lower MCQ-CC scores, when compared to the first cluster. In both clusters, the higher VOCI scores were on the “*just right*” and the *contamination* subscales. The clusters for cognitive confidence are depicted in Figure 1, and the results of a multivariate analysis of variance (MANOVA) between clusters on all variables of interest are displayed in Table 2.

Linear regression analyses were performed using the “Enter” method in SPSS, with the *checking*, *contamination*, *obsessions*, and “*just right*” VOCI subscales as predictors and the MCQ-CC as the dependent variable. The analyses generated only one model including all dependent variables that were entered. This model was statistically significant and accounted for 14.3 % of the variance in the MCQ-CC score  $F(4, 121) = 5.05, p < .001$ . More specifically, the *checking* and *obsessions* subscales added statistically significantly to the prediction,  $p < .05$ .

The same analyses were performed to examine inferential confusion, using the ICQ-EV, across OCD subtypes. TwoStep cluster analyses, using the four VOCI subscales and the ICQ-EV total score as continuous variables, revealed a three-cluster model of fair cluster quality, with a size ratio of 2.67. The smallest cluster size was of 19.1% ( $n = 21$ ), while the largest cluster size was of 50.9% ( $n = 56$ ). The VOCI *obsessions* subscale emerged as the most significant cluster predictor, and the VOCI *checking* subscale as the second most significant predictor. The clusters pointed to three profiles: the first cluster revealed high inferential confusion scores and high scores on the “*just right*” and *contamination* subscales, but very low scores on the *obsessions*

subscale. The second cluster included the highest scores of inferential confusion, along with high scores on the *obsessions* and “*just right*” subscales. Finally, the third cluster (30%;  $n = 33$ ), presented the lowest inferential confusion scores, along with higher scores on the “*just right*” and *contamination* subscales and very low scores on the *obsessions* and *checking* subscales. Please refer to Figure 2 for a depiction of the clusters for inferential confusion. The MANOVA results to examine scores between clusters on variables of interest are shown in Table 3.

Linear regression analyses were also performed to examine which OCD subtypes are more likely to predict inferential confusion. Again, the *checking*, *contamination*, *obsessions*, and “*just right*” VOCI subscales were entered as predictors and the ICQ-EV total score as the dependent variable, which yielded one model including all dependent variables entered. This model was statistically significant and accounted for 36.1 % of the variance in the ICQ-EV score  $F(4, 105) = 14.83, p < .001$ . More specifically, the *checking*, *obsessions* and “*just right*” subscales came out as statistically significant predictors,  $p < .05$ .

### **Hypothesis 2: Correlations Between OCD Subtype Symptoms, Cognitive Confidence, and Inferential Confusion**

In order to test this hypothesis, Pearson correlation coefficients were computed between scores on the four VOCI subscales, the ICQ-EV, and the MCQ-CC (see Table 4).

Both the MCQ-CC and ICQ-EV showed significant positive correlations with the *checking*, *obsessions*, and “*just right*” subscales of the VOCI ( $p < .01$ ), but no significant correlations were found with the *contamination* subscale ( $p > .05$ ). Moreover, the MCQ-CC and the ICQ-EV were positively correlated ( $p < .01$ ).

### **Hypothesis 3: OCD Symptom Severity, Cognitive Confidence, and Inferential Confusion**

To examine this hypothesis, a median split was performed on the Y-BOCS total score in order to differentiate between participants with less vs. more severe symptoms of OCD. A cut-off score of 26 was established. A total of 69 individuals were classified as OCD participants with less severe symptoms (Y-BOCS total score under 26), while the remaining 59 individuals were classified as OCD participants with more severe symptoms (Y-BOCS total scores of 26 or higher).

A one-way ANOVA was performed on the MCQ-CC and on the ICQ-EV in order to examine differences between less vs. more severe OCD symptoms. There were no significant differences between OCD participants with less severe symptoms and those with more severe symptoms on the MCQ-CC,  $F(1,126) = .589, p = .444$ . Similarly, there were no significant differences on the ICQ-EV between OCD participants with less vs. more severe symptoms,  $F(1,109) = 1.09, p = .298$ .

#### **Hypothesis 4: OCD Beliefs Predicting Cognitive Confidence and Inferential Confusion**

In order to test which OCD beliefs, as measured by the OBQ-44, predict cognitive confidence, linear regression analyses were conducted with the three OBQ-44 subscales (Responsibility for Harm and Threat Overestimation, Perfectionism and Intolerance for Uncertainty, and The Importance of and Control Over Thoughts) entered as predictors and the MCQ-CC score as the dependent variable, which yielded one model including all dependent variables entered. This model was statistically significant and accounted for 24.9 % of the variance in the MCQ-CC score  $F(4, 105) = 12.71, p < .001$ . More specifically, the *Importance of and Control Over Thoughts* subscale came out as a statistically significant predictor ( $p < .05$ ), and the *Responsibility for Harm and Threat Overestimation* subscale was marginally significant ( $p = .087$ ).

The same linear regression analyses were conducted for inferential confusion: the three OBQ-44 subscales were again entered as predictors and the ICQ-EV score was entered as the dependent variable. This produced one statistically significant model that included all dependent variables entered and accounted for 38.2 % of the variance in the ICQ-EV score  $F(3, 100) = 22.2, p < .001$ . The *Importance of and Control Over Thoughts* subscale came out as a statistically significant predictor ( $p < .05$ ), as well as the *Responsibility for Harm and Threat Overestimation* subscale ( $p < .001$ ). Please refer to Table 5 for all values pertaining to the linear regressions.

### **Discussion**

Different OCD profiles have emerged with regard to endorsement of low cognitive confidence and inferential confusion. These results suggest that cognitive confidence and inferential confusion are likely to be manifested differently depending on the clinical presentation of OCD. Our results demonstrate that cognitive confidence and inferential confusion appear to be relevant to different constellations of OCD symptoms grouped together. Therefore, our results speak to the clinical reality of OCD. Considering the heterogeneity of OCD and the fact that an individual may present with a collection of OCD symptoms (e.g., have both checking and contamination obsessions), it is logical that the tendency to lack confidence in one's cognitive abilities or to distrust the senses presents itself differently across individuals.

With regard to cognitive confidence, only two profiles emerged – one profile was characterized by overall greater OCD severity paired with lower cognitive confidence. Although all scores of OCD symptoms were more elevated for this cluster, the checking and “just right” indices were particularly elevated when compared to the second cluster. This suggests that a typical profile of individuals more likely to display low cognitive confidence may involve greater checking and “just right” symptoms. In addition, our results demonstrated that the

obsessions subscale was the factor that was the less likely to determine cluster membership, indicating an almost even representation of this subtype across the clusters. Our results also suggest that the construct of cognitive confidence seems to be less relevant to this specific subtype.

On the other hand, there were more diverse profiles for inferential confusion, with three clusters that emerged. One profile showed the highest inferential confusion endorsement along with an OCD presentation where obsessionality and “just right” feelings prevail. A second profile revealed also high inferential confusion endorsement, with the predominance of contamination and “just right” feelings, yet with the very low presence of the obsessional profile. Finally, a third profile appeared, which demonstrated the lowest inferential confusion endorsement along with overall low OCD symptoms, in which the contamination profile prevailed along with particularly low checking scores. It is interesting that participants with different scores on the VOICI subscales showed low, average, and high scores on the ICQ-EV, indicating that inferential confusion offers a greater breadth of OCD profiles and taps into a construct distinct from cognitive confidence.

The fact that there was less diversity of profiles for cognitive confidence could have been expected, considering that the cognitive confidence items of the MCQ-65 tap more into confidence in memory and therefore might speak more to a certain type of OCD (i.e., checking). On the other hand, there was a greater diversity of profiles for inferential confusion. This suggests that inferential confusion, as captured by the ICQ-EV, may be more likely to represent an overall OCD cognitive tendency or a general way of relating to one’s internal and external experiences, as opposed to a depiction of a distrust of a specific cognitive domain that is more likely to be tied to a given subtype, as seen in the MCQ-65 (e.g., “I have little confidence in my

memory for actions”.) Notwithstanding these differences and the fact that the two constructs produced different sets of clusters, the two constructs were found to be strongly associated, underlining the fact that they are still closely intertwined.

Moreover, the “just right” feelings appeared to be relevant to both low cognitive confidence and inferential confusion and came out as a predictor of inferential confusion endorsement. Individuals with OCD with this subtype (also associated with symmetry/ordering) experience feelings that something is not quite right or incomplete (i.e., “not just right experiences”; NJREs) and this overwhelming sense of doubt leads to repetitive behaviors. Common triggers for the “just right” subtype implicate the senses, which fuel the need to achieve a feeling of completeness to terminate a compulsion (e.g., after a person *sees* that his pen is not in “quite the right place” on the table, he might replace it repeatedly until the feeling of incompleteness is gone; after *touching* a book, a person may feel a sudden need to touch it repeatedly until the tension goes away). Summerfeldt (2007, 2004) conceptualized NJREs as a sensory-affective dysregulation whereby individuals with OCD lack the ability to use sensory experience to guide behavior. Therefore, it is possible that OCD individuals with NJREs are more likely to distrust their senses and cognitive faculties and thus fail to rely on their memory, perception or attention to judge whether to stop a behavior or not. Furthermore, the underlying motivational factor for compulsions of symmetry and ordering associated with the “just right” subtype seems to be different from that of other forms of OCD, as it involves a need to eliminate a sense of incompleteness rather than a fear of harm or of a catastrophic consequence (McKay et al., 2004). Therefore, this subtype may require a more tailored treatment, and our results suggest that cognitive confidence and inferential confusion could prove to be important therapeutic targets for this OCD subtype.

## **Factors Influencing Cognitive Confidence and Inferential Confusion**

In addition, the checking and obsessions subscales both emerged as significant predictors of low cognitive confidence and high inferential confusion. Our results with regard to checking are in line with those of Hermans and colleagues (2008), who found that cognitive confidence was a significant predictor of checking behavior and support the breadth of literature documenting a link between checking and memory distrust. On the other hand, the finding that obsessionality (e.g., obsessions with sexual, religious or aggressive themes) was predictive of cognitive confidence and inferential confusion is less intuitive yet interesting. Considering that individuals with the obsessional subtype are also likely to rely on rules and compulsions to eliminate their obsessions (e.g., check that they are not aroused to make sure that they are not attracted to individuals of the same gender), it is possible that a distrust of the senses and cognitive faculties may also play an important role amongst this subtype.

The fact that contamination was not associated with either cognitive confidence or inferential confusion is also intriguing, as the research by Taylor and Purdon (2016) indicated that contamination fears and compulsive washing led to lower sensory confidence. However, they also found no association between compulsive washing and memory confidence, and as previously discussed most of the MCQ-CC items relate to confidence in this specific cognitive domain. It may also be that there is a small subgroup of individuals with OCD with contamination fear that is prone to lower levels of inferential confusion, as demonstrated by our cluster analyses, and that this association is obscured when the entire groupings are collapsed. In addition, we found no differences in the extent to which individuals with more or less severe symptoms of OCD distrust their senses. This runs counter to previous research that indicated that inferential confusion tends to be higher when OCD symptoms are more severe (O'Connor &



Aardema, 2011), and that inferential confusion is a significant predictor of obsessional symptoms (Aardema, Moulding, Radomsky, Doron, Allamby, & Souki, 2013; Goods, Rees, Egan, & Kane, 2014; Wu, Aardema, & O'Connor, 2009).

However, previous research has shown that OCD beliefs (e.g., magical thinking) tend to be present across the spectrum of obsessionality, such that individuals in the general population are also likely to experience OCD-like thoughts (Einstein, & Menzies, 2006; Julien, O'Connor, & Aardema, 2007; Kingdon, Egan, & Rees, 2012). Therefore, it is possible that OCD symptom severity does not influence endorsement of either cognitive confidence or inferential confusion. Notably, previous studies have shown that dysfunctional OCD beliefs are not relevant to all individuals with OCD (Calamari, Cohen, Rector, Szacun-Shimizu, Riemann, & Norberg, 2006; Chik, Calamari, Rector, & Riemann, 2010; Taylor et al., 2006; Tolin, Woods, & Abramowitz, 2003), such that inferential confusion and cognitive confidence may be less relevant to certain individuals with OCD (e.g., those with blasphemous obsessions), and this irrespective of symptom severity. This notion was supported by our cluster analyses, which revealed certain subgroups with lower endorsement of these two constructs.

Finally, the need to control thoughts and the responsibility for harm/threat overestimation came out as important predictors of both inferential confusion and cognitive confidence, although the latter predictor was only marginally significant for cognitive confidence. This is in line with past research that found negative associations between memory confidence, the need to control thoughts and the responsibility for harm/threat overestimation (Nedeljkovic, Moulding, Kyrios, & Doron, 2009). Notably, one study examined changes in metacognition in OCD patients undergoing exposure therapy and found that changes in all metacognitive variables (including improvements in cognitive confidence) were related to improvements post-treatment

in OCD symptoms and cognitions, including the need to control thoughts and the responsibility for harm/threat overestimation (Solem, Håland, Vogel, Hansen, & Wells, 2009). Our results are also in line with the systematic review on cognitive confidence, which highlighted the finding that perceived responsibility for harm, in the context of idiosyncratic OCD situations, leads to lower cognitive confidence (Ouellet-Courtois et al., 2018).

### **Limitations, Conclusions and Future Directions**

One limitation of the current study is that cognitive confidence and inferential confusion were examined via self-report questionnaires. Measuring cognitive constructs with questionnaires is an important limitation in and of itself. Moreover, as mentioned previously, the MCQ-CC mostly captures memory confidence, such that it may not speak to OCD subtypes where perceptual, attentional or sensory confidence is more relevant. Experimental studies reproducing cognitive confidence and inferential confusion as expressed differently across OCD subtypes (e.g., memory confidence for turning off the stove; perceptual confidence for having blood on oneself) are required to further our knowledge of the role of cognitive confidence in OCD.

In support of previous research, we cannot disconfirm the importance of cognitive confidence and inferential confusion to checking and just right/orderliness. However, different profiles emerged, suggesting that the general tendency to distrust the senses and cognitive faculties is also relevant to other OCD subtypes. Both cognitive confidence and inferential confusion are not tied to OCD as they have been implicated in other mental health disorders. However, specific variants of low cognitive confidence and inferential confusion may be revealed in the context of OCD. In fact, the omission of individual patient variables in the evaluation of these constructs may result in the underestimation of their role in OCD symptoms.

This underlines the need for experimental studies with different OCD subtypes with tasks tailored to their obsessions and compulsions. In addition, it is possible that not all individuals with OCD hold negative beliefs about their cognition only but that other beliefs, such as a perceived sense of responsibility for harm or the need to control thoughts, interact with low cognitive confidence and contribute to OCD symptoms. Cognitive confidence and inferential confusion could both play an important role within cognitive-behavioral conceptualizations of OCD and therefore warrant further investigation to foster the development of improved treatments. One study found that psychoeducation and behavioural experiments targeting memory confidence did improve checking symptoms (Alcolado & Radomsky, 2016). Further systematic research on cognitive confidence and inferential confusion as personalized intervention targets is needed.

### **Role of Funding Sources**

This work was supported by the Fonds de recherche du Québec - Société Culture (FRQSC) [grant number 256181] and the Canadian Institutes of Health Research (CIHR) [grant number 93556]. FRQSC and CIHR both had no role in the study design, analysis or interpretation of the data, writing the manuscript, or the decision to submit the paper for publication.

### **Contributors**

Catherine Ouellet-Courtois designed the study, conducted the statistical analyses and drafted the manuscript. Kieron O'Connor supervised all aspects of the research. Both authors contributed to and have approved the final manuscript.

### **Acknowledgements**

We would like to thank Charles-Édouard Giguère for his help with the statistical analyses.

## References

- Aardema, F., Moulding, R., Radomsky, A. S., Doron, G., Allamby, J., & Souki, E. (2013). Fear of self and obsessionality: Development and validation of the Fear of Self Questionnaire. *Journal of Obsessive-Compulsive and Related Disorders, 2*, 306-315. DOI: 10.1016/j.jocrd.2013.05.005
- Aardema, F., O'Connor, K. P., & Emmelkamp, P. M. (2006). Inferential confusion and obsessive beliefs in obsessive-compulsive disorder. *Cognitive Behaviour Therapy, 35*, 138-147. DOI: 10.1080/16506070600621922
- Aardema, F., O'Connor, K. P., Emmelkamp, P. M., Marchand, A., & Todorov, C. (2005). Inferential confusion in obsessive-compulsive disorder: the inferential confusion questionnaire. *Behaviour Research and Therapy, 43*, 293-308. DOI: 10.1016/j.brat.2004.02.003
- Aardema, F., Wu, K. D., Careau, Y., O'Connor, K., Julien, D., & Dennie, S. (2010). The expanded version of the Inferential Confusion Questionnaire: further development and validation in clinical and non-clinical samples. *Journal of Psychopathology and Behavioral Assessment, 32*, 448-462. DOI: 10.1007/s10862-009-9157-x
- Abramovitch, A., Abramowitz, J. S., & Mittelman, A. (2013). The neuropsychology of adult obsessive-compulsive disorder: a meta-analysis. *Clinical Psychology Review, 33*, 1163-1171. DOI:10.1016/j.cpr.2013.09.004
- Alcolado, G. M., & Radomsky, A. S. (2016). A novel cognitive intervention for compulsive checking: Targeting maladaptive beliefs about memory. *Journal of Behavior Therapy and Experimental Psychiatry, 53*, 75-83. DOI: 10.1016/j.jbtep.2015.02.009

- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., Text Revision). Washington, DC: Author.
- American Psychiatric Association. (2013). Anxiety Disorders. In *Diagnostic and Statistical manual of mental disorders* (5th ed.). DOI: 10.1176/appi.books.9780890425596.dsm05
- Beck, A. T., & Steer, R. A. (1990). *Manual for the Beck Anxiety Inventory*. San Antonio, TX: Psychological Corporation.
- Beck, A. T., Steer, R. A., Ball, R., & Ranieri, W. F. (1996). Comparison of Beck Depression Inventories-I and-II in psychiatric outpatients. *Journal of Personality Assessment*, *67*, 588-597. DOI:10.1207/s15327752jpa6703\_13
- Bloch, M. H., Landeros-Weisenberger, A., Rosario, M. C., Pittenger, C., & Leckman, J. F. (2008). Meta-analysis of the symptom structure of obsessive-compulsive disorder. *American Journal of Psychiatry*, *165*, 1532-1542. DOI: 10.1176/appi.ajp.2008.08020320
- Calamari, J. E., Cohen, R. J., Rector, N. A., Szacun-Shimizu, K., Riemann, B. C., & Norberg, M. M. (2006). Dysfunctional belief-based obsessive-compulsive disorder subgroups. *Behaviour Research and Therapy*, *44*, 1347-1360. DOI: 10.1016/j.brat.2005.10.005
- Cartwright-Hatton, S., & Wells, A. (1997). Beliefs about worry and intrusions: The Meta-Cognitions Questionnaire and its correlates. *Journal of Anxiety Disorders*, *11*, 279-296. DOI:10.1016/S0887-6185(97)00011-X
- Chik, H. M., Calamari, J. E., Rector, N. A., & Riemann, B. C. (2010). What do low-dysfunctional beliefs obsessive-compulsive disorder subgroups believe?. *Journal of Anxiety Disorders*, *24*, 837-846. DOI: 10.1016/j.janxdis.2010.06.006

- Coles, M. E., Radomsky, A. S., & Horng, B. (2006). Exploring the boundaries of memory distrust from repeated checking: Increasing external validity and examining thresholds. *Behaviour Research and Therapy*, *44*, 995-1006. DOI: 0.1016/j.brat.2005.08.001
- Einstein, D. A., & Menzies, R. G. (2006). Magical thinking in obsessive-compulsive disorder, panic disorder and the general community. *Behavioural and Cognitive Psychotherapy*, *34*, 351-357. DOI: 10.1017/S1352465806002864
- First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. B. (1997). *User's guide for the Structured clinical interview for DSM-IV axis I disorders SCID-I: clinician version*. American Psychiatric Pub.
- Goodman, W. K., Price, L. H., Rasmussen, S. A., Mazure, C., Fleischmann, R. L., Hill, C. L., ... & Charney, D. S. (1989). The Yale-Brown obsessive compulsive scale: I. Development, use, and reliability. *Archives of General Psychiatry*, *46*, 1006-1011. DOI: 10.1001/archpsyc.1989.01810110048007
- Goodman, W. K., Price, L. H., Rasmussen, S. A., Mazure, C., Fleischmann, R. L., Hill, C. L., ... & Charney, D. S. (1989). The Yale-Brown obsessive compulsive scale: I. Development, use, and reliability. *Archives of General Psychiatry*, *46*, 1006-1011. DOI:10.1001/archpsyc.1989.01810110048007
- Goods, N. A. R., Rees, C. S., Egan, S. J., & Kane, R. T. (2014). The relationship between magical thinking, inferential confusion and obsessive-compulsive symptoms. *Cognitive Behaviour Therapy*, *43*, 342-350. DOI:10.1080/16506073.2014.941393
- Hermans, D., Engelen, U., Grouwels, L., Joos, E., Lemmens, J., & Pieters, G. (2008). Cognitive confidence in obsessive-compulsive disorder: distrusting perception,

