Association splitting of the sexual orientation-OCD-relevant semantic network

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ABSTRACT
There is little research on treating symptoms of sexual orientation-obsessive-compulsive disorder (SO-OCD). Semantic networks represent a new cognitive approach for understanding cognitive mechanisms of SO-OCD. Specifically, we tested whether the self-help cognitive technique of association splitting (AS) developed from this approach would be efficacious in reducing SO-OCD symptoms and thought suppression. One hundred and twenty heterosexual undergraduates (82 females, 38 males) were randomly assigned to either the AS or waitlist control group. At baseline and four weeks later, participants completed items assessing SO-OCD symptoms, measures of sexual obsessions and thought suppression, and an association task in which they generated associations to different cue words. Generated associations were coded based on SO-OCD relevance and emotional valence. Results indicated reductions in SO-OCD-relevant associations across levels of emotional valence and SO-OCD-irrelevant negative associations, and increases in SO-OCD-irrelevant positive and neutral associations, only in the AS group. Furthermore, there were reductions in SO-OCD symptoms, sexual obsessions, and thought suppression only in the AS group. Importantly, these findings were obtained with overall large effect sizes. AS appears to be an efficacious self-help technique in reducing SO-OCD symptoms, sexual obsessions, and thought suppression. Clinical implications, limitations, and suggestions for future research are discussed.

Introduction
Symptoms of obsessive-compulsive disorder (OCD) can manifest in various ways. Individuals who endorse unacceptable/taboo thoughts can suffer from sexual orientation-OCD (SO-OCD; Pinto et al., 2007; Williams, Slimowicz, Tellawi, & Wetterneck, 2014). These individuals experience obsessions about their sexual orientation changing (Gordon, 2002; Moulding, Aardema, & O’Connor, 2014; Purdon, 2004; Williams, Crozier, & Powers, 2011). To elaborate, individuals with same-sex obsessions are typically heterosexual, but worry about being or becoming lesbian, gay, bisexual, or queer (LGBQ) against their will, and engaging in associated sexual activities (Bhatia & Kaur, 2015). In response to these
obsessions, heterosexual individuals with SO-OCD may perform compulsive rituals that include reassurance-seeking about their sexual orientation, checking for physical/sexual arousal when around same-sex and/or LGBQ individuals, mental review of arousal levels during such interactions, or avoiding these groups of people or situations in which such interactions might occur altogether (Williams, Tellawi, Davis, & Slimowicz, 2015). Importantly, SO-OCD symptoms in heterosexual sufferers are rarely motivated by homophobia; in fact, these individuals tend to express positive opinions toward the LGBQ community (Williams, 2008). Rather, the predominant concern is the consequent inability to enjoy existing or potential romantic, intimate heterosexual relationships.

There are considerable prevalence rates for SO-OCD symptoms. Grant et al. (2006) found that approximately 24.9% of individuals with OCD had experienced sexual obsessions (inclusive of SO-OCD symptoms) at some point during their lives, and Williams and Farris (2011) found that 8.0% and 11.9% of individuals seeking treatment for OCD reported current and lifetime SO-OCD symptoms. However, stigma, shame, and fear of judgment by ill-informed mental health tend to increase symptom concealment (Glazier, Calixte, Rothschild, & Pinto, 2013; Glazier, Wetterneck, Singh, & Williams, 2015; Newth & Rachman, 2001), making actual prevalence rates possibly much higher than indicated. SO-OCD is also associated with extreme levels of distress, including suicidality (Williams, Wetterneck, Tellawi, & Duque, 2015). However, very little research has been conducted in regard to specifically understanding and treating SO-OCD (Ball, Baer, & Otto, 1996; Williams, Mugno, Franklin, & Faber, 2013; Williams, Slimowicz et al., 2014; Williams, Tellawi et al., 2015). This paucity of research is surprising especially since repugnant obsessions have also been associated with exaggerated mental compulsions and poorer treatment outcomes, compared with other OCD symptom dimensions (Williams, Farris et al., 2011; Williams et al., 2013).

