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Exploring dimensionality in the contamination-relevant semantic network with simulated obsessions and association splitting

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ABSTRACT

The semantic network approach to obsessive-compulsive disorder (OCD) represents a new cognitive approach to understanding the condition. With a dimensional perspective on OC symptoms, we attempted to: (1) uncover a contamination-relevant semantic network in an unselected undergraduate sample; and (2) validate the purported mechanism of association splitting, a network-based intervention for OC symptoms. Contamination-relevant, negatively valenced, and neutral Deese/Roediger-McDermott (DRM) word lists were presented, accompanied by relational or item-specific semantic processing simulations of obsessions or association splitting, respectively. Good veridical recognition performance across list types was observed with simulated obsessions and association splitting. Substantial false recognition rates across critical lure types followed simulated obsessions; such rates were lower with simulated association splitting. Network-based accounts of the contamination-relevant findings supported the aforementioned research aims. Additionally, enhanced contamination-relevant veridical recognition confidence with simulated association splitting suggests a memory confidence pathway through which the technique might reduce contamination-related symptoms. Lastly, contamination-relevant recognition performance was not related to contamination-related symptom severity across conditions, signaling non-dimensionality in contamination-relevant semantic network intensification. Our findings indicate the need for rigorous research on the semantic network approach to OCD to refine its tenets. Association splitting should also be more extensively researched as a viable technique for treating OCD.

1. Introduction

A semantic network is a constellation of linked concepts in memory which can be associatively activated (i.e., spreading activation; Anderson, 1983; Anderson & Bower, 1973; Anderson & Pirolli, 1984; Collins & Loftus, 1975) when any one or more of such concepts are first activated (McDermott & Watson, 2001; Roediger, Balota, and Watson, 2001; Roediger & McDermott, 2000). Semantic network models of obsessive-compulsive disorder (OCD) represent a new cognitive approach to understanding and treating the condition. For example, Moritz, Jelinek, Klinge, and Naber (2007) first conceptualized obsessions as exaggerated activations of linked concepts within an OC-relevant semantic network. They then demonstrated the efficacy of association splitting (Moritz & Jelinek, 2007) for ameliorating OC symptoms (see also Moritz & Jelinek, 2011; Moritz & Russu, 2013). Association splitting is a cognitive practice technique based on the fan effect in a semantic network (Anderson, 1974; Reisberg, 2001), which involves weakening each association to a concept in the network by increasing the number of competing associations to that same concept. In other words, association splitting reduces obsessions – and by functional linkage, compulsions – through practicing the redirection of spreading activation away from established associations in an OC-relevant semantic network to novel or atrophied links between OC-relevant and non-OC-relevant concepts.

Notably, an OC-relevant semantic network has yet to be uncovered beyond OCD patient groups (i.e., in an unselected sample), as would have been expected with dimensionality in OC symptom severity (Abramowitz et al., 2010; see also Blom et al., 2011; Fullana et al., 2009). The purported mechanism of association splitting has also not been empirically validated. These questions were examined here because of the significant potential research and clinical implications. Uncovering an OC-relevant semantic network in an unselected sample will validate the semantic network approach to OCD, thereby invigorating future related research in refinement of its tenets. There will also be motivation to investigate association splitting more rigorously as a viable

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technique for treating OCD, should there be sound evidence for its underlying mechanism. We chose to focus on contamination-related concerns in this study because it is a cross-culturally preponderant OC symptom dimension (Girischandra & Sumant, 2001; Kim et al., 2005; Li et al., 2009; Matsunaga et al., 2008; Wheaton et al., 2013).

The Deese/Roediger-McDermott (DRM) paradigm (Deese, 1959; Roediger & McDermott, 1995) is useful for our purposes, given the link between one of its most widely endorsed explanatory accounts (i.e., the activation-monitoring framework; McDermott & Watson, 2001; Roediger et al., 2001; Roediger & McDermott, 2000) and semantic network models. The DRM paradigm conventionally involves presenting words semantically related to non-presented items, eliciting robust veridical and false memory rates (for reviews, see Gallo, 2006, 2010). Veridical memory refers to memory for (e.g., recognition of) items presented during an earlier memorization phase, while false memory refers to memory for non-presented items semantically related to memorized ones. The non-presented items are typically termed as critical lures. The activation-monitoring framework attributes these findings to repetitive activations of memorized concepts and their associated critical lures in the semantic network, as well as failed monitoring of the source of activated information (Johnson, 1997; Underwood, 1965).