- attention and memory. *Behaviour Research and Therapy*, 46, 98-113. DOI: 0.1177/1049732302238251
- Hermans, D., Martens, K., De Cort, K., Pieters, G., & Eelen, P. (2003). Reality monitoring and metacognitive beliefs related to cognitive confidence in obsessive–compulsive disorder. *Behaviour Research and Therapy*, 41, 383-401. DOI: 10.1016/S0005-7967(02)00015-3
- Julien, D., O'Connor, K. P., & Aardema, F. (2007). Intrusive thoughts, obsessions, and appraisals in obsessive–compulsive disorder: A critical review. *Clinical Psychology Review*, 27, 366-383. DOI: 10.1016/j.cpr.2006.12.004
- Kingdon, B. L., Egan, S. J., & Rees, C. S. (2012). The illusory beliefs inventory: a new measure of magical thinking and its relationship with obsessive compulsive disorder. *Behavioural and Cognitive Psychotherapy*, 40, 39-53. DOI: 10.1017/S1352465811000245
- Leckman, J. F., Grice, D. E., Boardman, J., Zhang, H., Vitale, A., Bondi, C., ... & Goodman, W. K. (1997). Symptoms of obsessive-compulsive disorder. *American Journal of Psychiatry*, 154, 911-917. DOI:10.1212/CON.0000000000000603
- 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. DOI: 10.1016/j.cpr.2004.04.003
- Muller, J., & Roberts, J. E. (2005). Memory and attention in obsessive–compulsive disorder: a review. *Journal of Anxiety Disorders*, 19, 1-28. DOI: 10.1016/j.janxdis.2003.12.001



- Nedeljkovic, M., Moulding, R., Kyrios, M., & Doron, G. (2009). The relationship of cognitive confidence to OCD symptoms. *Journal of Anxiety Disorders, 23*, 463-468. DOI: 10.1016/j.janxdis.2008.10.001
- Norušis, M. J. (2010). Chapter 16: Cluster analysis. *PASW Statistics 18 Statistical Procedures Companion* (pp. 361-391). Upper Saddle River, NJ: Prentice Hall.
- O'Connor, K., & Aardema, F. (2011). *Clinician's handbook for obsessive compulsive disorder: inference-based therapy*. Hoboken, NJ: John Wiley & Sons.
- O'Connor, K., Aardema, F., & Pélissier, M. C. (2005). *Beyond reasonable doubt: Reasoning processes in obsessive-compulsive disorder and related disorders*. John Wiley & Sons.
- O'Connor, K., Ouellet-Courtois, C. & Aaderma, F. (December 2018). Innovative cognitive-behavioural treatments for obsessive-compulsive disorder. In L. Fontenelle & M. Yucel (Eds), *A transdiagnostic diagnostic approach to obsessions, compulsions and related phenomena*, (pp. 217-228), Cambridge: Cambridge University Press. DOI 10.1017/9781108164313
- Obsessive Compulsive Cognitions Working Group. (2003). Psychometric validation of the obsessive beliefs questionnaire and the interpretation of intrusions inventory: Part I. *Behaviour Research and Therapy, 41*, 863-878. DOI: org/10.1016/S0005-7967(02)00099-2
- 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*, 1527-1542. DOI: 10.1016/j.brat.2004.07.010

- Olley, A., Malhi, G., & Sachdev, P. (2007). Memory and executive functioning in obsessive-compulsive disorder: a selective review. *Journal of Affective Disorders, 104*, 15-23.  
DOI: 10.1016/j.jad.2007.02.023
- Ouellet-Courtois, C., Wilson, S., & O'Connor, K. (2018). Cognitive confidence in obsessive-compulsive disorder: A systematic review and meta-analysis. *Journal of Obsessive-Compulsive and Related Disorders, 19*, 77-86. DOI: org/10.1016/j.jocrd.2018.08.003
- Ouimet, A. J., Ashbaugh, A. R., & Radomsky, A. S. (2019). Hoping for more: How cognitive science has and hasn't been helpful to the OCD clinician. *Clinical Psychology Review, 69*, 14-29. DOI:10.1016/j.cpr.2018.04.003
- Rachman, S. (2002). A cognitive theory of compulsive checking. *Behaviour Research and Therapy, 40*, 625-639. DOI: 10.1016/S0005-7967(01)00028-6
- Radomsky, A. S., Dugas, M. J., Alcolado, G. M., & Lavoie, S. L. (2014). When more is less: Doubt, repetition, memory, metamemory, and compulsive checking in OCD. *Behaviour Research and Therapy, 59*, 30-39. DOI: 10.1016/j.brat.2014.05.008
- Radomsky, A. S., Gilchrist, P. T., & Dussault, D. (2006). Repeated checking really does cause memory distrust. *Behaviour Research and Therapy, 44*, 305-316. DOI: 10.1016/j.brat.2005.02.005
- Schulze, D., Kathmann, N., & Reuter, B. (2018). Getting it just right: A reevaluation of OCD symptom dimensions integrating traditional and Bayesian approaches. *Journal of anxiety disorders, 56*, 63-73. DOI: 10.1016/j.janxdis.2018.04.003
- Solem, S., Håland, Å. T., Vogel, P. A., Hansen, B., & Wells, A. (2009). Change in metacognitions predicts outcome in obsessive-compulsive disorder patients undergoing

- treatment with exposure and response prevention. *Behaviour Research and Therapy*, 47, 301-307. DOI: 10.1016/j.brat.2009.01.003
- Stein, M.B., Rode, D.R., Anderson, G., & Walker, J.R. (1997). Obsessive-Compulsive Disorder in the community: An epidemiologic survey with clinical appraisal. *American Journal of Psychiatry*, 154, 1120-1126. DOI: 10.1176/ajp.154.8.1120
- Summerfeldt, L. J. (2007). Treating incompleteness, ordering, and arranging concerns. In M. M. Antony, C. Purdon, & L. J. Summerfeldt (Eds.), *Psychological treatment of obsessive-compulsive disorder: Fundamentals and beyond*. Washington, DC: American Psychological Association.
- Summerfeldt, L. J., Richter, M. A., Antony, M. M., & Swinson, R. P. (1999). Symptom structure in obsessive-compulsive disorder: a confirmatory factor-analytic study. *Behaviour Research and Therapy*, 37, 297-311. DOI: 10.1016/S0005-7967(98)00134-X
- Summerfeldt, L.J. (2004). Understanding and treating incompleteness in obsessive-compulsive disorder. *Journal of Clinical Psychology*, 60, 1155–1168. DOI: 10.1002/jclp.20080
- Taylor, J., & Purdon, C. (2016). Responsibility and hand washing behaviour. *Journal of Behavior Therapy and Experimental Psychiatry*, 51, 43-50. DOI: 10.1016/j.jbtep.2015.12.005
- Taylor, S., Abramowitz, J. S., McKay, D., Calamari, J. E., Sookman, D., Kyrios, M., ... & Carmin, C. (2006). Do dysfunctional beliefs play a role in all types of obsessive-compulsive disorder?. *Journal of Anxiety Disorders*, 20, 85-97. DOI: 10.1016/j.janxdis.2004.11.005

- Thordarson, D. S., Radomsky, A. S., Rachman, S., Shafran, R., Sawchuk, C. N., & Hakstian, A. R. (2004). The Vancouver obsessional compulsive inventory (VOCI). *Behaviour Research and Therapy*, *42*, 1289-1314. DOI: org/10.1016/j.brat.2003.08.007
- Tolin, D. F., Woods, C. M., & Abramowitz, J. S. (2003). Relationship between obsessive beliefs and obsessive-compulsive symptoms. *Cognitive Therapy and Research*, *27*, 657-669. DOI: 10.1023/A:1026351711837
- Van den Hout, M. A., & Kindt, M. (2003a). Repeated checking causes memory distrust. *Behaviour Research and Therapy*, *41*, 301-316. DOI:10.1016/S0005-7967(02)00012-8.
- Van den Hout, M. A., & Kindt, M. (2003b). Phenomenological validity of an OCD-memory model and the remember/know distinction. *Behaviour Research and Therapy*, *41*, 369-378. DOI:10.1016/S0005-7967(02)00097-9
- Van den Hout, M. A., & Kindt, M. (2004). Obsessive-compulsive disorder and the paradoxical effects of perseverative behaviour on experienced uncertainty. *Journal of Behavior Therapy and Experimental Psychiatry*, *35*, 165-181. DOI:10.1016/j.jbtep.2004.04.007.
- Wells, A., & Cartwright-Hatton, S. (2004). A short form of the metacognitions questionnaire: properties of the MCQ-30. *Behaviour Research and Therapy*, *42*, 385-396. DOI: 10.1016/S0005-7967(03)00147-5
- Wu, K. D., & Carter, S. A. (2008). Further investigation of the Obsessive Beliefs Questionnaire: Factor structure and specificity of relations with OCD symptoms. *Journal of Anxiety Disorders*, *22*, 824-836. DOI: 10.1016/j.janxdis.2007.08.008

- Wu, K. D., Aardema, F., & O'Connor, K. P. (2009). Inferential confusion, obsessive beliefs, and obsessive-compulsive symptoms: A replication and extension. *Journal of Anxiety Disorders, 23*, 746-752. DOI: 10.1016/j.janxdis.2009.02.017
- Yorulmaz, O., Gençöz, T., & Woody, S. (2010). Vulnerability factors in OCD symptoms: Cross-cultural comparisons between Turkish and Canadian samples. *Clinical Psychology & Psychotherapy: An International Journal of Theory & Practice, 17*, 110-121. DOI: 10.1002/cpp.642

Table 1

*Demographic characteristics and OCD-related variables*

		<i>M</i>	<i>SD</i>
Age		39.17	12.84
BAI		15.34	11.18
BDI-II		16.53	11.59
Y-BOCS	<i>Obsessions</i>	12.75	3.46
	<i>Compulsions</i>	12.59	3.96
	<i>Total</i>	25.30	6.50
OBQ-44	<i>Responsibility for Harm and Threat Overestimation</i>	61.04	24.23
	<i>Perfectionism and Intolerance for Uncertainty</i>	69.69	20.37
	<i>The Importance of and Control Over Thoughts</i>	39.28	16.61
VOCI	<i>Checking</i>	11.68	7.56
	<i>Contamination</i>	18.39	13.35
	<i>Obsessions</i>	11.20	10.07
	<i>“Just right”</i>	21.41	9.87
	<i>Total</i>	80.02	31.25
MCQ-CC		22.20	7.26
ICQ-EV		111.09	34.35

*Note.* BAI = Beck Anxiety Inventory; BDI-II = Beck Depression Inventory-II; Y-BOCS = Yale-

Brown Obsessive-Compulsive Scale; OBQ-44 = Obsessional Belief Questionnaire; VOCI =

Vancouver Obsessional Compulsive Inventory; MCQ-CC = Metacognitions Questionnaire –

Cognitive Confidence Subscale; ICQ-EV = Inferential Confusion Questionnaire-Expanded

Version; *N* = 128.

Table 2

*Means and standard deviations on measures of interest for cognitive confidence clusters*

	Cluster 1	Cluster 2	<i>F</i>	<i>df</i>	Significant pairwise comparisons with Bonferroni corrections ( $p < .05$ )
	<i>M (SD)</i>				
MCQ-CC	24.41(7.31)	18.48 (5.62)	22.59*	1	Cluster 1 > Cluster 2
VOCI Checking	15.90 (5.76)	4.33 (3.68)	150.23*	1	Cluster 1 > Cluster 2
VOCI “Just right”	26.29 (8.17)	12.91 (6.12)	93.10*	1	Cluster 1 > Cluster 2
VOCI Contamination	20.49 (13.63)	14.74 (12.15)	5.61*	1	Cluster 1 > Cluster 2
VOCI Obsessions	11.93 (9.75)	9.935 (10.60)	1.14	1	-

*Note.* MCQ-CC = Metacognitions Questionnaire – Cognitive Confidence Subscale; VOCI =

Vancouver Obsessional Compulsive Inventory. \*  $p < .05$  for *F* values.

Table 3

*Means and standard deviations on measures of interest for inferential confusion clusters*

	Cluster 1	Cluster 2	Cluster 3	<i>F</i> *	<i>df</i>	Significant post hoc comparisons with Bonferroni corrections ( $p < .05$ )
	<i>M (SD)</i>					
ICQ-EV	112.46 (29.82)	132.89 (23.24)	74.33 (30.70)	27.77	2	Cluster 2 > Cluster 1 > Cluster 3
VOCI Checking	15.66 (5.89)	10.79 (6.80)	2.38 (2.77)	41.26	2	Cluster 2 > Cluster 1 > Cluster 3
VOCI "Just right"	23.00 (9.15)	23.82 (7.96)	10.67 (6.71)	19.38	2	Cluster 1 > Cluster 3; Cluster 2 > Cluster 3
VOCI Contamination	21.30 (14.70)	15.33 (9.44)	12.81 (13.05)	4.16	2	Cluster 1 > Cluster 3
VOCI Obsessions	6.00 (4.53)	25.52 (6.82)	4.19 (5.19)	142.54	2	Cluster 2 > Cluster 1; Cluster 2 > Cluster 3

*Note.* ICQ-EV = Inferential Confusion Questionnaire-Expanded Version; VOCI = Vancouver

Obsessional Compulsive Inventory. \* $p < .05$  for all *F* values.



Table 4

*Correlation matrix between the VOCI subscales, cognitive confidence and inferential confusion*

	1.	2.	3.	4.	5.	6.
1. Contamination	-					
2. Checking	.109	-				
3. Obsessionality	-.096	.050	-			
4. “Just right”	.231**	.477**	.190*	-		
5. MCQ-CC	.104	.282**	.232**	.258**	-	
6. ICQ-EV	.102	.301**	.472**	.407**	.450**	-

*Note.* MCQ-CC = Metacognitions Questionnaire – Cognitive Confidence Subscale; ICQ-EV =

Inferential Confusion Questionnaire-Expanded Version;  $N = 128$ .

\*  $p < .05$

\*\*  $p < .01$

Table 5

*Linear regression analyses of the OBQ-44 subscales as predictors of the MCQ-CC and ICQ-EV*

DV	Predictor	Standardized $\beta$	$t$	$p$
	Responsibility for Harm and Threat Overestimation	.201	1.724	.087
<u>MCQ-CC</u>	Perfectionism and Intolerance for Uncertainty	.134	1.281	.203
	The Importance of and Control Over Thoughts	.249	2.365	.020
	Responsibility for Harm and Threat Overestimation	.403	3.745	.000
<u>ICQ-EV</u>	Perfectionism and Intolerance for Uncertainty	.046	.473	.637
	The Importance of and Control Over Thoughts	.267	2.689	.008

*Note.* OBQ-44 = Obsessional Belief Questionnaire; MCQ-CC = Metacognitions Questionnaire – Cognitive Confidence Subscale; ICQ-EV = Inferential Confusion Questionnaire-Expanded Version.

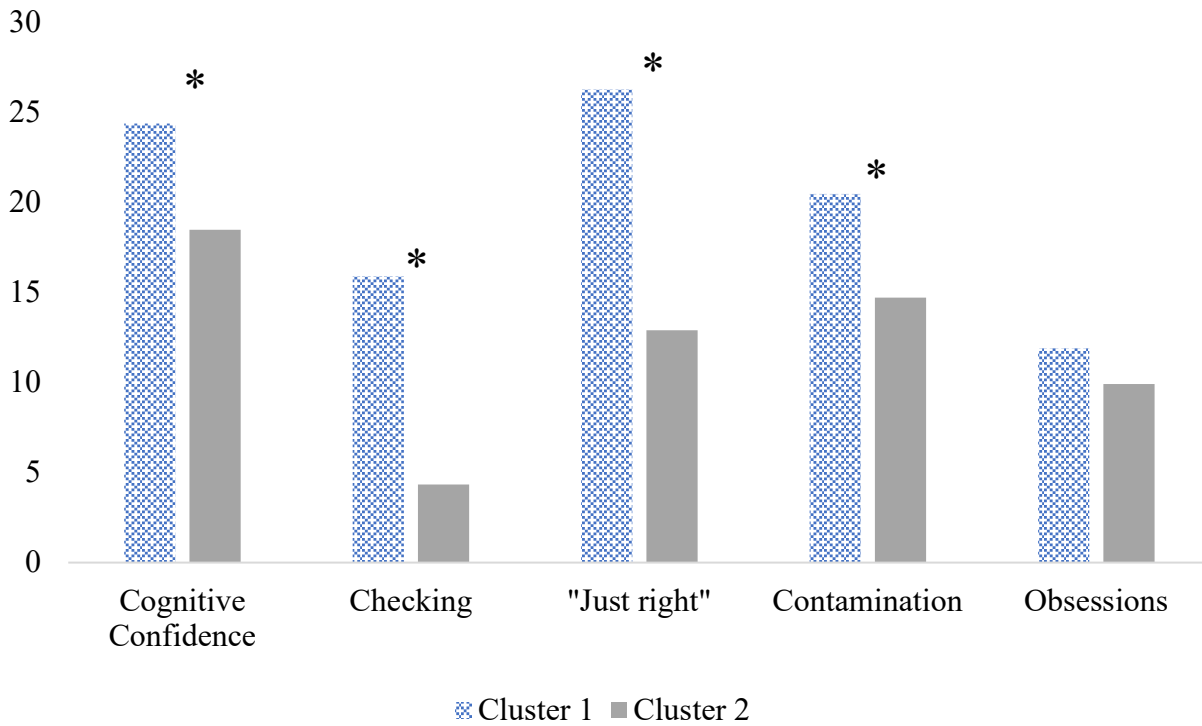
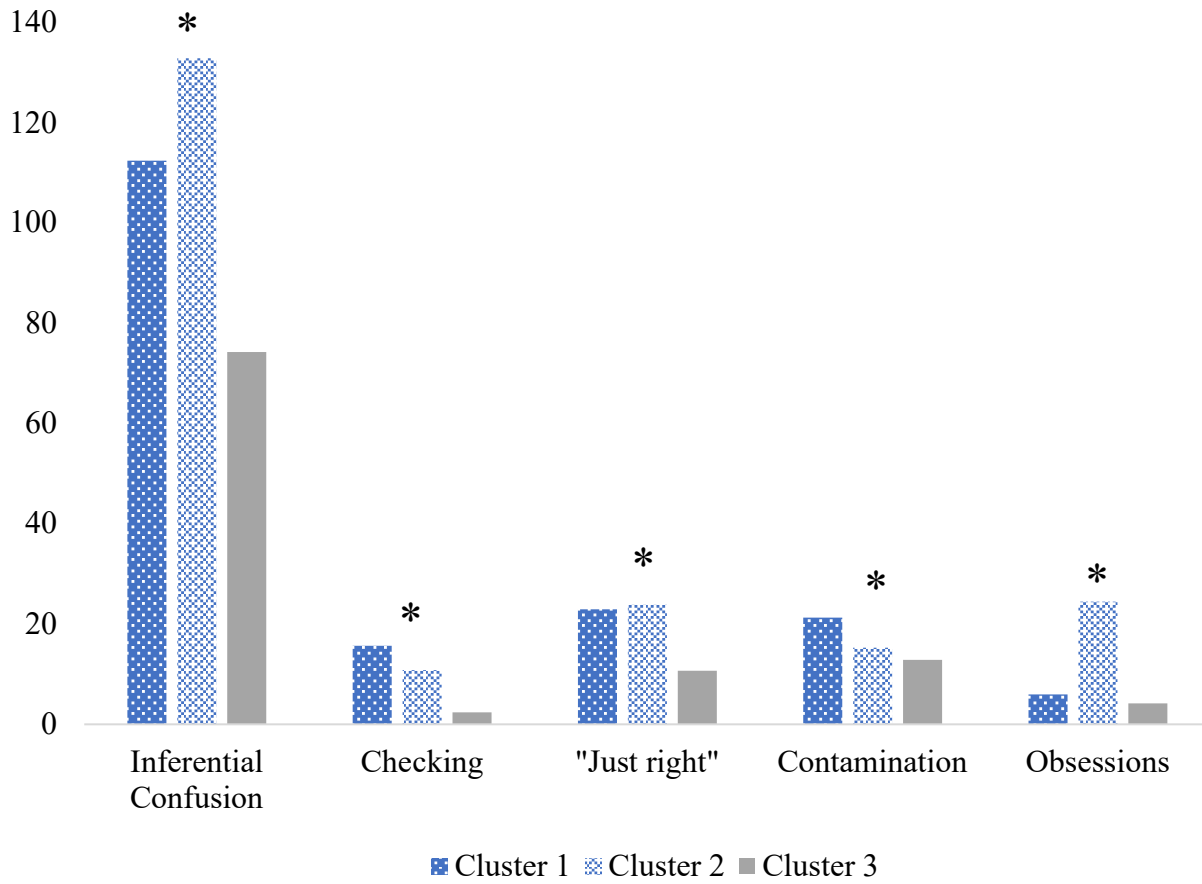


Figure 1. Clusters for cognitive confidence as measured with the Metacognitions Questionnaire - Cognitive Confidence Subscale. Asterisks indicate statistical differences between clusters at  $p < .05$ .



*Figure 2.* Clusters for inferential confusion as measured with the Inferential Confusion Questionnaire-Expanded Version. Asterisks indicate statistical differences between clusters at  $p < .05$ .

**Article 3: Reality Check: An Experimental Manipulation of Inferential Confusion in  
Eating Disorders<sup>7</sup>**

Catherine Ouellet-Courtois<sup>ab</sup> & Kieron O'Connor<sup>ac</sup>

<sup>a</sup>OCD Spectrum Study Center, Montreal Mental Health University Institute

7331 Hochelaga

Montreal (Quebec), Canada

H1N 3V2

<sup>b</sup>Université de Montréal, Psychology Department

<sup>c</sup>Université de Montréal, Psychiatry Department

2900, boul. Édouard-Montpetit

Montreal (Quebec), Canada

H3T 1J4

Correspondence concerning this article should be addressed to Catherine Ouellet-Courtois

Email: [catherine.ouellet-courtois@umontreal.ca](mailto:catherine.ouellet-courtois@umontreal.ca)

Phone: (1) 514 251 4000 ext: 3532

---

<sup>7</sup> This manuscript was submitted for publication in the *Journal of Behavior Therapy and Experimental Psychiatry*.