Semantic networks represent a new cognitive approach to understanding and treating OCD symptoms, and are useful for conceptualizing the cognitive mechanisms of SO-OCD obsessions. A semantic network consists of several concepts meaningfully linked together in one's memory. Importantly, when one or more of such concepts in a semantic network are first activated, other concepts in the network are also activated due to the spread of activation energy along their associations to one another (i.e. spreading activation; Anderson, 1983; Anderson & Bower, 1973; Anderson & Pirolli, 1984; Collins & Loftus, 1975; McDermott & Watson, 2001; McNamara & Altarriba, 1988; Roediger, Balota, & Watson, 2001; Roediger & McDermott, 2000). With this approach, Moritz, Jelinek, Klinge, and Naber (2007) conceptualized obsessions as exaggerated, biased activations of linked concepts within an OCD-relevant semantic network. In other words, individuals with OCD process ambiguous concepts almost exclusively in the context of their OCD-relevant concerns (Jelinek, Hottenrott, & Moritz, 2009). For example, a heterosexual male experiencing severe SO-OCD obsessions is likely to associate the word “gay” with his fear of his sexuality changing, rather than a positive association with the word “happy”. Therefore, in SO-OCD obsessions, activation energy becomes concentrated along a sparse number of biased associations in the SO-OCD-relevant semantic network, making alternative, SO-OCD-irrelevant associations much less salient.

Association splitting (AS) is a cognitive technique for OCD symptoms that was developed from this approach. The technique is described in a self-help manual (Moritz & Jelinek, 2007). AS is based on the “fan effect” (Anderson, 1974; Reisberg, 2001) in an OCD-relevant semantic network, in which exaggerated associations to any concept in the network are
gradually weakened by increasing the number of competing OCD-irrelevant associations to that same concept. The practice of AS therefore reduces obsessions (and compulsions) by continuously redirecting limited activation energy away from established associations in an OCD-relevant semantic network to novel associations to OCD-irrelevant concepts (Ching, Goh, & Tan, 2015).

There were several studies conducted with OCD and non-clinical samples that demonstrated the efficacy of AS, as a self-help strategy, in improving biased OCD-relevant semantic networks, OCD symptoms, and related constructs (e.g. thought suppression), with medium to large effect sizes (Jelinek, Hauschildt, Hottenrott, Kellner, & Moritz, 2014; Moritz & Jelinek, 2011; Moritz & Russu, 2013; Moritz et al., 2007; Rodríguez-Martín, Moritz, Molerio-Pérez and Gil-Pérez, 2013). In these studies, participants who underwent AS largely viewed the technique as easy to comprehend and practice. However, the specific efficacy of AS for different OCD symptom dimensions has not been examined. As such, the efficacy of AS in improving symptoms and semantic networks relevant to SO-OCD could not be inferred.

In the present study conducted entirely online, we sought to assess the efficacy of AS, as a self-help technique, in improving SO-OCD-relevant semantic networks, SO-OCD symptoms, sexual obsessions (in which SO-OCD symptoms are subsumed), and thought suppression in an unselected sample. Specifically, we hypothesized statistically significant reductions in the proportion of SO-OCD-relevant semantic associations, as well as improvements in SO-OCD symptoms, sexual obsessions, and thought suppression after four weeks in the AS group, compared with a waitlist control group. An unselected sample was viable given the continua perspective of OCD symptoms (Abramowitz et al., 2010; Blom, Hagestein-de Bruijn, de Graaf, ten Have, & Denys, 2011; Fullana et al., 2009). Because SO-OCD symptoms tend to be underreported and improperly treated, it makes sense to use AS as a readily available self-help tool for people who might not seek or receive proper treatment for such concerns (Moritz, Wittekind, Hauschildt, & Timpano, 2011). This technique may also have clinical value for those who are unwilling to engage in challenging exposure and response prevention (ERP) sessions in face-to-face psychotherapy (Abramowitz, 2006; Foa, 2010). Validating the efficacy of this self-help tool for SO-OCD will provide evidence in support of the semantic network approach as applicable to understanding its cognitive mechanisms, as well as avail an empirically tested technique targeting such concerns to a wider audience.

**Method**

**Participants and design**

An unselected sample of 120 college students (82 females, 38 males) recruited from a participant pool in a large university in the United States participated for course credit. Criteria for inclusion were being 18 years or older and a native English speaker, and not currently receiving pharmacological/psychological treatment for OCD or other mental disorders. Mean age was 20.08 years (SD = 1.84). The sample comprised 96 non-Hispanic Whites, 7 African-Americans, 2 Latino/Hispanic Americans, 11 Asians/Asian Americans, and 4 individuals of other ethnoracial identities. All participants identified as heterosexual. Participants were randomly assigned to either the AS group or a waitlist control group. The randomization sequence was obtained with a free online tool in order to ensure equal number of participants in either group. Age (t < 1), gender [χ²(1, N = 120) = 0], and ethnoracial
identity \([\chi^2(3, N = 120) = 1.54, p > .05]\) did not differ between groups. Each participant participated in two online assessments, once at baseline and another four weeks later. In each assessment, participants completed symptom measures and an association task in which they generated semantic associations to SO-OCD-relevant, negative, and neutral cue words. These associations were then coded based on SO-OCD relevance (SO-OCD-relevant, SO-OCD-irrelevant) and emotional valence (positive, neutral, negative) into six different categories. Therefore, this study had a 2(group) × 2(time) × 6(association category) mixed factorial design for analyses of semantic associations, and a 2(group) × 2(time) mixed factorial design for analyses of symptom measures.

