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Inverse reasoning processes in obsessive-compulsive disorder

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ABSTRACT

The inference-based approach (IBA) is one cognitive model that aims to explain the aetiology and maintenance of obsessive-compulsive disorder (OCD). The model proposes that certain reasoning processes lead an individual with OCD to confuse an imagined possibility with an actual probability, a state termed inferential confusion. One such reasoning process is inverse reasoning, in which hypothetical causes form the basis of conclusions about reality. Although previous research has found associations between a self-report measure of inferential confusion and OCD symptoms, evidence of a specific association between inverse reasoning and OCD symptoms is lacking. In the present study, we developed a task-based measure of inverse reasoning in order to investigate whether performance on this task is associated with OCD symptoms in an online sample. The results provide some evidence for the IBA assertion: greater endorsement of inverse reasoning was significantly associated with OCD symptoms, even when controlling for general distress and OCD-related beliefs. Future research is needed to replicate this result in a clinical sample and to investigate a potential causal role for inverse reasoning in OCD.

1. Introduction

The cognitive appraisal model is an influential psychological model of obsessive-compulsive disorder (OCD), which proposes that obsessions originate from catastrophic misappraisals of the significance of one's intrusive thoughts, impulses, or images (i.e., cognitive appraisal model; Rachman, 1997). As such, the cognitive appraisal model assumes that the content of the intrusions experienced by those with and without OCD are similar. Although there is some support for this assumption (Rachman & de Silva, 1978; Salkovskis & Harrison, 1984), recent findings have cast some doubt (Julien, O'Connor, & Aardema, 2007). That is, studies reporting the universality of intrusions utilised non-clinical samples that were not representative of the general population (i.e., female students). Student years are associated with stress and stress with obsessional symptoms (Warren, Gershuny, & Sher, 2002), and obsessional themes are more common among females (Purdon & Clark, 1993). Thus the estimate of non-clinical occurrences of intrusions in past studies may have been inflated due to the study population.

The model also proposes that dysfunctional beliefs held by the individual with OCD drives his or her appraisal of intrusions as being personally meaningful. For example, one might hold the belief that he is responsible for preventing negative outcomes (i.e., inflated responsibility; Salkovskis, 1985) and thus will interpret an intrusive thought of harming a child as an indication that he is a dangerous individual. According to the model, the personal significance of the intrusion causes it to take on obsessional qualities such as increased intensity, duration, frequency, and anxiety evoked (Rachman, 1997; Salkovskis, 1985). The role of these dysfunctional appraisals based on these beliefs have been empirically-validated in individuals with OCD (Julien et al., 2008); however, some studies have since reported that 25–73% of individuals diagnosed with OCD do not report high levels of dysfunctional appraisals (Calamari et al., 2006; Polman, O'Connor, & Huisman, 2011; Taylor et al., 2006). These findings suggest that dysfunctional beliefs and appraisals may not completely account for the aetiology of OCD (Julien, O'Connor, & Aardema, 2016).

The inference-based approach (IBA) provides an alternate cognitive account of the aetiology of OCD that also is largely compatible with the cognitive appraisal model, but claims to address some of its aforementioned shortcomings. Importantly, the IBA reconceptualises obsessions as pathological doubts or imagined possibilities about reality that are grossly incompatible with the actual state of the world (O'Connor, Ecker, Lahoud, & Roberts, 2012), but are inferred to be true via a state termed inferential confusion (Aardema, O'Connor, & Emmelkamp, 2006; Aardema, O'Connor, Emmelkamp, Marchand, & Todorov, 2005; O'Connor & Robillard, 1995). The IBA suggests that when typically benign doubts (e.g.,

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'the car *might be* unlocked') are inferred to be true (e.g., 'the car is unlocked'; primary inference; O'Connor et al., 2012) because of inferential confusion, any consequences are also inferred to be true (e.g., 'my car will be stolen'; secondary inference; O'Connor et al., 2012). This process arouses anxiety and distress which individuals with OCD attempt to reduce via compulsive behaviours (e.g., constantly checking on the car).

Inferential confusion is characterised by maladaptive reasoning devices proposed to be exclusive to OCD, which ostensibly enforce the credibility of the initial doubt. Inverse reasoning is one such device (for a detailed explanation of the other reasoning devices, see O'Connor et al., 2012). It is defined as the opposite of normal or healthy reasoning, in which a conclusion follows the observation of a state of affairs (e.g., 'this pole is dirty, therefore a lot of people must have touched this pole'). In inverse reasoning, a hypothesised cause is believed to be true ('a lot of people must have touched this pole'), leading to the conclusion that the effect must be true ('therefore, it must be dirty') despite opposing sensory evidence (that the pole is clean). The IBA proposes that individuals with OCD typically use one or more of these reasoning devices to justify their doubts (O'Connor et al., 2012). This justification of doubt takes the form of an inductive narrative, which is part of the obsessional process. According to the IBA, it is the existence of these unusual or inappropriate reasoning devices that sets OCD obsessions qualitatively apart from the content of obsessions observed in non-clinical populations (O'Connor et al., 2012; O'Connor, Koszegi, Aardema, van Niekerk, & Taillon, 2009). In sum, the IBA argues that the process of inferential confusion drives the genesis of obsessions, rather than the appraisal of intrusions. The IBA does concede a role for cognitive appraisal, but suggests that cognitive appraisals serve to maintain obsessions rather than cause them (Julien et al., 2016).