## Abstract

*Background and Objectives.* Inferential confusion (IC) entails confusing an imagined possibility with a sensory-based possibility, and acting upon the imagined possibility as if it was real. Although IC was formulated in the context of obsessive-compulsive disorder (OCD), this reasoning bias has shown to be relevant to other obsessive-compulsive spectrum disorders, such as eating disorders (EDs). The goal of this study was to induce IC experimentally in individuals with EDs relative to healthy controls (HC). *Methods.* Thirty-six women (ED group,  $n = 18$ ; HC group,  $n = 18$ ) were assigned to one of two experimental conditions: in the High IC condition, participants watched videos with key sequences missing – provoking a distrust of the senses and lending more space for the imagination, thus triggering IC. In the Low IC condition, participants watched videos without sequences missing. Participants completed measures of OCD and ED symptoms at baseline, post-videos, and at the end of the experiment. *Results.* Repeated-measures ANOVA indicated a trend for ED participants assigned to the High IC condition to report higher IC. These participants also neutralized more after watching ED rituals and reported elevated OCD symptoms post-experiment. *Limitations.* There was no clinical control group. *Conclusions.* These findings suggest that individuals with EDs display a greater vulnerability to IC and that they are more prone to compulsive behaviors when exposed to stimuli relevant to their obsessional themes. This investigation may foster our understanding of the relationship between EDs and OCD through the examination of cognitive factors that are implicated in both disorders.

*Keywords:* Eating Disorders; Inferential Confusion; Experimental Manipulation; OCD Spectrum

## 1. Introduction

Inferential confusion (IC) refers to a reasoning bias that implicates (1) a distrust of the senses, and (2) an investment in imaginary possibilities. IC was originally formulated in order to account for the phenomenology of obsessive-compulsive disorder (OCD), whereby individuals tend to doubt sensory-based information (e.g., “I’m not sure if I can see the dirt on my hands”), and to give credence to imagined feared scenarios (e.g., “I might contract a terrible disease”). Several studies have demonstrated an association between IC and OCD symptoms (Aardema, O’Connor, Emmelkamp, Marchand, & Todorov, 2005a; Aardema, Wu, Careau, O’Connor, Julien, & Dennie, 2010; Aardema & Wu, 2011; Paradisis, Aardema, & Wu, 2015; Wong & Grisham, 2016), and that IC predicts OCD symptoms (Aardema, Radomsky, O’Connor, & Julien, 2008).

IC is an important target in Inference-Based Therapy (IBT; O’Connor & Aardema, 2011; O’Connor, Koszegi, Aardema, Van Niekerk, & Taillon, 2009), which aims to move the individual away from investing in feared narratives (i.e., I might have contracted a terrible disease) and to bring them back to the world of the senses (e.g., I show no signs of illness). The results of a randomized-controlled trial suggested that IBT and Cognitive-Behavioural Therapy did not differ significantly in their effectiveness for treating OCD (O’Connor et al., 2005), and these results have been replicated by another research group (Visser, van Megen, van Oppen, Eikelenboom, Hoogendorn, Kaarsemaker, & van Balkom, 2015). Notably, an examination of mechanisms of change during IBT indicated that clinical improvements over the course of therapy corresponded with changes in IC (Aardema, Emmelkamp, & O’Connor, 2005b; Aardema et al., 2005a; Aardema, Wu, Careau, O’Connor, & Dennie, 2010). IC thus appears as

an important cognitive factor in the treatment of OCD.

## **1.2. Inferential Confusion in Eating Disorders**

Although the concept of IC was originally formulated in the context of OCD, research suggests that it can also be revealed in other psychopathologies with an obsessional nature (Aardema et al., 2005a; Blais, Bodryzlova, Aardema, & O'Connor, 2016; Taillon, O'Connor, Dupuis, & Lavoie, 2013). The link between OCD and eating disorders (EDs) has been repeatedly documented. OCD and EDs share many similarities, both in terms of their phenomenology and of underlying cognitive processes (Bertrand, Bélanger, & O'Connor, 2011; Hsu, Kaye, & Weltzin, 1993; Shafran, 2002).

Just as individuals with OCD, individuals with EDs also present obsessional thoughts and compulsions, yet that tap into the realm of body shape and weight. The high rate of comorbidity between OCD and EDs speaks to the overlap between the two disorders (e.g. Bellodi, Cavallini, Bertelli, Chiapparino, Riboldi, & Smeraldi, 2001; Halmi et al., 2005; Speranza, Corcos, Godart, Loas, Guilbaud, Jeammet, & Flament, 2001). Researchers have put forth the hypothesis that EDs are part of the obsessive-compulsive spectrum disorders (Hollander & Benzaquen, 1997; Hollander, Kim, Braun, Simeon, & Zohar, 2009; McElroy, Phillips, & Keck, 1994), and some others have suggested that OCD and EDs are phenotypic expressions of the same genetic vulnerability (Bellodi et al., 2001). The presence of OCD-like thinking amongst individuals with EDs has been found by numerous lines of research (e.g., Coelho, Baeyens, Purdon, Pitet, & Bouvard, 2012; Lavender, Shubert, de Silva, & Treasure, 2006). In line with the hypothesis that EDs and OCD are different expressions of the same etiological vulnerability, it is possible that both disorders display the same general cognitive processes, but that in EDs these broader beliefs are translated to the realm of food, shape and weight.



Notably, it has been postulated that IC may play an important role in EDs (Purcell-Lalonde & O'Connor, 2015). For instance, an individual with an ED who looks at herself in the mirror will not rely on her senses (e.g., “I don’t see any fat on my body”) in judging her body shape or weight, but will rely on possibility-based information from her imagination (e.g., “if I don’t get to exercise enough today I will get fat”). One study indicated that individuals with EDs score significantly higher on the Inferential Confusion Questionnaire when compared to healthy controls and that they give more importance to possibility-based information than to reality-based information when presented with ED-relevant scenarios (Wilson, Aardema, & O'Connor, 2018a). Another recent experiment demonstrated that individuals with EDs are more likely to doubt their perception (i.e, reality-based information) after engaging in repeated body checking (Wilson, Aaderma, & O'Connor, 2018b). Notably, in a trial of IBT adapted for EDs, it was found that the treatment produced significant reductions in body image disturbance and ED symptoms in a sample of individuals with bulimia nervosa (Purcell-Lalonde & O'Connor, 2015). Altogether, these findings support the idea that IC might be an important factor in the aetiology and maintenance of EDs.

### **1.3. Objectives and Hypotheses**

While there is mounting evidence for the role of IC in EDs, the current project endeavored to expand this line of research and to examine susceptibility to IC in this clinical population. No causal link has ever been established between IC and obsession-related cognitions, behaviors and symptoms. In order to have indications of such potential causality, the proposed project thus used an experimental design (Shadish, Cook, & Campbell, 2002). Moreover, considering that the transdiagnostic model of EDs posits that all ED subtypes stem

from the same core problem and that they share the same cognitive processes (Fairburn, Cooper, & Shafran, 2003), the proposed research project involved a mixed ED sample.

In the present study, IC was experimentally manipulated in order to examine susceptibility in ED and healthy individuals, as well as to examine how this susceptibility is reflected cognitively, emotionally and behaviorally. This study aimed to reproduce IC through videos depicting rituals seen in OCD and EDs, therefore reproducing the construct of IC in ways that are ecologically valid. Previous research has shown that individuals with EDs are equally susceptible to inductions of cognitive distortions involving OCD or ED-related themes (Coelho, Ouellet-Courtois, Purdon, & Steiger, 2015), suggesting a general vulnerability to obsessional material. In line with the postulation that EDs and OCD are part of the same psychopathological spectrum, we thought that it would be relevant to see if individuals with EDs only show susceptibility to IC in situations that speak to their disorder, or if they show a general susceptibility that is expressed across obsessional themes. In the High IC condition, some key sequences in the videos were missing – thus removing important visual and auditory sensory information, thereby provoking distrust of the senses and lending more space for imagination. On the other hand, the Low IC condition consisted of videos where all sequences were clearly depicted, thus leaving very little space for alternative conclusions about what might have happened in the videos.

It was hypothesized that (1) individuals with EDs assigned to the High IC condition would show more cognitive, affective and behavioral reactivity than individuals with EDs assigned to the Low IC condition, (2) individuals with EDs assigned to the High IC condition would report significantly more cognitive, emotional and behavioral reactivity than healthy controls also assigned to this experimental condition, (3) individuals with EDs assigned to the

High IC condition would show higher scores on measures of OCD and ED symptomatology at the end of the experimental session than individuals with EDs assigned to the Low IC condition, (4) individuals with EDs would report higher scores on the trait IC measure than would healthy controls, and that scores of trait IC would be stable across pre-post measurements (therefore representing trait vulnerability, as opposed to reactivity to the experimental manipulation).

## **2. Method**

### **2.1. Participants**

This study involved two groups of participants: 18 participants with a diagnosis of an ED and 18 healthy controls. Participants were recruited from the community and local mental health service centers. All participants were between 18-55 years of age. Solely female participants were recruited for this study, as EDs are much more prevalent amongst this group (Fairburn et al., 2003) and we wanted to avoid confounding gender differences. Exclusion criteria for all participants were current drug/alcohol abuse or dependence, current psychotic symptoms and a body mass index (BMI) below 13 (as a BMI below this cut-off may involve cognitive deficits influencing participants' performance in the study; Mathias & Kent, 1998). For the clinical group, comorbidities were allowed, although individuals in the ED group needed to have an ED as their primary diagnosis and have no history of or current OCD. Individuals with a comorbid primary diagnosis requiring treatment were also excluded. Please refer to Table 1 for demographic information. The diagnostic breakdown for the ED group was as follows: bulimia nervosa ( $n = 6$ ); bulimia nervosa in partial remission ( $n = 1$ ); anorexia nervosa ( $n = 4$ ); anorexia nervosa in partial remission ( $n = 2$ ); binge eating disorder ( $n = 2$ ); other specified feeding or eating disorder ( $n = 3$ ).

Table 1

*Demographic characteristics and scores on variables of interest at baseline*

	Eating Disorder Group		Healthy Control Group	
	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>
Age	27.33	11.58	28.78	8.72
BMI	25.24	10.57	26.80	5.71
BAI*	24.22	13.86	3.56	3.81
BDI-II*	22.61	14.34	4.44	5.35
EDE-Q*	3.82	1.26	.24	.22
ICQ-EV*	91.39	29.21	56.06	23.11
OCI-R*	19.17	12.73	6.50	6.48

*Note.* BAI = Beck Anxiety Inventory; BDI-II = Beck Depression Inventory-II; EDE-Q = Eating Disorder Examination - Questionnaire; ICQ-EV = Inferential Confusion Questionnaire-Expanded Version; OCI-R = Revised Obsessive-Compulsive Inventory;  $N = 36$ .

\* Indicates significant differences between groups at  $p < .05$ .

## 2.2. Experimental Videos

A total of six videos were presented to the participants. Two videos depicted OCD scenarios (a woman washing her hands; a woman locking a door), two depicted ED scenarios (a woman weighing herself before and after eating a donut; a woman weighing herself before and after exercising), and two depicted neutral scenarios (a woman replicating a drawing, a woman finding her way around a building). To induce higher levels of IC, the key sequences of the High IC condition videos (e.g., close up on hands being washed, scale indicating the woman's weight) were removed from the videos and replaced by more ambiguous sequences (e.g., seeing the

woman up on the scale but not seeing the actual weight number on the scale). As a result, less sensory (seeing, hearing) information were provided in these modified videos, thus making it more likely that the participant had to rely on her imagination to form a conclusion about what might have happened. By contrast, videos for the Low IC were highly clear and didn't leave space for ambiguity (i.e., not eliciting investment in imaginary possibilities). Three different actresses played in the videos and were dressed differently for each video, in order to avoid creating the effect of following one character in her whereabouts. The lengths of the videos for the Low vs. High IC conditions only differed by a few seconds.

## **2.3. Measures**

### **2.3.1. Trait Measures**

**Inferential Confusion Questionnaire-Expanded Version (ICQ-EV;** Aardema et al., 2010). This is a 30-item self-report questionnaire measuring the tendency to distrust the senses and to rather rely on possibility-based information from the imagination. Items are rated on a 6-point Likert-scale ranging from “strongly disagree” to “strongly agree”. Higher scores indicate an increased tendency to confuse imagined possibilities with reality. Internal consistency has been shown to vary between  $\alpha = .96 - .97$  in non-clinical samples (Aardema et al., 2010).

**The Revised Obsessive-Compulsive Inventory (OCI-R;** Foa, Huppert, Leiberg, Langner, Kichic, Hajcak, & Salkovskis, 2002). The 18-item self-report questionnaire contains six subscales: washing, checking, ordering, obsessing, hoarding, and neutralizing. The OCI-R has excellent psychometric properties (Foa et al., 2002).

**Eating Disorders Examination – Questionnaire (EDE-Q;** Fairburn & Beglin, 1994). This 28-item questionnaire is a widely used self-report measure that assesses the frequency and

severity of ED behaviors and symptoms, and contains four subscales: restraint, eating concern, shape concern and weight concern.

**Beck Anxiety Inventory (BAI;** Beck & Steer, 1990). The BAI is a 21-item self-report questionnaire that lists symptoms of anxiety. The symptoms are rated on a four-point scale, ranging from “not at all” (0) to “severely” (3). The instrument has excellent internal consistency ( $\alpha = .92$ ) and high test–retest reliability ( $r = .75$ ; Beck & Steer, 1990).

**Beck Depression Inventory-II (BDI-II;** Beck, Steer, Ball & Ranieri, 1996). This measure is one of the most widely used and empirically validated measure for assessing depressive symptoms, with 21 items rated on a 4-point Likert-scale, ranging from 0 to 3.

### 2.3.2. State measures

**Positive Affect Negative Affect Scale (PANAS;** Watson, Clark, & Tellegen, 1988). Participants were asked to evaluate their mood “right now, at this moment” by rating on a 5-point scale the extent to which they endorsed each of 20 different affective states. A total negative affect score was obtained by calculating the average of the 10 negative affective states.

**Manipulation check.** After watching each video, participants had to rate on a visual analogue scale (VAS) format of 10 cm the extent to which they thought that the woman in the video (1) lost weight after exercising (ED video 1); (2) didn’t gain weight after eating the donut (ED video 2); (3) properly washed her hands (OCD video 1); (4) properly locked the door (OCD video 2), (5) found the right room (neutral video 1); (6) succeeded at replicating a drawing (neutral video 2). Higher scores on the manipulation checks indicate greater certainty about what happened in the video, and therefore suggest lower IC.

**Inferential Confusion Questionnaire – State version (ICQ-state).** After watching each video, participants were asked to rate three items derived from the ICQ-EV and adapted for each

video using a VAS scale of 10 cm, in order to have an index of state IC. For instance, for one of the ED videos, the three items were as follows: To what extent do you feel like your imagination can make you lose confidence in what you perceived in the video? To what extent do you doubt that the woman has *not* gained weight? Do the possibilities you've imagined feel more real to you than what you saw in the video?.

**State measure of compulsions.** After watching each video, participants provided VAS ratings of their urge to perform three compulsive behaviors. The three items were adapted for each video (for example, for one of the ED videos: If you were the person in the video, to what extent would you want to follow some kind of rule to make sure that you won't put on weight?; If you were the person in the video, to what extent would you want to perform some kind of ritual to make sure that you won't put on weight?; If you were the person in the video, to what extent would you want to check that you haven't put on weight?).

**Behavioral measure (neutralization).** After watching each video, the experimenter asked the participant:

“Sometimes people tell us that they found it distressing to watch the video, and they want to try to neutralize or reduce the effects of having watched it. For example, sometimes people say that they want to make sure that their weight hasn't changed, or do something to make sure that their hands are clean. Is there anything you have an urge to do having watched the video?”

## **2.4. Procedure**

Upon arrival at the experimental setting, participants provided informed consent and filled out baseline measures (PANAS, ICQ, OCI-R, EDE-Q, BAI, BDI-II). Next, study participants were randomly assigned to one of two experimental conditions: High IC vs. Low IC, and watched the six videos. The order of presentation of all six videos was counterbalanced across participants. As mentioned previously, three types of scenarios (OCD, ED, neutral), with two videos for each scenario type, were presented to all participants.

After watching each video, participants completed a set of state measures (manipulation check, PANAS, personal narrative, ICQ-state and State Measure of Compulsions). The experimenter then provided the neutralization instructions and recorded whether neutralization took place. After participants watched all videos, participants completed again a battery of questionnaires (ICQ, OCI-R, EDE-Q). In addition, selected modules (substance abuse and dependence, psychotic symptoms, EDs, OCD) of the Structured Clinical Interview for DSM-5 (SCID-5; First, Williams, Karg, & Spitzer, 2015) were used to evaluate inclusion and exclusion criteria. Finally, participants' weight and height were taken. Upon study completion, participants were debriefed about the purpose of the study and were provided with a \$30 honorarium. This project received ethical approval from the institutional research committee at the hospital where the study was conducted.

## **2.5. Statistical Analyses**

The study entailed a 2 (High IC, Low IC) X 3 (OCD, ED, neutral video type) X 2 (ED group, healthy control group) randomized-group design. To detect a medium-sized effect, at a power of .8 and an alpha of .05, using repeated-measures, within-between interaction analyses of variance (ANOVA), a total sample size of 36 participants (9 participants per group and condition) was needed. Sample size calculations were performed using G\*Power (Faul, Erdfelder, Lang, & Buchner, 2007). The power level was chosen based on another experimental study using a similar design (Coelho, Carter, McFarlane, & Polivy, 2008).

Planned comparisons were utilized to examine differences across groups and conditions. Bonferroni corrections were used for contrasts between groups and time points to control for multiple comparisons. When there were violations of sphericity, Greenhouse-Geisser was used. SPSS Statistics (Version 25) was used for all analyses.



### 3. Results

#### 3.1. Manipulation Check

A repeated-measures ANOVA was performed on participants' ratings on the manipulation checks, with scores across the six videos entered as the dependent variable, and condition as the between-subjects variable. There were significant differences in manipulation check ratings between condition, indicating that the Low Inferential Condition ( $M = 75.01$ ,  $SD = 12.86$ ) produced more certainty about what happened in the videos than the High Inferential Condition ( $M = 61.77$ ,  $SD = 12.86$ ),  $F(1, 34) = 9.55$ ,  $p < .004$ . The interaction between video and condition did not reach significance,  $p < .05$ .

#### 3.2. Reactivity to the Experimental Manipulation

Three-way repeated-measures ANOVAs with video type as the within-subject factor and condition and group as the between-subject factors were performed to examine cognitive, emotional and behavioral reactivity to the experimental manipulation. Scores of all six videos were collapsed according to video type (i.e., ED, OCD, neutral).

**3.2.1. State inferential confusion (cognitive reactivity).** There was a trend for a group by condition interaction,  $F(1, 32) = 2.97$ ,  $p = .095$ ,  $\eta^2 p = .085$ . Independent sample t-tests were conducted to examine this interaction, which revealed that ED participants assigned to the High Inferential Condition had significantly higher ICQ-state scores across video types ( $M = 34.17$ ,  $SD = 18.72$ ) than ED participants assigned to the Low Inferential Condition ( $M = 20.92$ ,  $SD = 18.72$ ),  $t(34) = 2.12$ ,  $p = .004$ ), as well as compared to control participants assigned to the High Inferential Condition ( $M = 19.56$ ,  $SD = 18.72$ ),  $t(34) = 2.34$ ,  $p = .025$ ). Please refer to Figure 1.

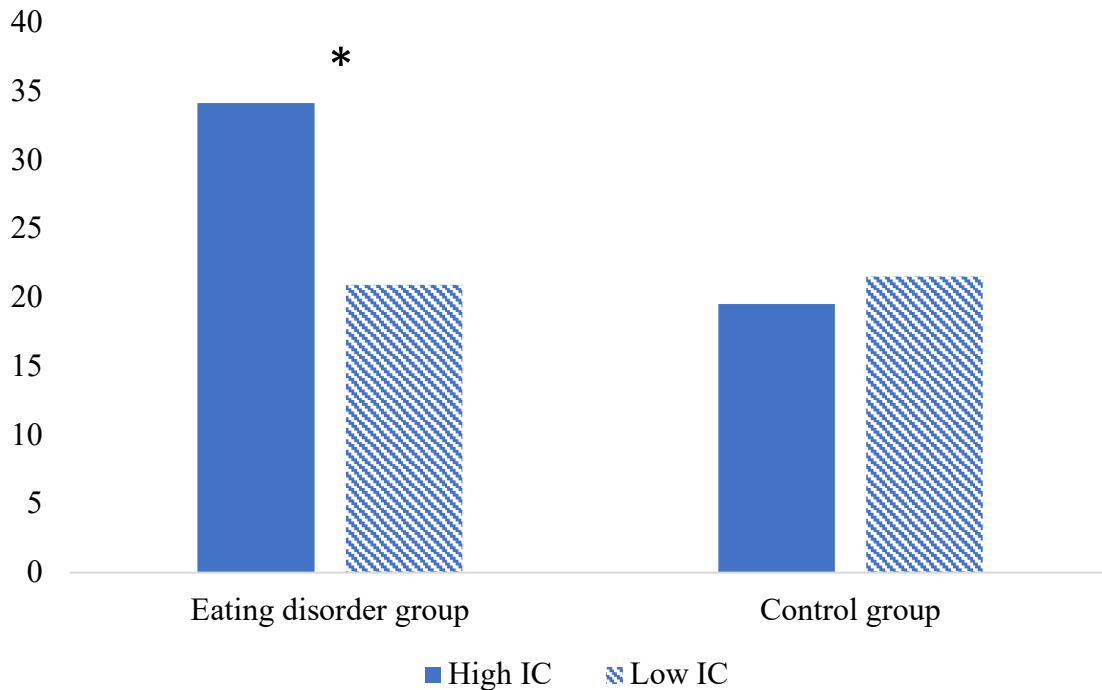


Figure 1. State inferential confusion scores. Asterisks indicate significant differences between conditions at  $p < .05$ .