**Stimuli and measures**

**Association task**

An association task comprising 10 SO-OCD-relevant, 10 negative, and 10 neutral cue words (see Appendix A) was developed to assess changes in SO-OCD-relevant semantic networks. This task was similar to that used in previous related research (Jelinek et al., 2009, 2014). A separate unselected sample of 40 heterosexual college students (27 females, 13 males; mean age = 20.06, SD = 1.82) provided SO-OCD-relevance ratings for its development. These participants were first educated on symptoms characteristic of SO-OCD. These participants then rated the relevance of aforementioned cue words to SO-OCD symptomatology on a seven-point scale, from 1 (not at all relevant) to 7 (extremely relevant). Analyses of ratings indicated a significant main effect of cue word type, \(F(2, 27) = 128.32, MSe = .20, p < .001, \eta^2_p = .91\). Pairwise comparisons with Bonferroni correction (of \(\alpha = .05\)) indicated that SO-OCD-relevant cue words \((M = 4.45, SD = .30)\) were more SO-OCD-relevant than negative \((M = 1.87, SD = .51)\) and neutral cue words \((M = 1.54, SD = .50)\), both \(p_s < .001\), 95% CIs for differences in means = [2.07, 3.09] and [2.40, 3.42], Cohen's \(d_s = 2.37\) and 2.67, respectively. There was no significant difference between the latter two, \(p = .33\). Additionally, based on the Affective Norms for English Words (Bradley & Lang, 2010), there was a significant main effect of cue word type on emotional valence, \(F(2, 27) = 78.36, MSe = .43, p < .001, \eta^2_p = .85\). Negative cue words \((M = 2.21, SD = .31)\) were more negatively valenced than SO-OCD-relevant \((M = 5.55, SD = 1.08)\) and neutral cue words \((M = 5.22, SD = .15)\), both \(p_s < .001\), 95% CIs for differences in means = [2.59, 4.09] and [2.25, 3.75], Cohen's \(d_s = 2.08\) and 1.87, respectively. There was no significant difference between the latter two, \(p = .79\). Lastly, all three types of cue words were equated on word length \((F < 1)\) and word frequency \([F(2, 27) = 1.14, MSe = 1.60, p = .33]\) (Balota et al., 2007), as well as emotional arousal \([F(2, 27) = 1.99, MSe = .57, p = .16]\) (Bradley & Lang, 2010).

**AS manual (adapted from Moritz & Jelinek, 2007)**

A brief version of the original AS self-help manual (Moritz & Jelinek, 2007) was developed, in which the core presentation structure and instructions were retained, but with content that specifically targeted sexual orientation obsessions. Concerns and symptoms typical of SO-OCD were defined as the focus of the manual at the outset. Suggestions for OCD-representative words and images and examples of OCD-irrelevant semantic associations for use in AS practice all focused exclusively on SO-OCD concerns. Readers were guided through choosing words and images (from internet search engines) that are at the core of
their SO-OCD cognitions, and then generating novel, underused, or otherwise creative and emotionally positive SO-OCD-irrelevant semantic associations to these representative words and images for their AS practice [e.g. “gay” → “day” (rhyme); “gaze” (similar phonetics); “happy” (positive synonym)]. Readers were instructed to avoid generating associations that ran directly counter to their SO-OCD cognitions (e.g. “gay” → “I’ll never turn gay!”), because they contain no alternative meanings and tend to backfire, similar to thought suppression (Wegner, Schneider, Carter, & White, 1987), thereby reinforcing the SO-OCD-relevant semantic network. Readers were also instructed to ensure appropriate unidirectionality in their associations during practice [e.g. “gay” → “Gaylord Focker” (from the comedy film Meet the Parents), not the other way around]. Lastly, readers were advised to practice the technique daily for a maximum of 10 min per session, preferably not while experiencing intrusions/obsessions, to prevent the practice of AS from becoming a compulsive neutralization ritual.