Aardema et al. (2005) developed the Inferential Confusion Questionnaire (ICQ) to measure the construct of inferential confusion. This questionnaire contains items that reflect two key reasoning devices, a distrust of the senses and inverse reasoning (e.g., 'I am sometimes more convinced by what might be there than by what I actually see'). Higher scores on the ICQ indicate a greater degree of reliance on these reasoning devices and consequently an increased tendency to confuse imagined possibilities with reality (Aardema et al., 2005). In support for the IBA, researchers have demonstrated in multiple studies a positive and significant association between scores on the ICQ and obsessive-compulsive (OC) symptoms, even when controlling for scores measuring general distress and the maladaptive belief domains proposed by the cognitive appraisal model (Aardema et al., 2005). More recently, Aardema and Wu (2011) found through a series of hierarchical multiple regression models that scores on the ICQ was the strongest and most consistent predictor of OC symptoms, controlling for negative affect.

Consistent with previous research, Aardema and Wu (2011) also found significant positive correlations between inferential confusion, OC symptoms, and scores on a measure of schizotypal personality features. The authors thus hypothesised that inferential confusion may play a role in delusional disorders which are also characterised by an absorption in alternate realities, albeit to a higher degree (Aardema et al., 2005; Sobin et al., 2000). The relationship between inferential confusion, delusional disorder, and OCD has been replicated in clinical samples (Aardema et al., 2005), with individuals diagnosed with delusional disorder and OCD scoring significantly higher on the ICQ than groups with no disorders or another anxiety disorder (i.e., social phobia), again controlling for general distress and OC beliefs.

In a recent review of the empirical evidence for the IBA, Julien et al. (2016) acknowledged that only a few studies across a small number of research labs have investigated its key premises and that the model requires additional empirical support using different methodological strategies. One component of the model suffering from some of these limitations is the reasoning device labelled inverse reasoning. Although two studies have found evidence for an inductive (but not deductive) reasoning style used by individuals with OCD that differs from individuals with generalised anxiety disorder and non-clinical participants (Pelissier & O'Connor, 2002; Pelissier, O'Connor, & Dupuis, 2009), no studies to date have examined the specific presence of inverse reasoning in the OCD narrative (O'Connor, Koszegi, Goulet, & Aardema, 2013). One quasi-experimental study has provided evidence for a style of reasoning in OCD that is characterised by an overreliance on possibility-based information, which is a characteristic of inferential confusion that closely relates to the construct of inverse reasoning (Aardema, O'Connor, Pelissier, & Lavoie, 2009). In this study, OCD and non-clinical participants were presented with beginnings of scenarios followed by alternating possibility- and reality-based information (Inference Processes Task). Aardema, Wu, Careau, O'Connor, Julien, & Dennie (2009) then examined how the type of information affected participants' levels of doubt in the ending of the scenarios having occurred or not. Results indicated that participants with OCD expressed higher levels of doubt compared to non-clinical participants only after receiving possibility-based information.

In sum, most empirical evidence for the role of inverse reasoning in OCD is limited to self-report measures, which cannot properly examine a reasoning process and thus needs to be supplemented by experimental research.

Our primary aim was to develop a new task-based measure of inverse reasoning (i.e., the Inverse Reasoning Task) to overcome current limitations in the measurement of this construct, including the overreliance on self-report measures. We predicted that we would replicate and extend the findings of Aardema and Wu (2011) by showing significant correlations between our task and self-reported levels of OC symptoms and schizotypal personality features, even when controlling for general distress and OCD-related beliefs.

An idea central to the IBA model is that individuals with OCD only rely on inverse reasoning when confronted with their OCD-relevant stimuli (Aardema et al., 2005; O'Connor et al., 2009). Given this, we predicted that scores on the component of our task that involved OCD-related scenarios and concerns would be associated with OC symptoms, whereas the component of the task involving non-OCD scenarios would show no such association.

2. Method

2.1. Participants

The sample for the current study was recruited from the internet-based Amazon Mechanical Turk (MTurk) interface. The MTurk website is an online platform through which registered users from around the world can complete surveys and/or computerised tasks in exchange for a small financial incentive. Access to the current study was restricted to MTurk participants based in the United States who participated online, after providing informed consent, in exchange for US$1 for their Amazon account. The use of MTurk participants has been shown to be appropriate for the studying of some clinical phenomena as this population typically endorses more clinical symptoms than the general population (Arditte, Cek, Shaw, & Timpano, 2015; Buhrmester, Kwang, & Gosling, 2011). More generally, the use of non-clinical samples in OCD research has been shown to be appropriate in understanding OC-related phenomena (Abramowitz et al., 2014). The final sample consisted of 138 participants. The sample demographics including means and sample deviations on all measures of the study are provided in Table 1.

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