**3.2.2. Negative affect (emotional reactivity).** There was a main effect of video type,  $F(2, 31) = 12.272, p = .000, \eta^2_p = .442$ , as well as a main effect of group,  $F(1, 32) = 16.65, p = .000, \eta^2_p = .342$ , which were qualified by a video type by group interaction,  $F(2, 31) = 8.234, p = .001, \eta^2_p = .347$ . Independent sample t-tests using a Bonferroni correction ( $p < .0167$ ) were conducted to examine this interaction, which revealed that ED participants across experimental conditions had significantly higher negative affect ( $M = 2.39, SD = 1.11$ ) after watching the ED videos than controls participants ( $M = 1.19, SD = .22, t(34) = 4.88, p = .000$ ). ED participants also demonstrated significantly higher negative affect ( $M = 1.30, SD = .28$ ) following the presentation of the neutral videos than controls participants ( $M = 1.08, SD = .13, t(34) = 3.05, p = .008$ ).

**3.2.3. State compulsions (behavioral reactivity).** There was a trend for a main effect of group,  $F(1, 31) = 3.87, p = .058, \eta^2_p = .111$ , with ED participants ( $M = 38.54, SD = 22.90$ ) showing a greater desire to engage in compulsive behaviors following video presentations across conditions and video types than control participants ( $M = 21.60, SD = 22.90$ ).

A significant group by video type interaction emerged  $F(2, 31) = 13.218, p = .000, \eta^2_p = .460$ . Paired t-tests (using the Bonferroni correction) demonstrated that for ED group, the ED videos led to significantly higher state compulsions scores ( $M = 56.47, SD = 31.50$ ) than for the control participants, ( $M = 9.59, SD = 15.67$ ),  $t(34) = 5.65, p = .000$ . ED participants also displayed significantly higher state compulsion scores ( $M = 40.24, SD = 21.48$ ) following the presentation of the neutral videos than controls participants ( $M = 22.27, SD = 19.06$ ),  $t(34) = 2.67, p = .012$ ).

**3.2.4. Neutralization (behavioral reactivity).** Significantly more ED participants neutralized after watching the video of the woman weighing herself before and after eating a donut in the High IC condition (27.80 %) than did ED participants in the Low IC condition (11.11 %), or than controls assigned to the High IC condition (0 %),  $\chi^2 = 8.69 (N = 36, df = 1), p = .003$ . Similarly, significantly more ED participants assigned the High IC condition neutralized after watching the video of the woman weighing herself before and after exercising (16.70 %) than did ED participants in the Low IC condition (5.60 %), or than controls assigned to the High IC condition (0 %),  $\chi^2 = 4.50 (N = 36, df = 1), p = .034$ . No significant effect emerged with regard to neutralization for all other videos,  $p$ 's > .05. See Figure 2 for a depiction of neutralizing behaviors for the ED videos.

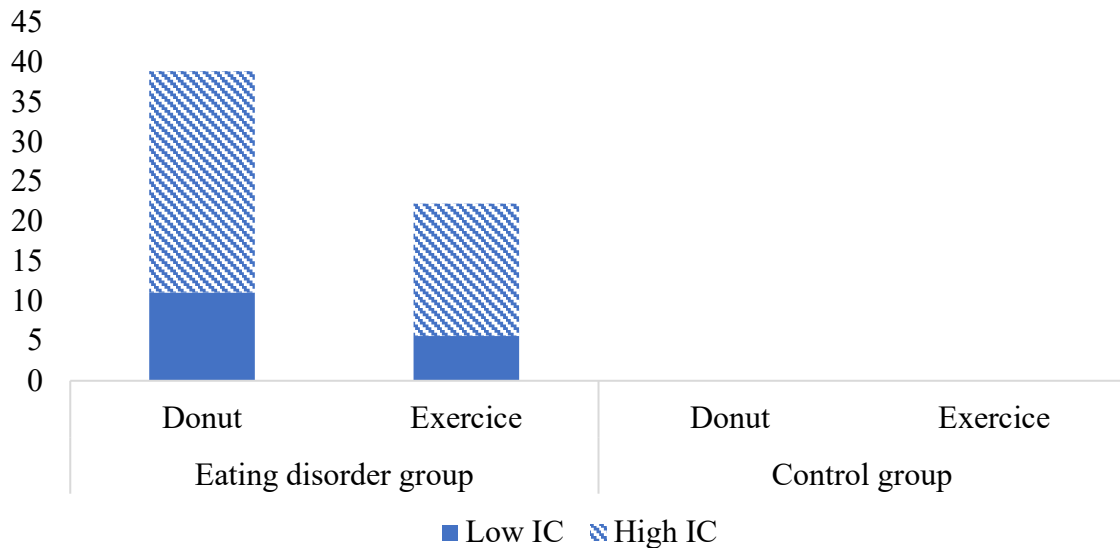


Figure 2. Proportions (in %) of neutralization behavior for the eating disorder videos.

### 3.3. General Trait Susceptibility to Inferential Confusion

A repeated-measures ANOVA was performed on ICQ-EV scores pre-and post-video presentation to examine the effect of the experimental manipulation on trait IC. There was a main effect of time,  $F(1, 32) = 5.255, p = .029, \eta^2_p = .141$ , indicating that ICQ-EV scores decreased from pre- ( $M = 73.72, SD = 31.55$ ) to post-video presentation ( $M = 69.42, SD = 33.82$ ) for all participants. There was also a main effect of group, indicating that ED participant reported significantly higher ICQ-EV scores averaged across time points ( $M = 89.17, SD = 27.24$ ) than did control participants ( $M = 53.97, SD = 27.24$ ),  $F(1, 32) = 15.014, p = .000, \eta^2_p = .319$ .

### 3.4. Clinical Relevance

A repeated-measures ANOVA was performed on OCI-R scores pre-and post-video presentation to see if the experimental manipulation produced changes in OCD symptoms. A

significant time by group by condition interaction emerged,  $F(1, 32) = 6.208, p = .018, \eta^2_p = .162$ . Paired t-tests revealed a trend for OCI-R scores for ED participants in the High IC condition to increase from pre- ( $M = 21.11, SD = 11.38$ ) to post-video presentation ( $M = 23.11, SD = 12.79$ ),  $t(8) = -2.19, p = .06$ , while OCI-R scores of control participants in the High IC condition did not change significantly from the beginning ( $M = 5.44, SD = 5.96$ ) to the end of the experimental session ( $M = 4.33, SD = 4.44$ ),  $t(8) = 1.25, p = .247$ .

The same analyses were performed on EDE-Q scores, to examine the effect of the experimental manipulation on ED symptoms. There was a main effect of group, indicating that ED participants reported significantly higher EDE-Q scores averaged across time points ( $M = 3.87, SD = .87$ ) than did control participants ( $M = .256, SD = .87$ ),  $F(1, 32) = 156.596, p = .000, \eta^2_p = .830$ . However, there was no time effect,  $F(1, 32) = .430, p = .517, \eta^2_p = .013$ .

#### **4. Discussion**

The current study aimed to evaluate the extent to which individuals with EDs are susceptible to display IC, a thought process that has been previously associated with OCD, and to examine the impact of endorsing IC in this clinical population. Our results were in line with most of our hypotheses – participants responses were in the expected directions, although power issues might have undermined our ability to detect clear effects. Individuals with EDs who were exposed to the High IC condition tended to report higher state IC, neutralized more and showed higher trait IC scores than did healthy controls. Taken together, our findings provide support for the notion that individuals with EDs are more susceptible to IC than healthy controls.

With regard to our hypothesis concerning cognitive reactivity, our results provide partial evidence that individuals with EDs are more susceptible to display greater levels of IC than individuals unaffected by this mental health problem. In fact, we assessed a trend for individuals

with EDs to have a greater tendency to display IC-like thinking following the induction of IC states. Notably, IC was triggered across obsessional themes, suggesting the presence of a general vulnerability to OCD thinking among individuals with EDs. Previous research has also demonstrated that individuals with EDs are amenable to endorse general cognitive processes related to obsessionality. For instance, Coelho and colleagues (2015) found that individuals with EDs are prone to thought-fusion, which entails the broad belief that negative thoughts can lead to adverse events, and that they manifest thought-fusion for both OCD and ED specific themes.

In terms of emotional reactivity, we did not find an effect of the experimental manipulation. In fact, ED participants displayed higher negative affect than healthy control participants, but this across experimental conditions. Interestingly, ED participants showed more negative affect subsequent to watching the ED and neutral videos, but not after watching the OCD scenarios. Although it makes sense that individuals with EDs would experience more negative emotions in response to watching scenes reflective of their disorder, it is less clear why alleged neutral everyday scenes would also trigger such emotional reactions. One possible explanation for this is that although the OCD scenarios might have been displaying pathological material, they did not speak to the problems of those struggling with EDs. On the other hand, it might have been easier for individuals with EDs to relate to normal, everyday scenes, bringing them back to their daily experience of struggling with EDs and triggering negative affective states. Although these findings were unexpected, previous work has also found that individuals with EDs are more likely to report greater negative affect following the presentation of neutral material than healthy controls (Coelho et al., 2015).

The same pattern of results emerged with regard to behavioral reactivity, lending further credence to our explanation that both ED and neutral videos might have triggered ED-related

experiences. In fact, individuals with EDs demonstrated a greater desire to engage into compulsive behaviors than healthy control individuals across experimental conditions, subsequent to watching both the ED and neutral videos. However, regarding neutralization, only the ED scenarios for individuals with EDs assigned to the High IC condition triggered greater behavioural responses, suggesting that while exposure to ED-related material in general might lead to greater desires to engage in compulsions and rituals, such materials are more likely to trigger direct behavioral responses (i.e., actual neutralization) when in an IC state. Previous studies have also found that neutralization is more likely to occur in samples of individuals with EDs following the presentation of idiosyncratic material (Coelho et al., 2008; Coelho et al., 2012; Coelho et al., 2015).

Although our manipulation check suggests that we successfully induced higher levels of IC in participants assigned to the High IC condition, it is possible that we have encountered a ceiling effect, considering that we found no effect of the experimental manipulation on our measures of emotional reactivity and desire to engage in compulsive behaviours. It is possible that the content of some videos was more triggering than others (e.g., a woman eating a donut vs. a woman locking a door), and that the contrast between the two videos in the different experimental conditions was not stark enough to overcome the very effect of the video's content. As mentioned previously, it is also possible that a lack of statistical power has impeded on our ability to detect clear statistical effects. Considering that this study was underpowered to detect small effect sizes, some important differences between groups might have been obscured.

Taken together, our results with regard to the cognitive, emotional and behavioral reactivity to the experimental manipulation for individuals with EDs seem to reveal a general obsessional cognitive vulnerability, where a greater IC thinking style can be triggered across

obsessional themes, but which translates emotionally and behaviorally into ED-specific reactions. This is line with several theories that posit a global shared vulnerability between OCD and EDs that is expressed in idiosyncratic ways according to the given psychopathology (e.g., Shafran, 2002). The idea of a broader propensity towards obsessional thinking was further supported by our results pertaining to changes in symptoms over the course of the experimental session. In fact, individuals with EDs assigned to the High IC condition showed a tendency to display higher OCD symptoms subsequent to completing the experiment, although this did not reach statistical significance. On the other hand, no changes in ED symptoms were assessed over the course of the experiment, which suggests that the induction of an IC state might have triggered general obsessional tendencies amongst individuals with EDs, but that such trigger did not translate to the realm of eating pathology.

In contrast to our hypotheses, we found that scores on the trait measure of IC significantly decreased over the course of the experimental session, and this for all participants across groups and experimental conditions. One explanation for these unexpected results is that participants might have been prompted to rely further on their senses (i.e., lower IC) after being exposed to a series of videos requesting their visual and auditory attention. In fact, similar to the mechanisms of cognitive bias modification, whereby extended exposure to tasks that favor selective processing leads to the manipulation of a cognitive bias (MacLeod & Mathews, 2012), we might have inadvertently trained participants to make use of their senses. Further, it is possible that repeated exposure to the videos triggered a habituation process. However, the fact that our experimental manipulation of IC produced changes in the expected directions (i.e., greater state IC, greater neutralization), goes against this postulation. Further research on the distinction between state and trait IC is warranted.



## **5. Conclusions**

The high levels of trait IC reported by the group of individuals with EDs, along with a trend for higher levels of state IC, greater neutralization behavior and higher OCD symptoms for those who were assigned to the High IC condition, underline the importance of conducting further research on IC in EDs. IC may be a transdiagnostic cognitive process that could account for the relationship between OCD and EDs. IC may be part of a larger array of underlying vulnerability structures in the development and maintenance of OCD spectrum symptoms. The evaluation of OCD-related cognitive processes in patients with EDs may prove to be helpful in the formulation of patient case conceptualization and individualized treatment plan. As such, a better understanding of the role of IC in EDs may help toward the formulation of more effective treatments for these disorders.

### **Contributors**

Catherine Ouellet-Courtois designed the study, tested all participants, conducted the statistical analyses and drafted the manuscript. Kieron O'Connor supervised all aspects of the research. Both authors contributed to and have approved the final manuscript.

### **Acknowledgements**

We would like to extend our gratitude to Charles-Édouard Giguère for his help with the statistical analyses.

### **Role of Funding Sources**

This work was supported by the Fonds de recherche du Québec - Société Culture (FRQSC) [grant number 256181] and the Canadian Institutes of Health Research (CIHR) [grant number 93556]. FRQSC and CIHR all had no role in the study design, analysis or interpretation of the data, writing the manuscript, or the decision to submit the paper for publication.

## References

- Aardema, F., & Wu, K. D. (2011). Imaginative, dissociative, and schizotypal processes in obsessive-compulsive symptoms. *Journal of Clinical Psychology, 67*, 74-81.  
DOI: 10.1002/jclp.20729
- Aardema, F., Emmelkamp, P. M., & O'Connor, K. P. (2005b). Inferential confusion, cognitive change and treatment outcome in Obsessive–Compulsive Disorder. *Clinical Psychology & Psychotherapy: An International Journal of Theory & Practice, 12*, 337-345.  
DOI: 10.1002/cpp.464
- Aardema, F., O'Connor, K. P., Emmelkamp, P. M., Marchand, A., & Todorov, C. (2005a). Inferential confusion in obsessive–compulsive disorder: the inferential confusion questionnaire. *Behaviour Research and Therapy, 43*, 293-308.  
DOI:10.1016/j.brat.2004.02.003
- Aardema, F., Radomsky, A. S., O'Connor, K. P., & Julien, D. (2008). Inferential confusion, obsessive beliefs and obsessive-compulsive symptoms: A multidimensional investigation of cognitive domains. *Clinical Psychology and Psychotherapy, 15*, 227–238.  
DOI:10.1002/cpp.581
- Aardema, F., Wu, K. D., Careau, Y., O'Connor, K., Julien, D., & Dennie, S. (2010). The expanded version of the inferential confusion questionnaire: Further development and validation in clinical and non-clinical samples. *Journal of Psychopathology and Behavioral Assessment, 32*, 448–462. DOI:10.1007 /s10862-009-9157-x.
- Beck, A. T., & Steer, R. A. (1990). *Manual for the Beck Anxiety Inventory*. San Antonio, TX: Psychological Corporation.

- Beck, A. T., Steer, R. A., Ball, R., & Ranieri, W. F. (1996). Comparison of Beck Depression Inventories-I and-II in psychiatric outpatients. *Journal of Personality Assessment*, *67*, 588-597. DOI:10.1207/s15327752jpa6703\_13
- Bellodi, L., Cavallini, M. C., Bertelli, S., Chiapparino, D., Riboldi, C., & Smeraldi, E. (2001). Morbidity risk for obsessive-compulsive spectrum disorders in first-degree relatives of patients with eating disorders. *American Journal of Psychiatry*, *158*, 563-569. DOI: 10.1176/appi.ajp.158.4.563
- Bertrand, A., Bélanger, C., & O'Connor, K. (2011). Troubles de l'alimentation et trouble obsessionnel-compulsif: facteurs communs. *Santé mentale au Québec*, *36*, 149-179. DOI : <https://doi.org/10.7202/1005819ar>
- Blais, M., Bodryzlova, Y., Aardema, F., & O'Connor, K. (2016). Open trial of inference-based therapy in the treatment of compulsive hoarding. *Journal of Psychology and Clinical Psychiatry*, *6*, 00403. DOI: 10.15406/jpcpy.2016.06.00403
- Coelho, J. S., Baeyens, C., Purdon, C., Pitet, A., & Bouvard, M. (2012). Cognitive distortions and eating pathology: Specificity of thought–shape fusion. *Behaviour Research and Therapy*, *50*, 449-456. DOI: 10.1016/j.brat.2012.04.003
- Coelho, J. S., Carter, J. C., McFarlane, T., & Polivy, J. (2008). “Just looking at food makes me gain weight”: Experimental induction of thought–shape fusion in eating-disordered and non-eating-disordered women. *Behaviour Research and Therapy*, *46*, 219-228. DOI: 10.1016/j.brat.2007.11.004
- Coelho, J. S., Ouellet-Courtois, C., Purdon, C., & Steiger, H. (2015). Susceptibility to cognitive distortions: the role of eating pathology. *Journal of Eating Disorders*, *3*, 31. DOI 10.1186/s40337-015-0068-9

- Fairburn, C. G., & Beglin, S. J. (1994). Assessment of eating disorders: Interview or self-report questionnaire?. *International Journal of Eating Disorders*, *16*, 363-370.  
DOI:10.1002/1098-108X(199412)16:4<363::AID-EAT2260160405>3.0.CO;2-%23
- Fairburn, C. G., Cooper, Z., & Shafran, R. (2003). Cognitive behaviour therapy for eating disorders: A “transdiagnostic” theory and treatment. *Behaviour Research and Therapy*, *41*, 509-528. DOI: 10.1016/S0005-7967(02)00088-8
- Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G\* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*, 175-191.
- First, M. B., Spitzer, R. L., Gibbon, M. G., & Williams, J. B. (1997). *Structured clinical interview for DSM-IV Axis I disorders (SCID-I) clinician version*. Washington, DC: American Psychiatric Press.
- Foa, E. B., Huppert, J. D., Leiberg, S., Langner, R., Kichic, R., Hajcak, G., & Salkovskis, P. M. (2002). The Obsessive-Compulsive Inventory: development and validation of a short version. *Psychological assessment*, *14*, 485. DOI:10.1037/1040-3590.14.4.485
- Halmi, K. A., Tozzi, F., Thornton, L. M., Crow, S., Fichter, M. M., Kaplan, A. S., ... & Plotnicov, K. H. (2005). The relation among perfectionism, obsessive-compulsive personality disorder and obsessive-compulsive disorder in individuals with eating disorders. *International Journal of Eating Disorders*, *38*, 371-374. DOI: 10.1002/eat.20190
- Hollander, E., & Benzaquen, S. D. (1997). The obsessive-compulsive spectrum disorders. *International Review of Psychiatry*, *9*, 99-110. DOI: 10.1080/09540269775628

- Hollander, E., Kim, S., Braun, A., Simeon, D., & Zohar, J. (2009). Cross-cutting issues and future directions for the OCD spectrum. *Psychiatry research, 170*, 3-6.  
DOI:10.1016/j.psychres.2008.07.015
- Hsu, L. G., Kaye, W., & Weltzin, T. (1993). Are the eating disorders related to obsessive compulsive disorder?. *International Journal of Eating Disorders, 14*, 305-318. DOI: 10.1002/1098-108X(199311)14:3<305::AID-EAT2260140309>3.0.CO;2-L
- Lavender, A., Shubert, I., de Silva, P., & Treasure, J. (2006). Obsessive-compulsive beliefs and magical ideation in eating disorders. *British Journal of Clinical Psychology, 45*, 331-342.  
DOI: 10.1348/014466505X53579
- MacLeod, C., & Mathews, A. (2012). Cognitive bias modification approaches to anxiety. *Annual Review of Clinical Psychology, 8*, 189-217. DOI: 10.1146/annurev-clinpsy-032511-143052
- McElroy, S. L., Phillips, K. A., & Keck, J. P. (1994). Obsessive compulsive spectrum disorder. *The Journal of Clinical Psychiatry, 55*, 33-51.
- Mathias, J. L., & Kent, P. S. (1998). Neuropsychological consequences of extreme weight loss and dietary restriction in patients with anorexia nervosa. *Journal of clinical and experimental neuropsychology, 20*, 548-564. DOI: 0.1076/jcen.20.4.548.1476
- O'Connor, K. P., Aardema, F., Bouthillier, D., Fournier, S., Guay, S., Robillard, S., ... & Pitre, D. (2005). Evaluation of an inference-based approach to treating obsessive-compulsive disorder. *Cognitive Behaviour Therapy, 34*, 148-163. DOI:10.1080/16506070510041211
- O'Connor, K., & Aardema, F. (2011). *Clinician's handbook for obsessive compulsive disorder: inference-based therapy*. John Wiley & Sons.