**Sexual Orientation Worries and Cognitions Scale (SOWACS; Ching et al., 2017; Williams & Wetterneck, in press)**

The SOWACS is a 12-item self-report measure of SO-OCD symptoms resulting from our most recent psychometric refinement and evaluation of a previous survey of 70 similar items (Williams, Wetterneck, Siev, Adams, Slimowicz, & Smith, 2015). Symptoms targeted include fears about one’s sexual orientation changing (e.g. “I worry that my sexual orientation may change”), concerns about others’ judgments should one’s sexual orientation change (e.g. “I worry that other people will think I am LGBQ”), and compulsive somatic checking of sexual arousal around same-sex and/or LGBQ individuals (e.g. “I check myself to see if I am sexually aroused around other people”), etc. In our most recent psychometric evaluation (Ching et al., 2017), the SOWACS demonstrated a sound two-factor structure (Sexual Orientation Transformation Fears; Compulsive Somatic Checking) and good to excellent reliability and validity across heterosexual and LGBQ students, community participants, and patients with either SO-OCD or other forms of OCD. Each item is rated on a five-point scale from 0 (never) to 4 (always). Higher total scores indicate more severe SO-OCD symptoms. In the present sample, Cronbach’s alphas for all items at baseline and four weeks later were .82 and .86, respectively.

**Sexually Intrusive Thoughts Scale (SIT; Wetterneck et al. 2015)**

The SIT was developed based on the format of the Dimensional Obsessive-Compulsive Scale (DOCS; Abramowitz et al., 2010), a reliable and valid self-report instrument assessing four prevalent OCD symptom dimensions. The SIT parses out content distinctively relevant to sexual obsessions from the unacceptable/taboo thoughts subscale of the DOCS, and has demonstrated good psychometric properties (Wetterneck et al., 2015). It consists of five items that assess the severity of sexual obsessions along five parameters of severity (e.g. “About how much time have you spent each day with sexually intrusive thoughts and with behavioral or mental actions to deal with them?”), all within the past month. Each item is rated on a five-point scale from 0 (no symptoms at all) to 4 (extreme symptoms). Higher total scores indicate more severe sexual obsessions. Cronbach’s alphas for the full scale at baseline and four weeks later were .84 and .93, respectively.
White Bear Suppression Inventory (WBSI; Wegner & Zanakos, 1994)

The WBSI is a 15-item self-report measure of thought suppression (e.g. “There are things that I try not to think about”) that has demonstrated moderate to excellent psychometric properties in non-clinical samples (e.g. Luciano et al., 2006). Items are endorsed from 1 (strongly disagree) to 5 (strongly agree). Higher total scores indicate a stronger tendency to suppress unwanted thoughts. Cronbach’s alphas for the full scale at baseline and four weeks later were .93 and .98, respectively.

Procedure

This study was approved by the university’s institutional review board, and informed consent was obtained before participation. At baseline, participants clicked on a link on the study’s sign-up page to a secure online portal to first complete the association task, with instructions to generate semantic associations (e.g. nouns, verbs, or adjectives) with different meanings that spontaneously come to their minds to the cue words presented. Possible associations could also be rhymes, words with similar phonetics, or associative chains (i.e. relating associations to one another). After being familiarized with the task (i.e. presentation of two neutral example cue words), SO-OCD-relevant, negative, and neutral cue words were randomly and individually presented. Participants were allowed to enter up to a maximum of five associations to each cue word. If participants could not produce any association to a cue word, they were allowed to proceed onto the next one. At the end of the task, the cue words were presented again for participants to rate their personal significance from 0 (personally completely insignificant) to 4 (personally very significant). Thereafter, participants completed items about demographic information and the symptom measures. Thereafter, participants in the AS group were immediately emailed the AS self-help manual for sexual orientation obsessions, along with instructions to familiarize themselves with the material and engage in daily 10-min AS practice sessions until their second assessment four weeks later. Three brief weekly check-ins (i.e. phone calls lasting less than three minutes each at the end of the first, second, and third weeks after the baseline assessment) were made to ensure that participants were practicing the technique consistently. On the other hand, participants in the control group were simply reminded, via the same method at the same frequency, to complete the second assessment four weeks after the baseline assessment. In the second assessment, participants were emailed the link to the same secure online portal, on which they completed the association task and the same symptom measures. Participants in the AS group additionally completed questions about their adherence to their AS practice (e.g. whether AS was practiced daily after familiarization with the manual; if not, how many days missed), the contents of their practice sessions (e.g. approximately what percentage of practice sessions involved concepts related to sexual orientation), and their subjective appraisal of the technique (e.g. how useful AS was for addressing SO-OCD concerns). All items in both assessments had to be responded to before participants could be fully credited, thereby ensuring no missing data. All participants were then debriefed about the entire study, and participants in the control group were emailed the AS manual for self-help purposes.
Association coding