It is also within the DRM paradigm that semantic processing manipulations can be implemented to simulate obsessions and association splitting, as conceptualized by Moritz et al. (2007). Obsessions can be simulated via relational semantic processing of DRM lists (i.e., thinking of the meaning of each word that relates it to the others in the same list; Hunt and McDaniel, 1993; McCabe et al., 2004). This is because the deliberate, repetitive association of contamination-relevant concepts to each other in relational processing mimics the active repetition of contamination-relevant cognitions characteristic of contamination-related obsessions (see Fig. 1). In this example, the non-presented critical lure would be the word *disease*, organized around a to-be-memorized DRM list that comprises words such as *germ*, *virus*, and *infection*.

If a contamination-relevant semantic network does exist in all individuals, then substantial contamination-relevant veridical and false recognition rates should accompany relational processing (hypothesis 1). False recognition arises due to repeated activations of encoded contamination-relevant items spreading to related, non-presented critical lures.

Additionally, stronger links might be present in the contamination-relevant semantic network of individuals with greater contamination-related symptom severity, similar to expertise for

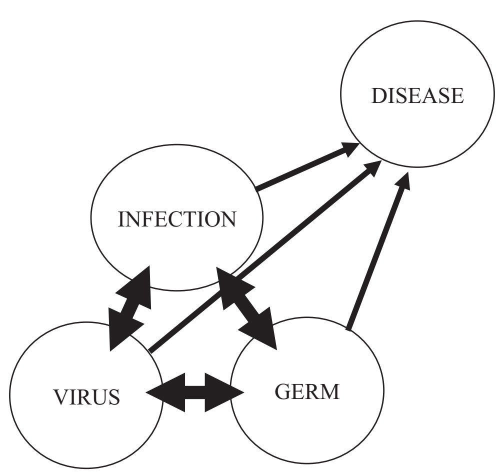

Fig. 1. Relational semantic processing as an experimental analog of obsessions (thick arrows) in a contamination-relevant semantic network, increasing the probability of falsely recognizing the critical lure (thin arrows; DISEASE).

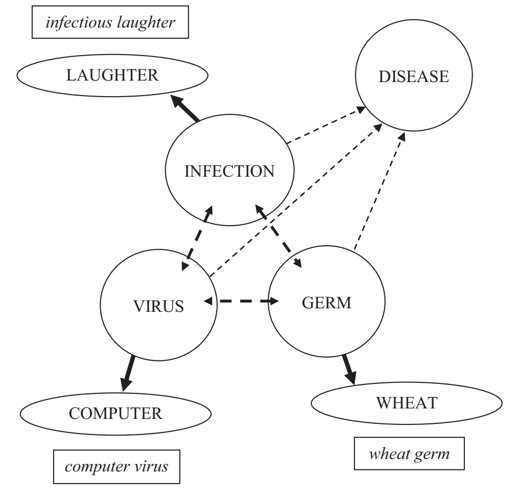

Fig. 2. Item-specific semantic processing as an experimental analog of association splitting (from thick dashed arrows to solid arrows and text in rectangles) in a contamination-relevant semantic network, decreasing the probability of falsely recognizing the critical lure (thin dashed arrows; DISEASE).

domain-specific information (Baird, 2003; Castel et al., 2007). Positive correlations between contamination-relevant recognition performance and contamination-related symptom severity were therefore expected following relational semantic processing (hypothesis 2).

While obsessions can be simulated with relational processing, association splitting can be simulated with item-specific semantic processing of DRM lists (i.e., thinking of a unique meaning or creative use of each word that differentiates it from the others in the same list; McCabe et al., 2004). The rationale is that item-specific processing, like association splitting, weakens contamination-relevant associations by redirecting spreading activation to non-contamination-relevant associations via the fan effect (see Fig. 2; Anderson, 2007; Anderson et al., 2004; Moritz & Jelinek, 2007).

Item-specific processing reduces false recognition rates in the DRM paradigm without detriment to veridical recognition rates (Butler et al., 2010; Hunt & McDaniel, 1993; Taconnat et al., 2006). This is because attention to distinctive semantic aspects – which non-presented critical lures lack – of encoded items helps participants differentiate between similar items. Therefore, if a contamination-relevant semantic network does exist in all individuals, and if association splitting does operate as purported, reduced contamination-relevant false recognition rates (relative to relational processing) amidst high contamination-relevant veridical recognition rates should be observed with item-specific processing (hypothesis 3).

Additionally, no significant correlation between contamination-related symptom severity and contamination-relevant recognition performance should be observed with item-specific processing (hypothesis 4). We hypothesize this because contamination-relevant associations may have been weakened to an extent that attenuates the influence of contamination-related symptom severity on contamination-relevant memory.

Finally, the effect of association splitting on contamination-relevant memory confidence has never been investigated. This is pertinent because memory confidence has consistently been demonstrated to be compromised in individuals with severe OC symptoms (Hermans et al., 2003; Tuna et al., 2005). It might also be interesting to explore the quality of contamination-relevant memory confidence in individuals differing in contamination-related symptom severity here. Therefore, recognition confidence was measured to explore the impact of both processing manipulations on memory confidence.