- O'Connor, K., Koszegi, N., Aardema, F., van Niekerk, J., & Taillon, A. (2009). An inference-based approach to treating obsessive-compulsive disorders. *Cognitive and Behavioral Practice, 16*, 420-429. DOI: 10.1016/j.jad.2016.05.060
- Obsessive Compulsive Cognitions Working Group. (2003). Psychometric validation of the obsessive beliefs questionnaire and the interpretation of intrusions inventory: Part I. *Behaviour Research and Therapy, 41*, 863-878. DOI: org/10.1016/S0005-7967(02)00099-2
- 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*, 1527-1542. DOI: 10.1016/j.brat.2004.07.010
- Paradisis, S. M., Aardema, F., & Wu, K. D. (2015). Schizotypal, dissociative, and imaginative processes in a clinical OCD sample. *Journal of Clinical Psychology, 71*, 606-624. DOI:10.1002/jclp.22173
- Purcell-Lalonde, M., O'Connor, K. (2015). Food for Thought: Change in ego-dystonicity and fear of self in bulimia nervosa over the course of inference-based treatment. *Journal of Psychology and Clinical Psychiatry, 3*, 00133.
- Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Boston, MA, US: Houghton, Mifflin and Company.
- Shafran, R. (2002). Eating disorders and Obsessive Compulsive Disorder. In R. O. Frost & G. Steketee (Eds.), *Cognitive approaches to obsessions and compulsions: Theory, assessment, and treatment* (pp. 215–232). Oxford: Pergamon.

- Speranza, M., Corcos, M., Godart, N., Loas, G., Guilbaud, O., Jeammet, P., & Flament, M. (2001). Obsessive compulsive disorders in eating disorders. *Eating Behaviors*, 2, 193-207. DOI :10.1016/S1471-0153(01)00035-6
- Taillon, A., O'Connor, K., Dupuis, G., & Lavoie, M. (2013). Inference-based therapy for body dysmorphic disorder. *Clinical Psychology & Psychotherapy*, 20, 67-76. DOI:10.1002/cpp.767
- Visser, H. A., van Megen, H., van Oppen, P., Eikelenboom, M., Hoogendorn, A. W., Kaarsemaker, M., & van Balkom, A. J. (2015). Inference-based approach versus cognitive behavioral therapy in the treatment of obsessive-compulsive disorder with poor insight: a 24-session randomized controlled trial. *Psychotherapy and Psychosomatics*, 84, 284-293. DOI: 10.1159/000382131
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of Personality and Social Psychology*, 54, 1063. DOI: 10.1037/0022-3514.54.6.1063
- Wilson, S., Aardema, F., & O'Connor, K. (2018a). Possibility-Based Information Elicits Doubt in Bulimia Nervosa: A Study of Inductive Reasoning. *International Journal of Cognitive Therapy*, 11, 410-420. DOI: 0.1007/s41811-018-0032-y
- Wilson, S., Aardema, F., & O'Connor, K. (2018b). What do I look like? Perceptual confidence in bulimia nervosa. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, 1-7. DOI: 0.1007/s40519-018-0542-x
- Wong, S. F., & Grisham, J. R. (2017). Causal role for inverse reasoning on obsessive-compulsive symptoms: Preliminary evidence from a cognitive bias modification for interpretation

bias study. *Journal of Behavior Therapy and Experimental Psychiatry*, 57, 143-155.

DOI: 10.1016/j.jbtep.2017.06.001



## General Discussion

### Summary of Objectives

In light of the heterogeneity of OCD and the necessity to identify shared cognitive factors amongst obsessional disorders, the overarching goal of the present thesis was to examine inferential confusion and cognitive confidence as putative common cognitive processes across OCD spectrum disorders. More specifically, these two constructs were studied across OCD subtypes and across other putative obsessive-compulsive disorders, namely eating disorders. Inferential confusion was chosen as a cognitive target because of its uppermost importance to IBA, a treatment model that has endeavoured to overcome the shortcomings of the cognitive appraisal model and that has repeatedly shown therapeutic efficacy for OCD (O'Connor et al., 2005b; Visser et al., 2015) and other related conditions (i.e., body dysmorphic disorder, Taillon et al., 2013; eating disorders, Purcell Lalonde & O'Connor, 2015; hoarding disorder; Blais et al., 2016).

In IBA, regardless of whether the obsessions pertain to contamination, checking, unacceptable thoughts, and so on, they are thought to develop from a series of dysfunctional reasoning processes that implicate a distrust of the senses and an overreliance on imagined possibilities, referred to as inferential confusion. Therefore, IBA can address the breadth of symptom presentations across individuals with OCD, and inferential confusion appears as a cognitive factor that can speak to all disorders across the OCD spectrum. In fact, while cognitive factors developed by the OCCWG and regrouped in the OBQ-44 appear to be relevant to only some OCD subtypes (Del Borrello & O'Connor, 2014; Julien, O'Connor, Aardema, & Todorov, 2006), research indicates that inferential confusion explains unique variance in overall OCD symptoms (Aardema et al., 2005; Del Borrello & O'Connor, 2014; Emmelkamp & Aardema,

1999). In short, the evidence suggests that inferential confusion is a broader cognitive domain that holds the potential to account for a variety of clinical presentations characterized by obsessionality.

Cognitive confidence was also chosen as a cognitive target because of its close association with inferential confusion. In fact, cognitive confidence and inferential confusion show great overlap as they both entail a tendency to distrust the senses, yet there has been specific empirical attention devoted to cognitive confidence over the past years. Considering the breadth of psychometric and experimental research that has been conducted on cognitive confidence in OCD, a systematic review and meta-analysis appeared as necessary to clarify the role of this construct across OCD subtypes (Article 1). To further our understanding of the relevance of cognitive confidence and inferential confusion to different OCD subtypes, available data at the OCD Spectrum Study Centre at the Montreal Mental Health University Institute was used in order to carry out a psychometric investigation of endorsement of these two constructs across OCD subtypes, using cluster analysis (Article 2). Finally, to clarify the relevance of inferential confusion to other OCD spectrum disorders, an experimental study was designed in order to provide direct evidence of inferential confusion as a causal factor in eating disorders (Article 3). Eating disorders were chosen as OCD spectrum disorders because of the mounting amount of research highlighting similarities between OCD and eating disorders, as well as the increasing evidence for the relevance of both inferential confusion (Purcell-Lalonde & O'Connor, 2015; Wilson et al., 2017; Wilson, et al., 2018a) and cognitive confidence (Cooper et al., 2007; Davenport et al., 2015; McDermott & Rushford, 2011; Olstad et al., 2015; Vann et al., 2014; Wilson et al., 2018b) to eating pathology.

### **Summary of Findings**

This thesis provides meta-analytic, psychometric and experimental evidence for inferential confusion and cognitive confidence as broader obsessional cognitive factors.

**Article 1.** The first thesis article endeavoured to synthesize the evidence for the role of cognitive confidence in OCD and to evaluate the extent to which poor cognitive confidence is associated with OCD symptomatology by conducting a systematic review with a meta-analysis. Considering that the cognitive confidence hypothesis had mostly been investigated in the context of OCD with primary checking, this article also aimed to review the evidence for lower cognitive confidence in this subtype vs. across other OCD subtypes. In order to examine cognitive confidence across the spectrum of obsessionality, studies evaluating this construct across clinical and analogue samples as well as using both clinical and nonclinical control groups were reviewed. A total of 36 studies were deemed eligible for the review ( $n = 36$ ). Experimental studies revealed that individuals with OCD present lower cognitive confidence than healthy controls. However, when comparing individuals with OCD to clinical controls, or when individuals with checking symptoms versus those with non-checking symptoms were compared, no clear effect appeared. The self-report studies revealed the same pattern of results as the experimental studies and a meta-analysis was performed on this psychometric data. When comparing OCD to healthy controls (i.e., based on 11 studies), an overall large effect size was produced, indicating lower cognitive confidence in individuals with OCD. However, the comparison of individuals with OCD to clinical controls (i.e., based on eight cross-sectional studies, of which two studies allowed for more than one comparison between groups) produced a small and non-statistically significant effect size. Furthermore, none of the studies that examined the association between cognitive confidence and OCD symptoms found a significant correlation. However, all studies that examined the association between checking symptoms and

memory confidence found evidence for a negative correlation, suggesting that some OCD subtypes might have greater cognitive vulnerability with regard to a given cognitive domain (e.g., poorer perceptual confidence for contamination fears vs. memory confidence for checking). Another striking finding that emerged with regard to OCD with primary checking is that all studies that examined the role of inflated responsibility indicated that a sense of perceived responsibility exacerbates memory confidence following checking, which is in line with Rachman's (2002) postulation that checking occurs when one experiences a sense of personal responsibility for preventing harm. Similarly, one important finding is that all studies (except one) that employed OCD-relevant tasks or stimuli supported the cognitive confidence hypothesis in OCD, thus highlighting the importance of using idiosyncratic tasks to investigate cognitive confidence in OCD. This is in line with previous work underlining the importance of tailoring experimental stimuli to the individual's particular belief (Radomsky & Rachman, 2004; Radomsky, Rachman, & Hammond, 2001). Overall, this systematic review and meta-analysis indicates that the cognitive confidence hypothesis is more likely to be confirmed in the context of OCD-specific tasks that tap into one's sense of perceived responsibility, and when individuals with OCD are compared to nonclinical controls.

**Article 2.** While Article 1 suggested that lower cognitive confidence can be expressed differently across OCD subtypes, such that idiosyncratic material is required to truly capture lower cognitive confidence, a closer investigation of the extent to which different OCD subtypes endorse cognitive confidence and inferential confusion appeared warranted. It was hypothesized that cluster analyses would reveal different OCD profiles with regard to cognitive confidence and inferential confusion. As expected, our clustering approach for cognitive confidence revealed two clusters: (1) low cognitive confidence/high checking/higher OCD symptoms; (2)

high cognitive confidence/low checking/lower OCD symptoms, while the analyses for inferential confusion resulted in three clusters: (1) average inferential confusion/high “just right”/high contamination/low obsessionality; (2) high inferential confusion/ high “just right”/high obsessionality; and (3) low inferential confusion/low obsessionality/low checking. The current results indicate that low cognitive confidence seems to be more relevant to “checking”, which is in line with Article 1’s finding for an association between checking symptoms and memory confidence. Moreover, the “just right” feelings appeared to be relevant to both low cognitive confidence and inferential confusion and came out as a predictor of inferential confusion endorsement. This is quite a notable finding, considering that this subtype is associated with NJREs and is an OCD profile that the cognitive appraisal model fails to account for. The presents results suggest that cognitive confidence and inferential confusion could prove to be important therapeutic targets for individuals struggling with NJREs. These results also suggest that inferential confusion may speak to a greater range of OCD profiles than cognitive confidence, which might be a narrower construct. This finding is rather promising, considering that the global goal of IBA is to target cognitive processes (i.e., inferential confusion) that are relevant to a breadth of OCD spectrum disorders in order to yield symptom improvements. Finally, it was hypothesized that specific OCD beliefs, as measured by the OBQ-44, would predict cognitive confidence and inferential confusion. Accordingly, it was found that “the need to control thoughts” was an important predictor of both inferential confusion and cognitive confidence. In line with the results of Article 1 that underscored the role of inflated responsibility, the responsibility for harm/threat overestimation OBQ-44 subscale also came out as a significant predictor of inferential confusion, but was only marginally significant for cognitive confidence. In light of our finding that not all OCD subtypes may endorse inferential

confusion or cognitive confidence to the same extent, this finding suggests that other beliefs, such as a perceived sense of responsibility or the need to control thoughts, may interact with the tendency to distrust the senses in their contribution to OCD symptoms.

**Article 3.** While there had been experimental studies underlining the causal role of inferential confusion in OCD (Wong & Grisham, 2017), no research had ever made use of an experimental manipulation in order to induce higher levels of inferential confusion in another OCD spectrum population. As Article 2 demonstrated that inferential confusion is relevant to various OCD subtypes, the third article of this thesis aimed to go beyond OCD pathology and to provide causal evidence for the relevance of inferential confusion to other OCD spectrum disorders, namely eating disorders. It was hypothesized that individuals with eating disorders would show a greater susceptibility to inferential confusion than healthy controls, as indicated by greater cognitive, emotional and behavioral reactivity to the experimental manipulation, as well as by greater endorsement of trait inferential confusion. This hypothesis was partially confirmed: individuals with eating disorders who were exposed to the High Inferential Confusion condition tended to report higher state inferential confusion (although this did not reach significance), neutralized more and showed greater OCD symptoms. Furthermore, individuals with eating disorders reported overall higher trait inferential confusion scores than did healthy controls. Contrary to predictions, there was no evidence of emotional reactivity amongst individuals with eating disorders. It is however of note that individuals with eating disorders presented greater negative affect, as well as a greater desire to engage in compulsive and neutralization behavior, following the presentation of eating disorder videos, again underlining the importance of employing idiosyncratic material. This is in line with previous research that has also demonstrated that individuals with eating disorders are more reactive to the presentation of

eating disorder material (Coelho, Baeyens, Purdon, Pitet, & Bouvard, 2012; Coelho, Carter, McFarlane, & Polivy, 2008), although other research has found reactivity to OCD-related material as well (Coelho et al., 2015). Furthermore, it is quite interesting to see that individuals with eating disorders responded to the idiosyncratic videos in ways that are typically seen in OCD, that is by reporting a greater desire to engage in compulsions or to neutralize. Further, they reported greater OCD symptoms. This pattern of results is in line with the postulation that OCD and eating disorders are phenotypic expressions of the same genetic vulnerability (Bellodi, Cavallini, Bertelli, Chiapparino, Riboldi, & Smeraldi, 2001) and gives further credence to the idea that eating disorders are part of the OCD spectrum (Hollander & Benzaquen, 1997; McElroy et al., 1994). Taken together, the results of the third thesis article provide evidence that inferential confusion is relevant to eating disorders and helps to elucidate the relationship between OCD and eating pathology.

### **Limitations and Strengths**

The implications of the aforementioned findings should be tempered by the acknowledgement of several limitations, with some of these having been raised in each of the thesis articles. With regard to Article 1, one important goal was to compare the evidence for cognitive confidence in individuals with OCD with primary checking vs. other OCD subtypes. However, most of the studies reviewed failed to specify the OCD subtypes present in their samples, such that we might have compared samples of individuals with OCD with primary checking to heterogeneous OCD samples also including the checking subtype, thus obscuring our conclusions and preventing us from detecting a clear effect. In addition, the fact that heterogeneous OCD samples were collapsed together precluded us to examine cognitive confidence in specific subtypes. Moreover, most of the cognitive confidence research that was

reviewed looked at memory confidence specifically, while other aspects of cognitive confidence (i.e., perception and attention) were most often not investigated, such that the full construct of cognitive confidence was not captured.

Along the same lines, a limitation to both Article 1 and 2 is that the Metacognitions Questionnaire (MCQ) does not measure cognitive confidence in a comprehensive way, as most questionnaire items tap into memory confidence specifically. Considering that different cognitive components may affect OCD subtypes in different ways (e.g., memory confidence for OCD with primary checking vs. attentional confidence for OCD with symmetry/orderliness), it is possible that this narrow operationalization of cognitive confidence has impeded on our ability to truly grasp the role of this construct across OCD subtypes.

Regarding Article 2, one limitation pertains to the way we created OCD subtypes, that is according to scores on the Vancouver Obsessional Compulsive Inventory (VOCI). Although the VOCI has already been used to determine OCD symptom domains (e.g., Aardema, Radomsky, O'Connor, & Julien, 2008), it remains that our subtypes were formed according to one single instrument, leaving the possibility that another measure of OCD symptoms would have generated different clusters. Furthermore, we examined cognitive confidence and inferential confusion across OCD subtypes with self-report questionnaires. Although this study was meant to be psychometric in nature, the use of experimental tasks would have been helpful to provide convergent validity and to capture the two constructs in a more ecologically valid way.

One important limitation of Article 3 is that the generalizability of the results to the OCD spectrum was limited by the exclusion of male participants, although this was considered necessary considering that eating disorders are much more prevalent amongst females (Fairburn et al., 2003), and that we wanted to avoid confounding gender differences. Moreover, the lack of



a clinical control group, namely a group of individuals with OCD, is an important limitation. Without such clinical control group, it is not possible to establish whether inferential confusion is specific to eating disorders or to OCD, or if the elevated scores on measures of inferential confusion and other symptoms is simply reflective of the greater distress due to having a mental health disorder. Another limitation of this study is the small sample size. Although power analyses indicated that this sample size would be sufficient to detect a medium effect, we were underpowered to detect small effect sizes, such that some important differences between groups might have been obscured. Finally, it is also possible that the experimental videos were not idiosyncratic enough and therefore did not speak to some participants. Although participants with eating disorders were more reactive to the eating disorder videos, there remains the possibility that we would have detected stronger effects should there have been more videos representing a greater range of eating disorder rituals and behaviors.

The current body of research also has several strengths. The systematic review and meta-analysis regrouped all studies looking at cognitive confidence in OCD, therefore summarizing the current state of knowledge on the topic. The evidence was reviewed in a comprehensive way, combining experimental and psychometric data and reviewing the methodology of all studies in detail. Further, both clinical and analogue studies were integrated in the review, therefore examining cognitive confidence across the spectrum of obsessionality. In addition, an investigation of the association between cognitive confidence, inferential confusion and OCD subtypes using cluster analysis was carried out, thereby adding psychometric evidence to one of the conclusions of the systematic review and meta-analysis, namely that that cognitive confidence can be endorsed to a different extent across OCD subtypes. Finally, the experiment that was conducted in Article 3 offers a novel approach to the investigation of inferential

confusion in eating disorders, that is by reproducing the construct via ecologically valid, idiosyncratic videos. The use of self-report measures of inferential confusion in this experiment, along with the experimental videos, allowed for convergent validity and for a comprehensive assessment of the construct of inferential confusion.

### **Theoretical Implications**

This thesis aimed to investigate the general tendency to doubt the senses, expressed by low cognitive confidence and inferential confusion, as a common cognitive feature shared across OCD spectrum disorders. IBA offers both an etiological and treatment model of OCD, as it posits that obsessions and compulsions result from the construction of a faulty inductive narrative characterized by the investment in imaginary fears and the distrust of reality information (i.e, inferential confusion; O'Connor et al., 2005a). IBA has been presented as a transdiagnostic approach to explain and treat disorders characterized by obsessionality (O'Connor, Ouellet-Courtois, Aardema, 2018), and the present thesis provides additional support for this notion.

Overall, this body of research underlines the idea of a common obsessional vulnerability that is expressed differently across OCD subtypes and OCD spectrum disorders. The relevance of cognitive confidence to OCD was demonstrated by the systematic review and meta-analysis, which stressed the importance of reproducing the construct via experimental tasks or questionnaires that are reflective of the individual's experience (e.g., examining memory confidence after checking that the door is locked vs. attentional confidence after reordering objects). Nonetheless, the systematic review highlighted that cognitive confidence is not only relevant to OCD pathology, as clinical control groups also reported low levels of cognitive confidence. This is coherent with Well's (2000) metacognitive model, which postulates that

maladaptive metacognitions, such as a lack of cognitive confidence, are maintaining factors across various psychological disorders. Previous research has demonstrated that cognitive confidence specifically is a consistent predictor of OCD symptoms (Gwilliam, & Cartwright-Hatton, 2004), and findings from the systematic review and meta-analysis are not inconsistent with the idea that cognitive confidence may be a maladaptive metacognition specific to OCD, but when measured in a way that accurately captures its expression in the context of OCD pathology. This notion was also supported by the fact that the cluster analyses in Article 2 revealed that higher checking symptoms were more likely to be associated with low levels of cognitive confidence on the MCQ, which mostly includes items that tap into memory confidence for checking-related behaviors.

Interestingly, the cluster analyses also revealed that inferential confusion may speak to a greater range of OCD profiles than cognitive confidence, which is in line with IBA's endeavor to work on cognitive processes that are implicated in various OCD spectrum disorders in order to produce symptom improvements (O'Connor et al., 2005a; O'Connor et al., 2018). This suggests that inferential confusion may be more likely to represent a broader obsessional cognitive domain that reflects a way of relating to one's internal and external experiences (i.e., distrust of reality information and investment in imaginary fears), as opposed to cognitive confidence that implicates a distrust of a specific cognitive domain that is more likely to be related to a specific OCD subtype (e.g., "I don't trust my memory for having locked the door").

This notion was confirmed in Article 3, as it was demonstrated that inducing higher levels of inferential confusion had an impact amongst individuals with eating disorders. More specifically, participants with eating disorders assigned to the High Inferential Confusion condition displayed greater OCD-related responses: a trend for higher inferential confusion

thoughts post videos, higher neutralizing behaviors and higher OCD symptoms. This pattern of results lends support to prevailing theories that eating disorders are part of the OCD spectrum and entail an initial obsessional vulnerability that is expressed symptomatically around the theme of food, shape and weight (Bertrand, Bélanger & O'Connor, 2011; Hsu, Kaye, & Weltzin, 1993; Shafran, 2002). These results also add to the body of research suggesting that inferential confusion is relevant to eating disorders (Purcell-Lalonde & O'Connor, 2015; Wilson et al., 2017; Wilson, et al., 2018a). In short, there is accumulating evidence that inferential may be an important shared core cognitive process that can clarify the relationship between eating disorders and OCD.