In accordance to the coding procedures of Jelinek et al. (2009, 2014), semantic associations generated in the association task were coded based on SO-OCD relevance and emotional valence by two trained, blinded coders. Categories include: 1 (positive and SO-OCD-relevant); 2 (neutral and SO-OCD-relevant); 3 (negative and SO-OCD-relevant); 4 (positive and SO-OCD-irrelevant); 5 (neutral and SO-OCD-irrelevant); and 6 (negative and SO-OCD-irrelevant). There was good interrater reliability for the initial codings, Cohen's $\kappa = .93$, $p < .001$. Discrepancies in coding were resolved by mutual agreement between coders. The number of coded associations in each category were then related to the total number of associations generated to give proportions.

Analytical procedure

A 2(group) × 2(time) × 6(association category) mixed analysis of variance (ANOVA), followed by planned analyses of significant interaction effects were conducted to examine changes in proportions of semantic associations in the different categories. Separate 2(group) × 2(time) mixed ANOVAs followed by planned analyses of significant interaction effects were conducted to examine changes in scores on symptom measures. Data from participants in either group who did not report any symptoms on the symptom measures at baseline were still included in the analyses. Particularly, for participants in the AS group, this was done so as to ascertain that no iatrogenic effects resulted from the self-help intervention. Indeed, for these participants (AS group: $n = 4$; control group: $n = 7$), a survey of the data indicated that there were no increases in absolute scores on the relevant symptom measure(s) four weeks later. Effect sizes were calculated for these analyses, where .01, .09, and .25 correspond to small, medium, and large effect sizes for partial eta-squared ($\eta_p^2$), and .20, .50, and .80 correspond to small, medium, and large effect sizes for Cohen's $d$.

Supplementary analyses were also conducted. We correlated baseline SO-OCD symptom severity with baseline proportions of semantic associations in the different categories, in order to ascertain whether biased SO-OCD-relevant associations will be observed with greater SO-OCD symptom severity. Additionally, we conducted a 2(group) × 2(time) mixed ANOVA to assess overall changes in personal significance of cue words in the association task. Lastly, we obtained demographic and descriptive statistics on adherence to, contents of, and perceived utility of AS practice in poor responders, defined as participants in the AS group with symptom severity remaining near individual baseline levels and at least 1.5 SDs above respective group means of at least any two of all three symptom measures at the second assessment interval. This was done to determine how poor responders differ on these characteristics from the other participants in the AS group. All analyses were conducted at $\alpha = .05$ (two-tailed).

Results

Semantic associations

Baseline SO-OCD symptom severity and baseline proportions of semantic associations in the different categories were first entered into a bivariate correlation analysis. SO-OCD
symptom severity significantly correlated only with negative SO-OCD-relevant associations, \( r = .21, p < .05 \).

In terms of semantic association proportions, there was a significant group \( \times \) time \( \times \) association category interaction effect, \( F(5, 708) = 567.88, MSe = .001, p < .001, \eta_p^2 = .80 \). This was followed up with a planned \( 2(\text{time}) \times 6(\text{association category}) \) mixed ANOVA for each group. There was no time \( \times \) association category interaction effect in the waitlist control group, \( F(5, 354) = 1.62, MSe = .0004, p = .15, \eta_p^2 = .02 \). On the other hand, the time \( \times \) association category interaction effect was significant in the AS group, \( F(5, 354) = 738.67, MSe = .001, p < .001, \eta_p^2 = .91 \) (see Figure 1). Additional planned comparisons with Bonferroni correction in the AS group indicated that baseline proportions of positive, neutral, and negative SO-OCD-relevant associations, as well as negative SO-OCD-irrelevant associations (\( M_s = .05, .22, .03, \) and \( .31, \) SDs = \( .04, .06, .03, \) and \( .06, \) respectively), were significantly reduced four weeks later (\( M_s = .02, .06, .005, \) and \( .13, \) SDs = \( .03, .04, .01, \) and \( .04, \) respectively), all \( ps < .0012, 95\% \) CIs for differences in means = \( [.01-.17, .03-.19] \), Cohen's \( d_s = .30-2.60 \). These were accompanied by significant increases in baseline proportions of positive and neutral SO-OCD-irrelevant associations (\( M_s = .07 \) and \( .33, \) SDs = \( .05 \) and \( .09, \) respectively) four weeks later (\( M_s = .19 \) and \( .60, \) SDs = \( .05 \) and \( .06, \) respectively), both \( ps < .001, 95\% \) CIs for differences in means = \( [.11, .13] \) and \( [.26, .28] \), Cohen's \( d_s = 1.73 \) and \( 3.88 \), respectively.

Lastly, there was a significant group \( \times \) time interaction effect for mean personal significance of cue words used in the association task, \( F(1, 118) = 27.78, MSe = .18, p < .001, \eta_p^2 = .19 \). Planned comparisons with Bonferroni correction showed that in the AS group, baseline personal significance of cue words (\( M = 1.14, \) SD = \( .68) \) was significantly reduced four weeks later (\( M = .46, \) SD = \( .64) \), \( p < .001, 95\% \) CI for difference in means = \( [.52, .83] \), Cohen's \( d = .78 \). In the waitlist control group, mean personal significance of cue words was not different four weeks later (\( M = .89, \) SD = \( .64) \) from baseline level (\( M = .99, \) SD = \( .65) \), \( p = .20 \).

**Figure 1.** Changes in proportions of semantic associations in different categories over time in the AS group. Notes: RelPos = positive SO-OCD-relevant; RelNeu = neutral SO-OCD-relevant; RelNeg = negative SO-OCD-relevant; IrrPos = positive SO-OCD-irrelevant; IrrNeu = neutral SO-OCD-irrelevant; IrrNeg = negative SO-OCD-irrelevant. All changes in means over time within each category were significant with Bonferroni correction at \( \alpha = .05 \), all \( ps < .0012 \) (two-tailed). Error bars represent standard deviations.
SO-OCD symptoms

There was a significant group × time interaction effect for SO-OCD symptom severity, $F(1, 118) = 28.53$, $MSe = 11.13$, $p < .001$, $\eta^2_p = .20$ (see Figure 2). Planned comparisons with Bonferroni correction indicated that baseline SO-OCD symptom severity was not different between groups, $p = .61$. In the AS group, baseline SO-OCD symptom severity ($M = 7.28$, $SD = 5.52$) was significantly reduced four weeks later ($M = 2.23$, $SD = 4.55$), $p < .001$, 95% CI for difference in means = [3.84, 6.26], Cohen’s $d = .76$. On the other hand, SO-OCD symptom severity remained stable from baseline ($M = 6.75$, $SD = 6.02$) to four weeks later ($M = 6.30$, $SD = 6.22$) in the waitlist control group, $p = .46$.

Sexual obsessions

Similarly, there was a significant group × time interaction effect for severity of sexual obsessions, $F(1, 118) = 82.05$, $MSe = 1.88$, $p < .001$, $\eta^2_p = .13$ (see Figure 3). Planned comparisons with Bonferroni correction indicated that baseline severity of sexual obsessions was not different between groups, $p = .71$. In the AS group, baseline severity of sexual obsessions ($M = 1.60$, $SD = 2.20$) was significantly reduced four weeks later ($M = 1.55$, $SD = 1.86$), $p < .001$, 95% CI for difference in means = [1.56, 1.55], Cohen’s $d = .38$. On the other hand, severity of sexual obsessions remained stable from baseline ($M = 1.43$, $SD = 2.59$) to four weeks later ($M = 1.83$, $SD = 2.95$) in the waitlist control group, $p = .11$.

Thought suppression

Again, there was a significant group × time interaction effect for thought suppression, $F(1, 118) = 58.56$, $MSe = 104.01$, $p < .001$, $\eta^2_p = .33$ (see Figure 4). Planned comparisons with Bonferroni correction indicated that baseline thought suppression was not different between groups, $p = .48$. In the AS group, baseline thought suppression ($M = 47.65$, $SD = 12.72$) was
significantly reduced four weeks later ($M = 25.80$, $SD = 16.40$), $p < .001$, 95% CI for difference in means = [18.16, 25.54], Cohen’s $d = 1.07$. On the other hand, thought suppression did not change from baseline level ($M = 46.02$, $SD = 12.32$) to four weeks later ($M = 44.32$, $SD = 14.92$) in the waitlist control group, $p = .36$.

Finally, five poor responders (2 females, 3 males; all non-Hispanic Whites) in the AS group were identified, based on symptom severity scores remaining near individual baseline levels and at least 1.5 SDs above respective group means of at least any two of all three symptom measures at the second assessment interval. These participants missed, on average, 15 days of AS practice after familiarizing themselves with the manual. They also reported an

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**Figure 3.** Severity of sexual obsessions over time for each group.
Notes: SIT = Sexually Intrusive Thoughts Scale. There was a significant reduction in severity of sexual obsessions four weeks later in the AS group, $p < .001$. There was no change in severity of sexual obsessions in the control group, $p = .11$. Error bars represent standard deviations.