Again supporting the idea that inferential confusion and cognitive confidence may be important cognitive factors for range of obsessional problems is Article 2's finding that "just right" feelings were shown to be relevant to both low cognitive confidence and inferential confusion. Furthermore, "just right" feelings were found to be significant predictors of inferential confusion. Considering that the cognitive appraisal model fails to account for the development of obsessions related to NJREs, as the maintaining factor for this subtype involves a need to eradicate a sense of incompleteness rather than a fear of harm or of a catastrophic consequence as seen in other OCD subtypes, it is quite notable to see that inferential confusion and cognitive confidence came out as relevant cognitive factors for this OCD presentation. As such, our results suggest that IBA may address a significant gap in the cognitive appraisal model, that is by offering an aetiological and treatment model that accounts for all OCD subtypes.

In summary, the research presented in this thesis suggests that inferential confusion and cognitive confidence may be transdiagnostic vulnerability factors in the development and maintenance of OCD spectrum symptoms. In light of the heterogeneity of mental disorders,

which calls into question the utility of psychiatric diagnoses (Owen, 2012; van Os, Delespaul, Wigman, Myin-Germeys, & Wichers, 2013), several authors have stressed the need to develop transdiagnostic models in order to account for core shared processes in the hope of addressing psychopathological problems more parsimoniously (Harvey et al., 2004; Mansell, Harvey, Watkins, & Shafran, 2009). The current body of research suggests that inferential confusion and cognitive confidence are important cognitive factors shared across OCD subtypes and that inferential confusion is a transdiagnostic cognitive process that extends beyond OCD pathology as it is also relevant to eating disorders. This thesis thus adds additional support to previous research indicating that IBA has great transdiagnostic value (Blais et al., 2016; Purcell Lalonde & O'Connor; Taillon et al., 2013). However, just like in the case of OCD, it is possible that the construct of inferential confusion does not speak to all eating disorders presentations to the same extent. Past research that found different inhibitory control profiles (i.e., under-control vs. over-control) within individuals EDs, which tap into either obsessive-compulsive or impulsive traits (Claes, Mitchell, & Vandereycken, 2012). It is possible that a subgroup of individuals with eating disorders have a greater propensity to obsessional thinking, which makes them more susceptible to inferential confusion. One other possibility, as suggested by our findings, is that activating OCD-like thinking in individuals with eating disorders via inferential confusion, in the context of ED-relevant material, triggers a greater urge to regain control and to prevent disinhibitory behaviors (e.g., bingeing) via compulsive actions.

### **Clinical Implications**

The results comprised in this thesis underline the relevance of evaluating inferential confusion and cognitive confidence in different OCD subtypes as well as in eating disorders. The overall findings suggest that cognitive confidence and inferential confusion are likely to reveal

themselves differently depending on the clinical presentation of OCD or of a given OCD spectrum disorder. Further, this thesis highlights that cognitive confidence and inferential confusion appear to be relevant to different groupings of OCD symptoms grouped together, which is reflective of the clinical reality of OCD characterized by great heterogeneity and varying symptom patterns (e.g., someone with both symmetry and morality obsessions). In short, the overall tendency to doubt the senses and cognitive faculties seems to reveal itself differently across OCD spectrum presentations.

Low cognitive confidence can have the same impact for individuals with OCD as an actual memory, attentional or perceptual deficit. For instance, after an individual with OCD has checked the door, he might have a clear memory for the action he just performed, but may lack confidence in his memory, therefore engaging in repetitive checking, which leads to further doubt and reinforces the disorder. The results presented in this thesis suggest that different cognitive components may apply to each OCD subtype (e.g., perceptual confidence for OCD individuals with contamination fears and compulsive washing). This finding has been already stressed by clinicians and researchers, who have made the remark that individuals with OCD who engage in different compulsions rarely say that they are washing their hands over and over again because they don't recall having washed them, although they admit checking the door again because they can't recall whether they have already locked it or not (Radomsky et al., 2001; Tallis, Pratt, & Jamani, 1999). The findings of this thesis underline the need to address cognitive confidence in a way that speaks to each OCD subtype, above and beyond memory confidence in relation to checking compulsions.

The current body of research also stresses the potential value of addressing cognitive confidence in current treatment models for OCD. Previous research has demonstrated that

changes in metacognitive beliefs, including improvements in cognitive confidence, predicted treatment outcome in individuals with OCD undergoing Exposure and Response Prevention (ERP; Solem, Håland, Vogel, Hansen, & Wells, 2009). However, as discussed by Ouimet, Ashbaugh, and Radomsky (2019), cognitive therapies for OCD would be more effective if they would target the specific dysfunctional belief endorsed by the patient (e.g., that they cannot trust their perception that they don't see dirt). Recent work has demonstrated that individuals with OCD with checking compulsions who took part in two 1-hour therapy sessions designed to challenge maladaptive beliefs about memory for checking showed significant decreases in checking symptoms post-treatment, as compared to waitlist controls (Alcolado & Radomky, 2016).

Inferential confusion can provide a similar account of the clinical presentations of OCD as the cognitive confidence hypothesis. For instance, the individual with OCD who displays inferential confusion fails to trust his memory for having locked the door and starts to generate ideas about everything that could happen should the door be unlocked, leading to checking behavior, which is maintained by the obsessional doubt that the door might be unlocked. According to IBA, OCD symptoms will be alleviated through the elimination of the obsessional doubt, and this is achieved by working on the faulty reasoning processes based on purely imagined events and by helping the individual come back to the world of the senses (O'Connor et al., 2012; O'Connor & Aardema, 2011).

It has been argued that cognitive models of OCD have been underestimated in their ability to offer help to those who don't respond to ERP (Emmelkamp, 2002). In addition to those who don't benefit from ERP, a significant number of individuals with OCD (25%) drop out of treatment because of their refusal to undergo exposure (Franklin, Abramowitz, Kozak, Levitt,

& Foa, 2000). Further, although ERP as well as CBT for OCD (which mostly focuses on exposure techniques with a small portion of the treatment devoted to cognitive biases and distortions) have shown treatment effectiveness (Abramowitz, 1998), 40% of OCD patients still show significant symptoms following treatment (Stanley & Turner, 1995). In light of the premises of IBA and its focus on reasoning processes, this treatment approach does not require exposure techniques and therefore appears as a good treatment avenue for those who don't respond to ERP or CBT. IBA has shown treatment effectiveness similar or greater to CBT and ERP for a variety of OCD subtypes (for a review, see Julien et al., 2016). In light of the results presented in this thesis, it seems that helping the individual with OCD trust his/her senses (i.e., one important goal of IBA) could prove to be beneficial, thus adding support to the notion that IBA is a fruitful treatment avenue. Further, considering the heterogeneity of OCD, treatment outcome variability could be greatly reduced by addressing dysfunctional cognitions, such as low cognitive confidence and inferential confusion, in a way tailored to the patient's obsessions and compulsions.

With regard to eating disorders, this thesis's research also suggests that inferential confusion may be a relevant aetiological and maintaining factor. For instance, individuals with eating disorders may distrust sensory information (e.g., "I can't trust what I see as I look in the mirror") and invest instead in imaginary feared possibilities (e.g., "What if I am fatter than what I see?"). This reasoning style may incite the person with an eating disorder to act as if her imaginary fears were true and lead to compulsive behaviours such as excessive exercise, calorie counting and repeated body checking. The results presented in this thesis demonstrate that inferential confusion may be a transdiagnostic cognitive process explaining the well-documented association between OCD and eating disorders. In fact, these findings support the postulation



that individuals with eating disorders present a general obsessional cognitive vulnerability to inferential confusion, which translates behaviorally into symptoms specific to eating pathology (Bertrand et al., 2001). Considering that a clinical trial found that IBT adapted for eating disorders was effective in reducing eating disorder symptoms (Purcell Lalonde & O'Connor, 2015), the evaluation of inferential confusion in patients with eating disorders may prove to be helpful in the formulation of patient case conceptualizations and personalized treatment plans.

Building from these data, clinicians may benefit from considering the relative presence of cognitive confidence and inferential confusion in the assessment and treatment of OCD spectrum conditions. Importantly, this will have to be done while considering the beliefs specific to the patient, thus warranting thorough investigations of the context and conditions in which obsessions and compulsive behaviors arise as well as the cognitive triggers behind these symptoms.

### **Future Directions**

The importance of using idiosyncratic material in future OCD spectrum research cannot be overstated. In fact, a general conclusion of the current thesis is the necessity to explore shared cognitive factors further, and to tailor the study of these factors to the particular experience of the individual struggling with a mental health problem. Experimental studies reproducing cognitive confidence and inferential confusion as expressed differently across OCD subtypes and other spectrum disorders (e.g., memory confidence for turning off the stove; perceptual confidence for correctly feeling one's body shape) are required to further our knowledge of the role of inferential confusion and cognitive confidence in OCD spectrum conditions.

In order to improve our current experimental paradigms, study protocols could be informed by the use of behavioural observations performed in laboratory settings in order to

correctly evaluate symptoms and beliefs. As suggested elsewhere (Ouimet et al., 2019), another helpful option could be to directly ask patients what cognitive factors and beliefs they think are relevant to their clinical problem, so that research can be as personalized and ecologically valid as possible. For instance, in their investigation of cognitive confidence in OCD, Hermans and colleagues (2003) examined the construct across compulsive actions relevant to participants (participants were asked to choose three compulsions that they usually perform), compulsive actions relevant to OCD in general and neutral control actions. As expected, the relevant compulsive actions were found to produce much more anxiety than the other types of actions, which demonstrates that presenting general, untailed OCD stimuli to individuals with OCD might not always elicit the expected reaction. The investigation of cognitive confidence and inferential confusion in OCD spectrum disorders is complex and needs to go beyond general disorder-relevant tasks and questionnaires and to move toward personalized research materials.

The research in the field of eating disorders also indicates that the use of idiosyncratic stimuli matters (e.g., Coelho et al., 2008; Coelho et al., 2012), and the results of this thesis corroborate with this notion, considering that participants with eating disorders tended to be more reactive to the eating disorder than to the OCD videos. Other lines of research have developed research paradigms that allow to examine eating disorder beliefs specific to the individual (e.g., Cooper, 2011; Cooper, Todd, & Turner, 2007), while other work has adapted eating disorder-related experimental stimuli to each participant (i.e., presenting the person's favourite "guilty" foods; McClelland, Kemps, & Tiggemann, 2006). Notably, the study by Wilson and colleagues (2018b) has adapted the mechanism of reduced cognitive confidence following repetitive checking, a phenomenon seen in OCD, to the experience of individuals with eating disorders, by employing a body checking task following mirror exposure. More studies of

this kind are warranted in order to truly capture cognitive factors as they relate to the experience of individuals struggling with eating disorders.

Regarding cognitive confidence, further research will need to be conducted on the components of cognitive confidence other than memory, namely attention and perception. This will require a more precise operationalization of the construct of cognitive confidence as well as the use of new self-report measures, as the MCQ mostly captures memory confidence and only devotes a few items to the construct. New measurements are warranted for a more comprehensive assessment of cognitive confidence, especially considering that different cognitive components may affect each OCD subtype differently. Furthermore, although the research by Wilson and colleagues (2018) did investigate the construct of cognitive confidence in eating disorders, further research should examine the construct experimentally across other OCD spectrum disorders.

With respect to inferential confusion, there is also a need to develop novel experimental tasks in order to reproduce the construct of inferential confusion. Other experiments have attempted to recreate inferential confusion in ways relevant to OCD (e.g., Wong & Grisham, 2017), while in this thesis such an attempt was made via videos depicting OCD and eating disorder rituals. However, as stated before, stereotypical OCD or eating disorder rituals might not speak to all individuals. Therefore, inferential confusion as it is experienced by the individuals may not be accurately captured. A next logical step would be to develop new ways to measure inferential confusion according to the problems patients report struggling with during assessment. Furthermore, in order to test the IBA model and its premises further, it will be warranted to evaluate the degree to which inferential confusion is predictive of symptoms of OCD, eating disorders and other OCD spectrum conditions, for instance by using longitudinal

models. With respect to eating disorders specifically, it will be warranted to examine the association between inferential confusion and other important eating disorder cognitive processes (e.g., thought-fusion, perfectionism), as it has been done in the context of OCD (e.g., Aardema et al., 2006; Aardema et al., 2008).

Lastly, an important other research avenue would be to investigate shared cognitive factors as they relate to OCD dimensions as opposed to categorical subtypes, similar to the cluster approach employed in Article 2. In fact, the use of subtypes has been criticized, as OCD symptoms exist on a continuum and the vast majority of individuals with OCD report multiple symptoms (Abramowitz, McKay, & Taylor, 2011). Dimensional models of OCD allow to rate patients according to severity, as opposed to evaluate the presence/absence of a given symptom domain. Such a dimensional investigation would be more in line with the idea of an OCD spectrum of disorders and is more likely to capture the clinical reality accurately.

## **Conclusions**

The diversity of symptoms seen in individuals struggling with OCD and the fact that some OCD subtypes are less responsive to treatment (e.g., Ball, Baer, & Otto, 1996) justify the need to identify core cognitive factors that are shared across individuals, irrespective of the specificities of any given clinical case. Nonetheless, when addressed in therapy or put to the test through empirical investigations, these shared cognitive factors need to be tackled in a way that speaks to the patient, that is by being portrayed in light of the very symptoms that this patient presents. The research presented in this thesis has revealed that a general tendency to distrust the senses and cognitive faculties, captured by the constructs of low cognitive confidence and inferential confusion, appears as a relevant core cognitive factor to various OCD subtypes and to eating disorders. This adds support to the notion that IBA is a fruitful treatment avenue for a

breadth of OCD-related conditions. This thesis also contributes to the OCD literature independent of its implications for the IBA model, as it stresses the importance of employing idiosyncratic, patient-tailored stimuli, and it demonstrates the relevance of studying shared cognitive factors that can be implicated in a range of related disorders. Finally, this thesis calls for the need for further translational research bridging the gap between clinical practice and research in the field of OCD spectrum disorders, in the hope of helping those struggling with these mental health problems.

## References Cited in the Introduction and General Discussion

- Aardema, F., O'Connor, K. P., Pélissier, M. C., & Lavoie, M. E. (2009). The quantification of doubt in obsessive-compulsive disorder. *International Journal of Cognitive Therapy*, 2, 188-205. DOI: 10.1521/ijct.2009.2.2.188
- Aardema, F., Moulding, R., Radomsky, A. S., Doron, G., Allamby, J., & Souki, E. (2013). Fear of self and obsessionality: Development and validation of the Fear of Self Questionnaire. *Journal of Obsessive-Compulsive and Related Disorders*, 2, 306-315. DOI: 10.1016/j.jocrd.2013.05.005
- Aardema, F., O'Connor, K. P., & Emmelkamp, P. M. (2006). Inferential confusion and obsessive beliefs in obsessive-compulsive disorder. *Cognitive Behaviour Therapy*, 35, 138-147.
- Aardema, F., Wu, K. D., Careau, Y., O'Connor, K., Julien, D., & Dennie, S. (2010). The expanded version of the inferential confusion questionnaire: further development and validation in clinical and non-clinical samples. *Journal of Psychopathology and Behavioral Assessment*, 32, 448-462.
- Aardema, F., O'Connor, K. P., Emmelkamp, P. M., Marchand, A., & Todorov, C. (2005). Inferential confusion in obsessive-compulsive disorder: the inferential confusion questionnaire. *Behaviour Research and Therapy*, 43, 293-308.  
DOI:10.1016/j.brat.2004.02.003
- Aardema, F., O'Connor, K. P., Pélissier, M. C., & Lavoie, M. E. (2009). The quantification of doubt in obsessive-compulsive disorder. *International Journal of Cognitive Therapy*, 2, 188-205. DOI: 0.1521/ijct.2009.2.2.188

- Aardema, F., Radomsky, A. S., O'Connor, K. P., & Julien, D. (2008). Inferential confusion, obsessive beliefs and obsessive-compulsive symptoms: a multidimensional investigation of cognitive domains. *Clinical psychology & psychotherapy*, *15*, 227-238.
- Aardema, F., Wu, K. D., Careau, Y., O'Connor, K., Julien, D., & Dennie, S. (2010). The expanded version of the Inferential Confusion Questionnaire: further development and validation in clinical and non-clinical samples. *Journal of Psychopathology and Behavioral Assessment*, *32*, 448-462. DOI: 10.1007/s10862-009-9157-x
- Abramowitz, J. S. (1998). Does cognitive-behavioral therapy cure obsessive-compulsive disorder? A meta-analytic evaluation of clinical significance. *Behavior therapy*, *29*, 339-355. DOI: 0.1016/S0005-7894(98)80012-9
- Abramowitz, J. S., McKay, D., & Taylor, S. (Eds.). (2011). *Obsessive-compulsive disorder: Subtypes and spectrum conditions*. Elsevier.
- Alcolado, G. M., & Radomsky, A. S. (2016). A novel cognitive intervention for compulsive checking: Targeting maladaptive beliefs about memory. *Journal of Behavior Therapy and Experimental Psychiatry*, *53*, 75-83. DOI: 10.1016/j.jbtep.2015.02.009
- American Psychiatric Association. (2013). Anxiety Disorders. In *Diagnostic and Statistical manual of mental disorders* (5th ed.). DOI: 10.1176/appi.books.9780890425596.dsm05
- Ball, S. G., Baer, L., & Otto, M. W. (1996). Symptom subtypes of obsessive-compulsive disorder in behavioral treatment studies: A quantitative review. *Behaviour Research and Therapy*, *34*, 47-51. DOI: 0.1016/0005-7967(95)00047-2
- Bartz, J. A., & Hollander, E. (2006). Is obsessive-compulsive disorder an anxiety disorder?. *Progress in neuro-psychopharmacology and biological psychiatry*, *30*, 338-352.

- Hollander, E. (1993). Obsessive-compulsive spectrum disorders: an overview. *Psychiatric Annals*, 23, 355-358.
- Bellodi, L., Cavallini, M. C., Bertelli, S., Chiapparino, D., Riboldi, C., & Smeraldi, E. (2001). Morbidity risk for obsessive-compulsive spectrum disorders in first-degree relatives of patients with eating disorders. *American Journal of Psychiatry*, 158, 563-569. DOI: 10.1176/appi.ajp.158.4.563
- Bertrand, A., Bélanger, C., & O'Connor, K. (2011). Troubles de l'alimentation et trouble obsessionnel-compulsif: facteurs communs. *Santé mentale au Québec*, 36, 149-179. DOI : <https://doi.org/10.7202/1005819ar>
- Blais, M., Bodryzlova, Y., Aardema, F., & O'Connor, K. (2016). Open trial of inference-based therapy in the treatment of compulsive hoarding. *Journal of Psychology and Clinical Psychiatry*, 6, 00403. DOI: 10.15406/jpcpy.2016.06.00403
- Bloch, M. H., Landeros-Weisenberger, A., Rosario, M. C., Pittenger, C., & Leckman, J. F. (2008). Meta-analysis of the symptom structure of obsessive-compulsive disorder. *American Journal of Psychiatry*, 165, 1532-1542.
- Bouvard, M., Fournet, N., Denis, A., Sixdenier, A., & Clark, D. (2017). Intrusive thoughts in patients with obsessive compulsive disorder and non-clinical participants: a comparison using the International Intrusive Thought Interview Schedule. *Cognitive Behaviour Therapy*, 46, 287-299.
- Calamari, J. E., Cohen, R. J., Rector, N. A., Szacun-Shimizu, K., Riemann, B. C., & Norberg, M. M. (2006). Dysfunctional belief-based obsessive-compulsive disorder subgroups. *Behaviour Research and Therapy*, 44, 1347-1360.