**Figure 4.** Thought suppression over time for each group.
Notes: WBSI = White Bear Suppression Inventory. There was a significant reduction in thought suppression four weeks later in the AS group, $p < .001$. There was no change in thought suppression in the control group, $p = .36$. Error bars represent standard deviations.
average of only 18.0% (SD = 2.7) of the contents of their practice sessions involving concepts related to sexual orientation. Additionally, the mean perceived utility of AS for addressing SO-OCD concerns for these participants, on a 100-point visual analog scale from 0 (not useful at all) to 100 (extremely useful), was only 20.00 (SD = 7.91). On the other hand, of the other 55 participants in the AS group, 94.5% (n = 52) reported practicing the technique daily after being familiarized with it, while 3.6% (n = 2) and 1.8% (n = 1) reported missing only two and three days of practice, respectively. These 55 participants in the AS group also reported a higher percentage of the contents of their practice sessions involving concepts related to sexual orientation (M = 73.4%, SD = 11.2), in addition to being more likely to perceive AS as useful for addressing SO-OCD concerns (M = 70.00, SD = 15.63).

Discussion

Previous research has shown AS to be an efficacious self-help technique in improving biased OCD-relevant semantic networks, OCD symptoms, and related coping strategies such as thought suppression (Jelinek et al., 2014; Moritz & Jelinek, 2011; Moritz & Russu, 2013; Moritz et al., 2007; Rodríguez-Martín et al., 2013). Our study continues the general trend of these findings in demonstrating the efficacy of AS in improving SO-OCD-relevant semantic networks, SO-OCD symptoms, sexual obsessions in general, and thought suppression.

First, at baseline, SO-OCD symptom severity shared a significant positive relationship only with negative SO-OCD-relevant semantic associations. This supports the notion of biased semantic networks in SO-OCD, in that with more severe SO-OCD obsessions, the SO-OCD-relevant semantic network becomes more strongly reinforced, making negative SO-OCD-relevant associations more easily activated and available as responses in the association task. Validating that concepts relevant to SO-OCD concerns are organized into semantic networks in our sample therefore legitimizes the use of AS in addressing such symptoms for these participants.

Indeed, as our results show, AS practice decreased the generation of SO-OCD-relevant and negative SO-OCD-irrelevant semantic associations in the association task, while increasing the likelihood of responding with positive and neutral SO-OCD-irrelevant associations. This directly demonstrates how SO-OCD-relevant semantic networks (and their negative emotional connotations) are weakened over time with AS practice, in favor of emotionally positive (or at least neutral) SO-OCD-irrelevant associations. The creation of competing SO-OCD-irrelevant associations therefore builds a “fan effect” that redirects limited activation energy out of the exaggerated associations in SO-OCD-relevant semantic networks. In line with how the alleviation of biased semantic networks in OCD facilitates symptom improvement in the semantic network approach to OCD (Moritz et al., 2007), AS here was shown to be efficacious in improving SO-OCD symptoms and sexual obsessions (under which SO-OCD concerns are subsumed), as well as a maladaptive way of coping with such obsessions (i.e. thought suppression). These findings were also obtained with overall large effect sizes, especially when compared with the findings of previous related research by Moritz and colleagues, perhaps owing to the high specificity of our modified AS manual to SO-OCD concerns. By focusing on a specific OCD symptom dimension in the design of stimuli and choice of measures for our study, we might have allowed for the intensive remediation of SO-OCD concerns to occur in the AS group.
Although AS was overall efficacious in addressing SO-OCD symptoms and related constructs, the effects were not uniform throughout all participants who received the intervention. Findings from our supplementary analyses were, however, not discouraging. Indeed, only five poor responders were identified. Specifically, these participants adhered poorly to the daily AS practice schedule, focused much less on SO-OCD-relevant contents in the few practice sessions that they engaged in, and largely did not believe that AS was useful to them for addressing SO-OCD concerns. Contrarily, the rest of the AS group demonstrated better adherence to, and much more favorable subjective perceptions of, AS practice. This contrast therefore supports the general usability of AS in targeting this particular subset of sexual obsessions.

In addition to its efficacy, AS can help circumvent barriers to treatment for SO-OCD. As a self-help tool that is freely available online, AS can provide symptom relief in spite of high healthcare costs and poor treatment accessibility in rural regions (Marques et al., 2010). The AS manual, which is written in normalizing, non-pathologizing language, can also facilitate a positive self-help experience, especially in light of perceived stigma about one's symptoms (McCarty, Guzick, Swan, & McNamara, 2017; Moritz et al., 2011) and mistrust of mental health providers (Glazier et al., 2013; Glazier, Wetterneck et al., 2015; Moritz, Timpano, Wittekind, & Knaevelsrud, 2013), particularly for ethnoracial minority sufferers (Alegría et al., 2002; Leong, Kim, & Gupta, 2011; Thompson, Bazile, & Akbar, 2004; Williams, Domanico, Marques, Leblanc, & Turkheimer, 2012). As part of a stepped-care model (Mataix-Cols & Marks, 2006), AS can be useful in correcting sufferers’ misconceptions about their SO-OCD worries and provide some symptom relief in the initial help-seeking phase. This is then likely to boost chances of successful subsequent face-to-face treatment (e.g. ERP), which can prove to be challenging (Kulz et al., 2009; Moritz et al., 2013).

**Limitations and suggestions for future research**

There are a few limitations to the present study. For example, we recruited a sample of college students who were quite homogeneous in terms of age and level of education. It would be interesting to determine whether our findings can be replicated with community participants with varying ages and levels of education, as well as adolescent participants, owing to developmentally salient sexual identity-related concerns that may exacerbate SO-OCD symptoms. We also did not seek to establish an OCD diagnosis for participants in our sample. It is therefore unclear whether our findings can be replicated with a clinical sample, or whether they indicate clinical significant improvements in biased semantic networks and symptoms of interest here. Future longitudinal research with clinically diagnosed patient samples needs to be conducted to ascertain if such improvements can be observed and maintained for this particular OCD symptom dimension. At the same time, anxious control groups should be included, to rule out the possibility that results may also be explained by anxiety in general. Additionally, although we opted for a waitlist control group in the present study, we recommend having an active control group in future related research. Even though having a waitlist control group is common in psychotherapy research, and may represent an especially realistic control group for SO-OCD (i.e. no treatment is initiated by patients due to fear of stigma and shame), this may result in a “nocebo” effect (see Furukawa et al., 2014). More importantly, our conclusions are based on a solely heterosexual sample, and it will be interesting to see whether the same trends can be observed for LGBQ individuals.
who suffer from SO-OCD. This necessitates more deliberate recruitment of these individuals who are traditionally underrepresented in OCD-related research. Furthermore, although there was good interrater reliability for the initial codings of generated associations, there were still a few discrepancies that had to be resolved by consensus between coders. Future related research should seek to cross-validate data collected with the association task with alternative measurements of semantic networks (e.g. semantic priming and word recognition procedures). This will possibly provide converging evidence of potential changes in semantic networks due to the AS intervention. Lastly, demand characteristics might have been high in this study.

Conclusions

In summary, AS appears to be efficacious in reducing SO-OCD symptoms, sexual obsessions, and thought suppression. It is also generally well-received by participants in terms of intervention adherence and subjective utility of the technique for addressing SO-OCD concerns. Importantly, our findings were obtained with convincingly large effect sizes. Future research should continue to investigate the efficacy of this technique for improving SO-OCD concerns, as well as other taboo forms of OCD belonging in the unacceptable/taboo thoughts symptom dimension. Differential efficacy of AS for different symptoms related to SO-OCD concerns (e.g. obsessions vs. compulsions) should also be studied more extensively.

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Disclosure statement

No potential conflict of interest was reported by the authors. This research was conducted in compliance with the Code of Ethics of the World Medical Association (Declaration of Helsinki) and the standards established by the relevant Institutional Review Board.

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References


**Appendix A. Cue words for the association task**

<table>
<thead>
<tr>
<th>SO-OCD-relevant</th>
<th>Negative</th>
<th>Neutral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bisexual</td>
<td>Defeated</td>
<td>Arrow</td>
</tr>
<tr>
<td>Gay</td>
<td>Isolation</td>
<td>Violin</td>
</tr>
<tr>
<td>Gender</td>
<td>Useless</td>
<td>Umbrella</td>
</tr>
<tr>
<td>Heterosexual</td>
<td>Stupid</td>
<td>Industry</td>
</tr>
<tr>
<td>Homosexual</td>
<td>Selfish</td>
<td>Vegetable</td>
</tr>
<tr>
<td>Identity</td>
<td>Headache</td>
<td>Journal</td>
</tr>
<tr>
<td>Lesbian</td>
<td>Poverty</td>
<td>Machine</td>
</tr>
<tr>
<td>Orientation</td>
<td>Mistake</td>
<td>Subject</td>
</tr>
<tr>
<td>Sex</td>
<td>Overweight</td>
<td>Trend</td>
</tr>
<tr>
<td>Straight</td>
<td>Debt</td>
<td>Society</td>
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