- Cartwright-Hatton, S., & Wells, A. (1997). Beliefs about worry and intrusions: The Meta-Cognitions Questionnaire and its correlates. *Journal of Anxiety Disorders, 11*, 279-296. DOI:10.1016/S0887-6185(97)00011-X
- Cicek, E., Cicek, I. E., Kayhan, F., Uguz, F., & Kaya, N. (2013). Quality of life, family burden and associated factors in relatives with obsessive–compulsive disorder. *General Hospital Psychiatry, 35*, 253-258. DOI:10.1016/j.genhosppsy.2013.01.004
- Claes, L., Mitchell, J. E., & Vandereycken, W. (2012). Out of control?: Inhibition processes in eating disorders from a personality and cognitive perspective. *International Journal of Eating Disorders, 45*, 407-414. DOI: 10.1002/eat.20966
- Coelho, J. S., Baeyens, C., Purdon, C., Pitet, A., & Bouvard, M. (2012). Cognitive distortions and eating pathology: Specificity of thought–shape fusion. *Behaviour Research and Therapy, 50*, 449-456. DOI: 10.1016/j.brat.2012.04.003
- Coelho, J. S., Carter, J. C., McFarlane, T., & Polivy, J. (2008). “Just looking at food makes me gain weight”: Experimental induction of thought–shape fusion in eating-disordered and non-eating-disordered women. *Behaviour Research and Therapy, 46*, 219-228. DOI: 10.1016/j.brat.2007.11.004
- Coelho, J. S., Ouellet-Courtois, C., Purdon, C., & Steiger, H. (2015). Susceptibility to cognitive distortions: the role of eating pathology. *Journal of Eating Disorders, 3*, 31. DOI 10.1186/s40337-015-0068-9
- Coles, M. E., Radomsky, A. S., & Horng, B. (2006). Exploring the boundaries of memory distrust from repeated checking: Increasing external validity and examining thresholds. *Behaviour Research and Therapy, 4*, 995-1006. DOI: 0.1016/j.brat.2005.08.001

- Cooper, M. J. (2011). Working with imagery to modify core beliefs in people with eating disorders: A clinical protocol. *Cognitive and Behavioral Practice, 18*, 454-465. DOI: 10.1016/j.cbpra.2010.08.003
- Cooper, M. J., Grocutt, E., Deepak, K., & Bailey, E. (2007). Metacognition in anorexia nervosa, dieting and non-dieting controls: A preliminary investigation. *British Journal of Clinical Psychology, 46*, 113-117. DOI: 10.1348/014466506X115245
- Cooper, M. J., Todd, G., & Turner, H. (2007). The effects of using imagery to modify core emotional beliefs in bulimia nervosa: An experimental pilot study. *Journal of Cognitive Psychotherapy, 21*, 117. DOI: 10.1891/088983907780851577
- Dar, R., Rish, S., Hermesh, H., Taub, M., & Fux, M. (2000). Realism of confidence in obsessive-compulsive checkers. *Journal of Abnormal Psychology, 109*, 673. DOI: 10.1037/0021-843X.109.4.673
- Davenport, E., Rushford, N., Soon, S., & McDermott, C. (2015). Dysfunctional metacognition and drive for thinness in typical and atypical anorexia nervosa. *Journal of Eating Disorders, 3*, 24. DOI: 10.1186/s40337-015-0060-4
- Del Borrello, L., & O'Connor, K. (2014). The role of obsessive beliefs and inferential confusion in predicting treatment outcomes for different subtypes of obsessive-compulsive disorder. *International Journal of Cognitive Therapy, 7*, 43-66. DOI: 10.1521/ijct.2014.7.1.43
- Eisen, J. L., Mancebo, M. A., Pinto, A., Coles, M. E., Pagano, M. E., Stout, R., & Rasmussen, S. A. (2006). Impact of obsessive-compulsive disorder on quality of life. *Comprehensive psychiatry, 47*, 270-275. DOI: 10.1016/j.comppsy.2005.11.006

- Emmelkamp, P. M., & Aardema, A. (1999). Metacognition, specific obsessive–compulsive beliefs and obsessive–compulsive behaviour. *Clinical Psychology & Psychotherapy: An International Journal of Theory & Practice*, 6, 139-145. DOI: 10.1002/(SICI)1099-0879(199905)6:2<139::AID-CPP194>3.0.CO;2-9
- Emmelkamp, P. Commentary on treatment (2002). In R. O. Frost & G. Steketee (Eds.), *Cognitive approaches to obsessions and compulsions: Theory, assessment, and treatment* (pp. 461–463). Oxford: Pergamon.
- Fairburn, C. G., & Harrison, P. J. (2003). Eating disorders. *The Lancet*, 361(9355), 407-416. DOI: 10.1016/S0140-6736(03)12378-1
- Ferrão, Y. A., Shavitt, R. G., Bedin, N. R., De Mathis, M. E., Lopes, A. C., Fontenelle, L. F., ... & Miguel, E. C. (2006). Clinical features associated to refractory obsessive–compulsive disorder. *Journal of affective disorders*, 94, 199-209. DOI: 10.1016/j.jad.2006.04.019
- Foa, E. B., & Kozak, M. J. (1995). DSM-IV field trial: obsessive-compulsive disorder. *The American Journal of Psychiatry*, 152, 90-6. DOI: 10.1176/ajp.152.1.90
- Franklin, M. E., Abramowitz, J. S., Kozak, M. J., Levitt, J. T., & Foa, E. B. (2000). Effectiveness of exposure and ritual prevention for obsessive-compulsive disorder: randomized compared with nonrandomized samples. *Journal of Consulting and Clinical Psychology*, 68, 594. DOI: 10.1037/0022-006X.68.4.594
- Frost, R. O., & Steketee, G. (2002). *Cognitive approaches to obsessions and compulsions: Theory, assessment, and treatment*. Oxford: Pergamon.
- Goodman, W. K., Price, L. H., Rasmussen, S. A., Mazure, C., Fleischmann, R. L., Hill, C. L., ... & Charney, D. S. (1989). The Yale-Brown obsessive compulsive scale: I.

Development, use, and reliability. *Archives of General Psychiatry*, *46*, 1006-1011.

DOI:10.1001/archpsyc.1989.01810110048007

Goods, N. A. R., Rees, C. S., Egan, S. J., & Kane, R. T. (2014). The Relationship Between Magical Thinking, Inferential Confusion and Obsessive–Compulsive Symptoms.

*Cognitive Behaviour Therapy*, *43*, 342-350. DOI: 10.1080/16506073.2014.941393

Gwilliam, P., Wells, A., & Cartwright-Hatton, S. (2004). Dose meta-cognition or responsibility predict obsessive–compulsive symptoms: a test of the metacognitive model. *Clinical Psychology & Psychotherapy: An International Journal of Theory & Practice*, *11*, 137-144.

Halmi, K. A., Tozzi, F., Thornton, L. M., Crow, S., Fichter, M. M., Kaplan, A. S., ... & Plotnicov, K. H. (2005). The relation among perfectionism, obsessive-compulsive personality disorder and obsessive-compulsive disorder in individuals with eating disorders. *International Journal of Eating Disorders*, *38*, 371-374. DOI:

10.1002/eat.20190

Harvey, A. G., & Watkins, E. (2004). *Cognitive behavioural processes across psychological disorders: A transdiagnostic approach to research and treatment*. Oxford University Press, USA.

Hermans, D., Engelen, U., Grouwels, L., Joos, E., Lemmens, J., & Pieters, G. (2008).

Cognitive confidence in obsessive-compulsive disorder: distrusting perception, attention and memory. *Behaviour Research and Therapy*, *46*, 98-113. DOI:

0.1177/1049732302238251

Hermans, D., Martens, K., De Cort, K., Pieters, G., & Eelen, P. (2003). Reality monitoring and metacognitive beliefs related to cognitive confidence in obsessive–compulsive

- disorder. *Behaviour Research and Therapy*, *41*, 383-401. DOI: 10.1016/S0005-7967(02)00015-3
- Hollander, E., & Benzaquen, S. D. (1997). The obsessive-compulsive spectrum disorders. *International Review of Psychiatry*, *9*, 99-110. DOI: 10.1080/09540269775628
- Hollander, E., Kim, S., Braun, A., Simeon, D., & Zohar, J. (2009). Cross-cutting issues and future directions for the OCD spectrum. *Psychiatry Research*, *170*, 3-6.
- Rosen, J. C. (1992). Body image disorder: Definition, development, and contribution to eating disorders. In J.H. Crowther, D.L. Tennenbaum, S.E. Hobfoll, & M.A.P. Stephens (Eds), *The etiology of bulimia: The individual and familial context*, (pp. 157-177), Hemisphere Publishing. DOI 10.4324/9780203782286
- Van den Hout, M. A., & Kindt, M. (2003a). Repeated checking causes memory distrust. *Behaviour Research and Therapy*, *41*, 301-316. DOI:10.1016/S0005-7967(02)00012-8.
- Van den Hout, M. A., & Kindt, M. (2003b). Phenomenological validity of an OCD-memory model and the remember/know distinction. *Behaviour Research and Therapy*, *41*, 369–378. DOI:10.1016/S0005-7967(02)00097-9
- Van den Hout, M. A., & Kindt, M. (2004). Obsessive-compulsive disorder and the paradoxical effects of perseverative behaviour on experienced uncertainty. *Journal of Behavior Therapy and Experimental Psychiatry*, *35*, 165-181. DOI:10.1016/j.jbtep.2004.04.007.
- Hsu, L. G., Kaye, W., & Weltzin, T. (1993). Are the eating disorders related to obsessive compulsive disorder?. *International Journal of Eating Disorders*, *14*, 305-318. DOI: 10.1002/1098-108X(199311)14:3<305::AID-EAT2260140309>3.0.CO;2-L
- Janet, P., & Raymond, F. (1903). *Les obsessions et la psychasthénie* (Vol. 2). Paris : Félix Alcan.

- Julien, D., O'Connor, K. P., Aardema, F., & Todorov, C. (2006). The specificity of belief domains in obsessive–compulsive symptom subtypes. *Personality and Individual Differences, 41*, 1205-1216. DOI: 10.1016/j.paid.2006.04.019
- Julien, D., O'Connor, K., & Aardema, F. (2016). The inference-based approach to obsessive-compulsive disorder: A comprehensive review of its etiological model, treatment efficacy, and model of change. *Journal of Affective Disorders, 202*, 187-196. DOI: 10.1016/j.jad.2016.05.060
- Kessler, R. C., Petukhova, M., Sampson, N. A., Zaslavsky, A. M., & Wittchen, H. U. (2012). Twelve-month and lifetime prevalence and lifetime morbid risk of anxiety and mood disorders in the United States. *International Journal of Methods in Psychiatric Research, 21*, 169-184. DOI: 10.1002/mpr.1359
- Lazarov, A., Dar, R., Liberman, N., & Oded, Y. (2012). Obsessive-compulsive tendencies and undermined confidence are related to reliance on proxies for internal states in a false feedback paradigm. *Journal of Behavior Therapy and Experimental Psychiatry, 43*, 556-564. DOI: doi.org/10.1016/j.jbtep.2011.07.007
- Lazarov, A., Dar, R., Oded, Y., & Liberman, N. (2010). Are obsessive–compulsive tendencies related to reliance on external proxies for internal states? Evidence from biofeedback-aided relaxation studies. *Behaviour Research and Therapy, 48*, 516-523. DOI: 10.1016/j.brat.2010.02.007
- Leckman, J. F., Grice, D. E., Boardman, J., Zhang, H., Vitale, A., Bondi, C., ... & Goodman, W. K. (1997). Symptoms of obsessive-compulsive disorder. *American Journal of Psychiatry, 154*, 911-917.

- Mansell, W., Harvey, A., Watkins, E., & Shafran, R. (2009). Conceptual foundations of the transdiagnostic approach to CBT. *Journal of Cognitive Psychotherapy, 23*, 6-19.  
DOI: 10.1891/0889-8391.23.1.6
- Mataix-Cols, D., do Rosario-Campos, M. C., & Leckman, J. F. (2005). A multidimensional model of obsessive-compulsive disorder. *American Journal of Psychiatry, 162*, 228-238. DOI: 0.1176/appi.ajp.162.2.228
- McClelland, A., Kemps, E., & Tiggemann, M. (2006). Reduction of vividness and associated craving in personalized food imagery. *Journal of Clinical Psychology, 62*, 355-365. DOI: 10.1002/jclp.20216
- McDermott, C. J., & Rushford, N. (2011). Dysfunctional metacognitions in anorexia nervosa. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity, 16*, e49-e55.  
DOI: 10.1186/s40337-015-0060-4
- McElroy, S. L., Phillips, K. A., & Keck, J. P. (1994). Obsessive compulsive spectrum disorder. *The Journal of Clinical Psychiatry, 55*, 33-51.
- 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. DOI: 10.1016/j.cpr.2004.04.003
- Morillo, C., Belloch, A., & García-Soriano, G. (2007). Clinical obsessions in obsessive-compulsive patients and obsession-relevant intrusive thoughts in non-clinical, depressed and anxious subjects: Where are the differences?. *Behaviour Research and Therapy, 45*, 1319-1333.

- Moritz, S., & Larøi, F. (2008). Differences and similarities in the sensory and cognitive signatures of voice-hearing, intrusions and thoughts. *Schizophrenia Research, 102*, 96-107.
- O'Connor, K., & Aardema, F. (2011). *Clinician's handbook for obsessive compulsive disorder: inference-based therapy*. Hoboken, NJ: John Wiley & Sons.
- O'Connor, K. (2002). Intrusions and inferences in obsessive compulsive disorder. *Clinical Psychology & Psychotherapy, 9*, 38-46. DOI: 10.1002/cpp.303
- O'Connor, K. P., Aardema, F., Bouthillier, D., Fournier, S., Guay, S., Robillard, S., ... & Pitre, D. (2005b). Evaluation of an inference-based approach to treating obsessive-compulsive disorder. *Cognitive Behaviour Therapy, 34*, 148-163.
- O'Connor, K., Aardema, F., & Pélissier, M. C. (2005a). *Beyond reasonable doubt: Reasoning processes in obsessive-compulsive disorder and related disorders*. John Wiley & Sons.
- O'Connor, K., & Robillard, S. (1995). Inference processes in obsessive-compulsive disorder: Some clinical observations. *Behaviour Research and Therapy, 33*, 887-896. DOI: 10.1016/0005-7967(95)00042-V
- O'Connor, K. P., Ecker, W., Lahoud, M., Roberts, S. (2012). A review of the inference-based approach to obsessive compulsive disorder. *Verhaltenstherapie, 22*, 47–55.  
doi:10.1159/000333414
- O'Connor, K., Ouellet-Courtois, C. & Aardema, F. (December 2018). Innovative cognitive-behavioural treatments for obsessive-compulsive disorder. In L. Fontenelle & M. Yucel (Eds), *A transdiagnostic diagnostic approach to obsessions, compulsions and related phenomena*, (pp. 217-228), Cambridge: Cambridge University Press. DOI 10.1017/9781108164313



- Obsessive Compulsive Cognitions Working Group. (1997). Cognitive assessment of obsessive-compulsive disorder. *Behaviour Research and Therapy*, *35*, 667-681.
- Obsessive Compulsive Cognitions Working Group. (2003). Psychometric validation of the obsessive beliefs questionnaire and the interpretation of intrusions inventory: Part I. *Behaviour Research and Therapy*, *41*, 863-878.
- 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*, 1527-1542.
- Olstad, S., Solem, S., Hjemdal, O., & Hagen, R. (2015). Metacognition in eating disorders: Comparison of women with eating disorders, self-reported history of eating disorders or psychiatric problems, and healthy controls. *Eating behaviors*, *16*, 17-22. DOI: 0.1016/j.eatbeh.2014.10.019
- van Os, J., Delespaul, P., Wigman, J., Myin-Germeys, I., & Wichers, M. (2013). Beyond DSM and ICD: introducing “precision diagnosis” for psychiatry using momentary assessment technology. *World Psychiatry*, *12*, 113. DOI: 10.1002/wps.20046
- Ouimet, A. J., Ashbaugh, A. R., & Radomsky, A. S. (2019). Hoping for more: How cognitive science has and hasn't been helpful to the OCD clinician. *Clinical Psychology Review*, *69*, 14-29. DOI:10.1016/j.cpr.2018.04.003
- Owen, M. J. (2012). Intellectual disability and major psychiatric disorders: a continuum of neurodevelopmental causality. *The British Journal of Psychiatry*, *200*, 268-269. DOI: 10.1192/bjp.bp.111.105551

- Pélissier, M. C., & O'Connor, K. P. (2002). Deductive and inductive reasoning in obsessive-compulsive disorder. *British Journal of Clinical Psychology, 41*, 15-27. DOI: 10.1348/014466502163769
- Pélissier, M. C., O'Connor, K. P., & Dupuis, G. (2009). When doubting begins: Exploring inductive reasoning in obsessive-compulsive disorder. *Journal of Behavior Therapy and Experimental Psychiatry, 40*, 39-49. DOI: 0.1016/j.jbtep.2008.03.003
- Phillips, K. A., & Kaye, W. H. (2007). The relationship of body dysmorphic disorder and eating disorders to obsessive-compulsive disorder. *CNS Spectrums, 12*, 347-358.
- Pinto, A., Mancebo, M. C., Eisen, J. L., Pagano, M. E., & Rasmussen, S. A. (2006). The Brown Longitudinal Obsessive Compulsive Study: clinical features and symptoms of the sample at intake. *The Journal of clinical psychiatry, 67*, 703.
- Polman, A., O'Connor, K. P., & Huisman, M. (2011). Dysfunctional belief-based subgroups and inferential confusion in obsessive-compulsive disorder. *Personality and Individual Differences, 50*, 153-158.
- Purcell Lalonde, M., & O'Connor, K. (2015). Food for thought: Change in ego-dystonicity and fear of self in bulimia nervosa over the course of inference based treatment. *Journal of Psychology and Clinical Psychiatry, 3*(3), 1-10. doi: 10.15406/jpcpy.2015.03.00133
- Rachman, S., & de Silva, P. (1978). Abnormal and normal obsessions. *Behaviour Research and Therapy, 16*, 233-248. DOI: 10.1016/0005-7967(78)90022-0
- Rachman, S. (1998). A cognitive theory of obsessions: Elaborations. *Behaviour Research and Therapy, 36*, 385-401. DOI: 10.1016/S0005-7967(97)10041-9
- Rachman, S. (2002). A cognitive theory of compulsive checking. *Behaviour Research and Therapy, 40*, 625-639. DOI: 10.1016/S0005-7967(01)00028-6

- Radomsky, A. S., & Rachman, S. (2004). The importance of importance in OCD memory research. *Journal of Behavior Therapy and Experimental Psychiatry*, *35*, 137-151.  
DOI: 10.1016/j.jbtep.2004.04.005
- Radomsky, A. S., Dugas, M. J., Alcolado, G. M., & Lavoie, S. L. (2014). When more is less: Doubt, repetition, memory, metamemory, and compulsive checking in OCD. *Behaviour Research and Therapy*, *59*, 30-39. DOI: 10.1016/j.brat.2014.05.008
- Radomsky, A. S., Gilchrist, P. T., & Dussault, D. (2006). Repeated checking really does cause memory distrust. *Behaviour Research and Therapy*, *44*, 305-316. DOI: 10.1016/j.brat.2005.02.005
- Radomsky, A. S., Rachman, S., & Hammond, D. (2001). Memory bias, confidence and responsibility in compulsive checking. *Behaviour Research and Therapy*, *39*, 813-822.  
DOI: 10.1016/S0005-7967(00)00079-6
- Ruscio, A. M., Stein, D. J., Chiu, W. T., & Kessler, R. C. (2010). The epidemiology of obsessive-compulsive disorder in the National Comorbidity Survey Replication. *Molecular Psychiatry*, *15*, 53. DOI:10.1038/mp.2008.94
- Salkovskis, P., Forrester, E., & Richards, C. (1998). Cognitive-behavioural approach to understanding obsessional thinking. *British Journal of Psychiatry*, *173*, 53-63.  
doi:10.1192/S0007125000297900
- Schulze, D., Kathmann, N., & Reuter, B. (2018). Getting it just right: A reevaluation of OCD symptom dimensions integrating traditional and Bayesian approaches. *Journal of Anxiety Disorders*, *56*, 63-73.

- Shafran, R. (2002). Eating disorders and Obsessive Compulsive Disorder. In R. O. Frost & G. Steketee (Eds.), *Cognitive approaches to obsessions and compulsions: Theory, assessment, and treatment* (pp. 215–232). Oxford: Pergamon.
- Shafran, R., Fairburn, C. G., Robinson, P., & Lask, B. (2004). Body checking and its avoidance in eating disorders. *International Journal of Eating Disorders*, *35*, 93-101.  
DOI: 10.1002/eat.10228
- Shams, G., & Milosevic, I. (2015). A comparative study of obsessive beliefs in obsessive-compulsive disorder, anxiety disorder patients and a normal group. *Acta Medica Iranica*, *301-310*.
- Sica, C., Coradeschi, D., Sanavio, E., Dorz, S., Manchisi, D., & Novara, C. (2004). A study of the psychometric properties of the Obsessive Beliefs Inventory and Interpretations of Intrusions Inventory on clinical Italian individuals. *Journal of Anxiety Disorders*, *18*, 291-307.
- Solem, S., Håland, Å. T., Vogel, P. A., Hansen, B., & Wells, A. (2009). Change in metacognitions predicts outcome in obsessive–compulsive disorder patients undergoing treatment with exposure and response prevention. *Behaviour Research and Therapy*, *47*, 301-307.
- Stanley, M. A., & Turner, S. M. (1995). Current status of pharmacological and behavioral treatment of obsessive-compulsive disorder. *Behavior therapy*, *26*(1), 163-186. DOI: 0.1016/S0005-7894(05)80089-9
- Summerfeldt, L. J., Richter, M. A., Antony, M. M., & Swinson, R. P. (1999). Symptom structure in obsessive-compulsive disorder: a confirmatory factor-analytic study. *Behaviour Research and Therapy*, *37*, 297-311.

- Taillon, A., O'Connor, K., Dupuis, G., & Lavoie, M. (2013). Inference-based therapy for body dysmorphic disorder. *Clinical Psychology & Psychotherapy*, *20*, 67-76. DOI: 10.1002/cpp.767
- Tallis, F., Pratt, P., & Jamani, N. (1999). Obsessive compulsive disorder, checking, and non-verbal memory: a neuropsychological investigation. *Behaviour Research and Therapy*, *37*, 161-166. DOI: 10.1016/S0005-7967(98)00075-8
- Taylor, J., & Purdon, C. (2016). Responsibility and hand washing behaviour. *Journal of Behavior Therapy and Experimental Psychiatry*, *51*, 43-50. DOI: 10.1016/j.jbtep.2015.12.005
- Taylor, S., Abramowitz, J. S., McKay, D., Calamari, J. E., Sookman, D., Kyrios, M., ... & Carmin, C. (2006). Do dysfunctional beliefs play a role in all types of obsessive-compulsive disorder?. *Journal of Anxiety Disorders*, *20*, 85-97.
- Tolin, D. F., Woods, C. M., & Abramowitz, J. S. (2003). Relationship between obsessive beliefs and obsessive-compulsive symptoms. *Cognitive Therapy and Research*, *27*, 657-669.
- Treasure, J. (2006). Where do eating disorders lie on the diagnostic spectrum and what does it mean? *Nordic Journal of Psychiatry*, *60*, 27-31. doi: 10.1080/08039480500517984
- van Niekerk, J., Brown, G., Aardema, F., & O'Connor, K. (2014). Integration of inference-based therapy and cognitive-behavioral therapy for obsessive-compulsive disorder—A case series. *International Journal of Cognitive Therapy*, *7*, 67-82. DOI: 10.1521/ijct.2014.7.1.67
- Vann A, Strodl E, Anderson E (2014) The transdiagnostic nature of metacognitions in women with eating disorders. *Eating Disorders*, *22*, 306–320.  
DOI:10.1080/10640266.2014.890447

- Visser, H. A., van Megen, H., van Oppen, P., Eikelenboom, M., Hoogendorn, A. W., Kaarsemaker, M., & van Balkom, A. J. (2015). Inference-based approach versus cognitive behavioral therapy in the treatment of obsessive-compulsive disorder with poor insight: a 24-session randomized controlled trial. *Psychotherapy and Psychosomatics*, *84*, 284-293. DOI: 10.1159/000382131
- Wells, A. (2000). *Emotional disorders and metacognition: Innovative cognitive therapy*. Chichester, UK: Wiley.
- Wilson, S., Aardema, F., & O'connor, K. (2017). Doubt and fear of self in bulimia nervosa. *International Journal of Eating Disorders*, *50*, 1437-1441. DOI: 10.1002/eat.22789
- Wilson, S., Aardema, F., & O'Connor, K. (2018a). Possibility-Based Information Elicits Doubt in Bulimia Nervosa: A Study of Inductive Reasoning. *International Journal of Cognitive Therapy*, *11*, 410-420. DOI: 0.1007/s41811-018-0032-y
- Wilson, S., Aardema, F., & O'Connor, K. (2018b). What do I look like? Perceptual confidence in bulimia nervosa. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, 1-7. DOI: 0.1007/s40519-018-0542-x
- Wong, S. F., & Grisham, J. R. (2017). Causal role for inverse reasoning on obsessive-compulsive symptoms: Preliminary evidence from a cognitive bias modification for interpretation bias study. *Journal of Behavior Therapy and Experimental Psychiatry*, *57*, 143-155. DOI: 10.1016/j.jbtep.2017.06.001
- Wu, K. D., & Carter, S. A. (2008). Further investigation of the Obsessive Beliefs Questionnaire: Factor structure and specificity of relations with OCD symptoms. *Journal of Anxiety Disorders*, *22*, 824-836. DOI: 10.1016/j.janxdis.2007.08.008

Wu, K. D., Aardema, F., & O'Connor, K. P. (2009). Inferential confusion, obsessive beliefs, and obsessive-compulsive symptoms: A replication and extension. *Journal of Anxiety Disorders, 23*, 746-752. DOI: 10.1016/j.janxdis.2009.02.017

Yorulmaz, O., Gençöz, T., & Woody, S. (2010). Vulnerability factors in OCD symptoms: Cross-cultural comparisons between Turkish and Canadian samples. *Clinical Psychology & Psychotherapy: An International Journal of Theory & Practice, 17*, 110-121. DOI: 10.1002/cpp.642

## Appendices



**Appendix A: Ethics Certificates for Articles 2 and 3**

Le 13 mars 2018

Monsieur Kieron O'Connor  
CIUSSS de l'Est-de-l'Île-de-Montréal  
Installation Institut universitaire en santé mentale de Montréal

**Objet : Approbation finale du Comité d'éthique de la recherche**

Projet n° 2018-1443

Titre : *La confiance cognitive chez le trouble obsessionnel compulsif: Le rôle de différences qualitatives et quantitatives*

---

Monsieur O'Connor,

Le Comité d'éthique de la recherche du CIUSSS de l'Est-de-l'Île-de-Montréal a évalué, en comité accéléré, les aspects éthiques de votre projet de recherche. Lors de cette évaluation, les documents suivants ont été examinés :

- Protocole de recherche (MCQ\_Ethics Protocol\_7-02-2018.docx) [date : 07 février 2018, version : 1]
- Cadre de gestion de la banque de données et de matériel biologique (Cadre de gestion-BD TICTACTOC-finale.pdf) [date : 19 août 2014]
- Formulaire d'information et de consentement (FIC-Banque TICTACTOC-28-11-2014.pdf) [date : 09 décembre 2014]
- Pièce justificative (Cadre de gestion-BD TICTACTOC-finale.pdf)
- Fichier (score FRQSC copy.pdf)
- Document financier (score FRQSC copy.pdf) [date : 05 février 2018]
- Déclaration financière (déclaration financière.pdf)
- Engagement (Engagement du chercheur.pdf)

Le tout étant jugé satisfaisant, j'ai le plaisir de vous informer que votre projet de recherche a été approuvé, tel quel, par le Comité d'éthique de la recherche du CIUSSS de l'Est-de-l'Île-de-Montréal.

Les documents que le Comité a approuvés et que vous pouvez utiliser pour la réalisation de votre projet sont mentionnés ci-dessus.

Cette approbation éthique est valide pour un an à compter de la date de la présente lettre, date de l'approbation finale. Deux mois avant la date d'échéance, vous devrez faire une demande de renouvellement auprès du Comité, en utilisant le document du Comité prévu à cet effet.

Dans le cadre du suivi continu, le Comité vous demande de vous conformer aux exigences suivantes en utilisant les formulaires du Comité prévus à cet effet et de soumettre, le cas échéant :

1. toute demande de modification au projet de recherche ou à tout document approuvé par le Comité pour la réalisation de votre projet.
2. tout nouveau renseignement ou toute modification à l'équilibre clinique susceptible d'affecter l'intégrité ou l'éthicité du projet de recherche, d'accroître les risques et les inconvénients pour les participants, de nuire au bon déroulement du projet ou d'avoir une incidence sur le désir d'un participant de continuer à participer au projet.
3. les réactions indésirables qui rencontrent tous les critères suivants : a) cette réaction concerne un sujet recruté dans notre établissement ou dans un établissement pour lequel le CÉR a juridiction et; b) il doit s'agir de réaction indésirable grave et inattendue et; c) cette réaction doit être reliée ou possiblement, probablement ou certainement reliée au médicament à l'étude ou

- à une procédure de recherche.
4. tout accident survenu dans votre site.
  5. l'interruption prématurée du projet de recherche, qu'elle soit temporaire ou permanente.
  6. tout problème constaté à la suite d'une activité de surveillance ou de vérification menée par un tiers et susceptible de remettre en question l'intégrité ou l'éthicité du projet de recherche
  7. toute suspension ou annulation de l'approbation octroyée par un organisme de subvention ou de réglementation.
  8. toute procédure en cours de traitement d'une plainte ou d'une allégation de manquement à l'intégrité ou à l'éthicité ainsi que des résultats de la procédure.
  9. toute déviation au projet de recherche susceptible d'augmenter le niveau de risque ou susceptible d'influer sur le bien-être du participant ou d'entacher le consentement du participant.
  10. une demande de renouvellement annuel de l'approbation du projet de recherche.
  11. le rapport de la fin du projet de recherche.

Nous vous rappelons que la présente décision vaut pour une année et peut être suspendue ou révoquée en cas de non-respect de ces exigences.

Le CÉR achemine votre projet au bureau de la personne formellement mandatée responsable pour obtenir l'autorisation de la réalisation de votre projet au CIUSSS de l'Est-de-l'Île-de-Montréal. Il est entendu que vous ne pouvez commencer la réalisation de votre projet avant d'avoir obtenu cette autorisation.

De plus, nous vous rappelons que vous devez conserver pour une période d'au moins un an suivant la fin du projet, un répertoire distinct comprenant les noms, prénoms, coordonnées, date du début et de fin de la participation de chaque sujet de recherche.

Le Comité d'éthique de la recherche du CIUSSS de l'Est-de-l'Île-de-Montréal est désigné par le ministre de la Santé et des Services sociaux (MSSS) pour les fins d'application de l'article 21 du Code civil du Québec. Il adhère aux directives publiées dans l'Énoncé de politique des trois conseils (ÉPTC 2, 2014), au Plan d'action ministériel en éthique de la recherche et en intégrité scientifique (MSSS 1998) et aux exigences édictées pour les comités d'éthique de la recherche à la Partie C, Titre 5 du Règlement sur les aliments et drogues du Canada (C.R.C. ch.870). Il agit également en conformité avec les standards du *United States Code of Federal Regulations* encadrant la recherche avec des participants humains. Le Comité fonctionne de manière compatible avec les standards internationaux en appliquant, notamment, la Ligne directrice de l'ICH adoptée par Santé Canada : Les bonnes pratiques cliniques.

De plus, nous vous avisons que les règles de fonctionnement du Comité d'éthique de la recherche du CIUSSS de l'Est-de-l'Île-de-Montréal satisfont aux exigences de Santé Canada relatives à l'Attestation du comité d'éthique pour la recherche. La recherche nécessitant un numéro de « US Federal Wide Assurance » est effectuée au CIUSSS de l'Est-de-l'Île-de-Montréal sous les numéros suivants : FWA00001935 et IRB00002087.

Avec l'expression de nos sentiments les meilleurs.

Stéphane P. Ahern, M.A., M.D., Ph.D.  
Président  
Comité d'éthique de la recherche  
CIUSSS de l'Est-de-l'Île-de-Montréal

Le 19 septembre 2017

Monsieur Kieron O'Connor  
CIUSSS de l'Est-de-l'Île-de-Montréal  
Installation Institut universitaire en santé mentale de Montréal

**Objet : Autorisation de réaliser la recherche suivante :**

Titre du projet : *Vérification de la réalité: Une étude de la susceptibilité à la confusion inférentielle chez le trouble obsessionnel-compulsif et le trouble alimentaire*

Numéro attribué par le CÉR-CEMML : 2018-1115

Numéro attribué par le CIUSSS de l'Est-de-l'Île-de-Montréal : CIUSSS-EMML-304

Monsieur O'Connor,

Il nous fait plaisir de vous autoriser à réaliser la recherche identifiée en titre dans notre établissement, soit le Centre intégré universitaire de santé et de services sociaux de l'Est-de-l'Île-de-Montréal (CEMML) - installation Institut universitaire en santé mentale de Montréal.

Cette autorisation vous est accordée sur la foi des documents que vous avez déposés auprès de notre établissement, notamment la lettre du CÉR du CEMML portant la date du 7 juillet 2017 qui établit que votre projet de recherche a fait l'objet d'un examen éthique dont le résultat est positif et une lettre datée du 26 juin 2017 qui établit que votre projet de recherche a fait l'objet d'un examen scientifique positif. De plus, votre projet a reçu l'approbation de la convenance institutionnelle le 19 septembre 2017. Si ce CÉR vous informe, pendant le déroulement de cette recherche, d'une décision négative portant sur l'acceptabilité éthique de cette recherche, vous devez considérer que la présente autorisation de réaliser la recherche sous les auspices de notre établissement est, de ce fait, révoquée à la date que porte l'avis du CÉR évaluateur.

Notre établissement a reçu une copie de la version finale des documents se rapportant à la recherche, approuvée par le CÉR évaluateur.

Cette autorisation de réaliser la recherche suppose également que vous vous engagez :

- à vous conformer aux demandes du CÉR évaluateur, notamment pour le suivi éthique de la recherche;
- à rendre compte au CÉR évaluateur et au signataire de la présente autorisation du déroulement du projet, des actes de votre équipe de recherche, s'il en est une, ainsi que du respect des règles de l'éthique de la recherche;
- à respecter les moyens relatifs au suivi continu qui ont été fixés par le CÉR évaluateur;
- à conserver les dossiers de recherche pendant la période fixée par le CÉR évaluateur, après la fin du projet, afin de permettre leur éventuelle vérification;
- à respecter les modalités arrêtées au regard du mécanisme d'identification des sujets de recherche dans notre établissement, à savoir : La tenue à jour et la conservation de la liste à jour des sujets de recherche recrutés dans notre établissement. Cette liste devra nous être fournie sur demande.

La présente autorisation peut être suspendue ou révoquée par notre établissement en cas de non-respect des conditions établies. Le CÉR évaluateur en sera alors informé.

Cette autorisation de réaliser la recherche dans notre établissement sera renouvelée annuellement à la date du renouvellement de

l'approbation éthique du CÉR évaluateur.

Vous consentez également à ce que notre établissement communique aux autorités compétentes des renseignements personnels qui sont nominatifs au sens de la loi en présence d'un cas avéré de manquement à la conduite responsable en recherche de votre part lors de la réalisation de cette recherche.

Je vous invite à entrer en communication avec notre Bureau de coordination de la recherche clinique (BCRC) au 514-252-3400, poste 3724 ou poste 5963, ou par courriel au [bcrc.cemtl@ssss.gouv.qc.ca](mailto:bcrc.cemtl@ssss.gouv.qc.ca), pendant le déroulement de cette recherche dans notre établissement, si besoin est. Vous pouvez aussi solliciter l'appui de notre Comité d'éthique de la recherche au 514-252-3400, poste 5708, ou par courriel au [cer.cemtl@ssss.gouv.qc.ca](mailto:cer.cemtl@ssss.gouv.qc.ca) pour obtenir les conseils et le soutien voulu.

En terminant, je vous demanderais de toujours mentionner dans votre correspondance au sujet de cette recherche le numéro attribué à votre demande par notre établissement ainsi que le numéro attribué au projet de recherche par le CÉR.

Avec l'expression de mes sentiments les meilleurs.

Yvan Gendron  
Président-directeur général  
CIUSSS de l'Est-de-l'Île-de-Montréal

c. c. : Dr Stéphane P. Ahern, président du Comité d'éthique de la recherche du CIUSSS de l'Est-de-l'Île-de-Montréal

**Appendix B: Consent Form for Article 3**

## INFORMATION AND CONSENT FORM

<b>Research project title:</b>	Reality Check: An Examination of Susceptibility to Inferential Confusion in Obsessive-Compulsive Disorder and Eating Disorders
<b>Principal investigator of the research project:</b>	Catherine Ouellet-Courtois, MSc. PhD candidate in clinical psychology at l'Université de Montréal  Kieron O'Connor, PhD. Researcher at Centre de recherche de l'Institut universitaire en santé mentale de Montréal (CRIUSSM) du Centre intégré universitaire de santé et de services sociaux (CIUSSS) de l'Est-de-l'Île-de-Montréal
<b>Facility(ies) or site(s):</b>	Institut universitaire en santé mentale de Montréal (IUSMM)

## INTRODUCTION

We are inviting you to participate in a research project. However, before you agree to participate in this project and sign this information and consent form, please take the time to read, understand and carefully consider the following information.

This form may contain words that you do not understand. Please ask the principal investigator of this project or a member of his/her research staff all the questions you consider useful and ask them to explain to you any word or information that is not clear.

## NATURE AND OBJECTIVES OF THE RESEARCH PROJECT

The main goal of this project is to understand the reasoning style of individuals suffering from obsessive-compulsive disorder and eating disorders and the impact of this reasoning style on obsessive-compulsive disorder and eating disorders symptoms.

To accomplish this goal, we will administer questionnaires, ask participants to watch 6 short videos, and conduct interviews with 18 women suffering from obsessive-compulsive disorder, 18 women with an eating disorder and 18 women who are not suffering from these two mental disorders, aged 18-45 years old.

## HOW THE RESEARCH PROJECT WILL PROCEED

This research project will be conducted at the Centre d'étude sur les troubles obsessionnels-compulsifs et les tics (CÉTOCT) at l'Institut universitaire en santé mentale de Montréal (IUSMM).

### 1. Duration and number of visits

Your participation in this research project will include 1 visit that will last 90 minutes.

## **2. Nature of your participation**

Your participation in this research project will involve:

1. Filling out questionnaires that ask about your eating habits, your mood, your anxiety and that evaluate your reasoning style.
2. Watching a total of 6 short videos.
3. A semi-structured interview about psychological symptoms.
4. Measurement of your height and weight to determine body mass index (BMI).

### **ADVANTAGES ASSOCIATED WITH THE RESEARCH PROJECT**

You will not benefit from your participation in this research project. We hope that the results obtained will contribute to the advancement of scientific knowledge in this area and to the development of better treatments for patients.

### **RISKS AND DISADVANTAGES ASSOCIATED WITH THE RESEARCH PROJECT**

In addition to the time you spend participating in this research project and travelling, it is also possible that some questions or watching the videos may provoke a certain degree of distress or discomfort. In the case of an undesirable reaction, the situation will be addressed by one of the members of the research team and a list of psychological resources will be provided to you. Also, you can always choose to not answer a question or choose to terminate your participation at any time, without any negative consequences to you.

### **VOLUNTARY PARTICIPATION AND RIGHT TO WITHDRAW**

Your participation in this research project is voluntary. You are therefore free to refuse to participate in it. You can also withdraw from this project at any time, without having to provide reasons, by informing the research team.

Your decision not to participate in this research project or to withdraw from it will not have any effect on the quality of care and services to which you are entitled or on your relationship with the teams that provide them.

The principal investigator of this research project, the Research Ethics Board of the CIUSSS (Centre intégré universitaire de santé et de services sociaux [Integrated University Centre for Health and Social Services]) of the Est-de-l'Île-de-Montréal region, the funding agency, or the sponsor may terminate your participation, without your consent. This may happen if new discoveries or information indicate that your participation in the project is no longer in your best interest, if you do not follow the research project instructions, or if there are administrative reasons for abandoning the project.

If you withdraw or are withdrawn from the project, the information and material already collected in the context of this project will nevertheless be stored, analyzed, or used to ensure the integrity of the project.

Any new knowledge acquired during the course of the project that could affect your decision to continue participating in this project will be communicated to you quickly.

### **CONFIDENTIALITY**

While you are taking part in this research project, the principal investigator of this project and members of his/her research staff will collect information about you in a research file; this information is needed to meet the scientific objectives of this research project.

This information may include information contained in your medical record (if applicable, e.g., for patients at the CÉTOCT) concerning your past and present health, your lifestyle, as well as the results of all the tests, examinations, and procedures that will be carried out. Your file may also include other information, such as your name, gender, date of birth, and ethnicity.

All the information collected will remain confidential to the extent provided for by law. You will be identified only by a code number. The key to the code linking your name to your research file will be kept by the principal investigator of this research project.

The principal investigator of this research project (Dr Kieron O'Connor) will keep these research data for at least 25 years.



The research data may be published or be the subject of scientific discussions, but it will not be possible to identify you.

For the purposes of monitoring, control, protection, and safety, your research file and your medical records may be consulted by a person appointed by regulatory agencies in Canada or abroad, such as Health Canada, as well as by representatives of the funding agency, the institution or the Research Ethics Board of the CIUSSS of the Est-de-l'Île-de-Montréal region. All these individuals and organizations adhere to a confidentiality policy.

You have the right to consult your research file to verify the information collected and to have it corrected as needed. Furthermore, access to certain information before the end of the study could involve removing you from the project in order to preserve its integrity.

## **COMPENSATION**

As compensation for the expenses incurred due to your participation in the research project, you will receive an amount of \$30 per visit scheduled in the protocol, for a total of 1 visit, i.e. a total amount of \$30. If you withdraw from the project (or if your participation is terminated) before it is complete, the compensation will be proportionate to the duration of your participation.

If a monetary compensation exceeds the amount paid to reimburse your expenses, please note that you may be issued a T4A (Statement of Pension, Retirement, Annuity or Other Income).

## **IN THE EVENT OF INJURY**

Should you suffer any injury whatsoever following the administration of the study drug or any procedure related to this research project, you will receive all the care and services that your health condition requires.

By agreeing to participate in this research project, you do not waive any of your rights or release the principal investigator of this research project or the institution from their civil and professional liability.

## **IDENTIFICATION OF CONTACT PERSONS**

If you have any questions or experience any problems related to this research project, or if you wish to withdraw from it, you can contact the principal investigator of this research project or someone from the research team at the following number: (514) 251-4015 ext. 2343.

In the event of an emergency, please contact Karine Bergeron, research coordinator, at the following number: 514-251-4015 ext.3585 or go to the emergency room of the nearest hospital.

For any question concerning your rights as a participant in this research project or if you have any complaints or comments to make, you can contact the Service Quality and Complaints Commissioner for the CIUSSS of the Est-de-l'Île-de-Montréal region at 514-252-3400, ext. 3510.

## **MONITORING THE ETHICAL ASPECTS OF THE RESEARCH PROJECT**

The Research Ethics Board of the CIUSSS of the Est-de-l'Île-de-Montréal region has approved and will monitor the project. For any information, you can contact the Board's administrative office at 514-252-3400, extension 5708.

**Research project title:**

Reality Check: An Examination of Susceptibility to Inferential Confusion in Obsessive-Compulsive Disorder and Eating Disorders

**SIGNATURES**

***Participant's signature***

I have read the information and consent form. The research project and this information and consent form have been explained to me. My questions have been answered and I have been given enough time to make a decision. After thinking it over, I consent to participate in this research project under the conditions set out in this form.

I authorize the research team to access to my medical record.

[Optional: I authorize the principal investigator of this research project to contact me to ask whether I am interested in participating in other research projects.]

Yes  No

I authorize the principal investigator of this research project to inform my primary care doctor that I am taking part in this research project

Yes  No

---

Name and contact details of the primary physician

---

Participant's name and signature	Signature	Date
----------------------------------	-----------	------

***Signature of the person obtaining consent***

I have explained the research project and this information and consent form to the participant, and I have answered the questions he/she asked me.

---

Name and signature of the person obtaining consent	Signature	Date
--	-----------	------