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Please cite the final published version:

O'Toole, M. S., Watson, L., Rosenberg, N. K., & Berntsen, D. (2018). Changes in perceived centrality of anxious events following cognitive behavioral therapy for social anxiety disorder and panic disorder. *Journal of Behavior Therapy and Experimental Psychiatry*, 59, 150-156. DOI: [10.1016/j.jbtep.2018.01.007](https://doi.org/10.1016/j.jbtep.2018.01.007)

Publication metadata

Title:	Changes in perceived centrality of anxious events following cognitive behavioral therapy for social anxiety disorder and panic disorder
Author(s):	O'Toole, M. S., Watson, L., Rosenberg, N. K., & Berntsen, D.
Journal:	Journal of Behavior Therapy and Experimental Psychiatry
DOI/Link:	http://dx.doi.org/10.1016/j.jbtep.2018.01.007
Document version:	Accepted manuscript (post-print)

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Changes in Perceived Centrality of Anxious Events Following Cognitive Behavioral Therapy for Social Anxiety Disorder and Panic Disorder

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Abstract

Background and objective: The purpose of the present study was to explore the association between reductions in symptoms of psychopathology and perceived centrality of negative autobiographical memories in participants with social anxiety disorder (SAD) or panic disorder (PD). **Methods:** Thirty-nine individuals with SAD or PD recalled and rated four negative autobiographical memories before and after ten sessions of cognitive behavioral therapy (CBT) over a three-month period. Twenty-eight healthy controls did the same before and after a three-month period. **Results:** As hypothesized, results showed a decrease in perceived centrality following CBT. This decrease in perceived centrality was larger, although at the trend level, for individuals who experienced reliable change on disorder-specific symptoms. **Limitations:** The correlational nature of the study prevents establishing the causal relationship between changes in perceived centrality and psychopathology, and future studies should explore such mechanisms. **Conclusions:** The present study adds to the emerging body of literature, investigating changes in centrality of event following psychotherapy.

Key words: anxiety disorders; centrality of event; autobiographical memory; CBT; CES

1. Introduction

The present paper concerns the perceived centrality of negative autobiographical memories in two common anxiety disorders, namely social anxiety disorder (SAD) and panic disorder (PD). The role of mental imagery of past negative events has long been of interest in cognitive interventions for anxiety disorders (e.g., Arntz & Weertman, 1999; Beck, 1979; Hackmann, Bennett-Levy, & Holmes, 2011), and has been detected in both SAD and PD (Hackmann et al., 2011; Moscovitch, Gavric, Merrifield, Bielak, & Moscovitch, 2011; O'Toole, Watson, Rosenberg, & Berntsen, 2016; Wild & Clark, 2011).

One factor implicated in why past negative events may continue to be bothersome for individuals with anxiety disorders is the degree to which such events are considered central to identity. Autobiographical memories of past events differ in the degree to which they are perceived as central to an individual's identity or life story (Berntsen & Rubin, 2006b, 2007). To perceive some, but not all, memories as central may provide meaning and structure to life narratives, providing anchors for conceptions of ourselves (e.g., Baerger & McAdams, 1999; Pillemer, 1998; Pillemer, 2003; Robinson & Taylor, 1998; Robinson, 1992; Shum, 1998). However, when highly negative events become fixed reference points for such meaning making processes, this may bring about rigidity in negative self-assumptions (Berntsen & Rubin, 2006b; Berntsen, Willert, & Rubin, 2003), making it difficult for individuals experiencing psychopathology to update and revise negative views of the self and future (Boelen, 2009; Hackmann, Clark, & McManus, 2000).

Berntsen and Rubin (2006b) introduced the Centrality of Event Scale (CES) to examine the relation between the perceived centrality of a traumatic memory and symptoms of PTSD. An increasing number of studies in a variety of trauma populations have shown a positive

correlation between the centrality of traumatic memories and measures of PTSD symptoms, also when controlling for other factors, such as depression, anxiety, dissociation, neuroticism, repressive coping, self-consciousness and severity of the trauma (see Berntsen, Rubin, & Siegler, 2011; Berntsen & Rubin, 2007; Fitzgerald, Berntsen, & Broadbridge, 2016, for reviews). Outside of the PTSD and trauma literature, the association between the centrality of a negative event and symptoms of anxiety has been less studied, although a few studies exist. For instance, one study found that the perceived centrality of shame memories was a strong predictor of symptoms of social anxiety (Matos, Pinto-Gouveia, & Gilbert, 2013; Robinaugh & McNally, 2010). Other studies have investigated the association between centrality of loss, as the anchor event for bereavement, and post-loss traumatic symptoms. Boelen (2009, 2012) found a significant association both at the time when individuals had recently lost their loved one and prospectively over one year. Regarding SAD and PD specifically, it has been found that both patient groups evaluate past anxious experiences as more central to their identity than healthy controls and that they do not differ from each other in this evaluation (O'Toole et al., 2016).

1.1 Centrality of event following psychological intervention

CBT is suggested as choice of treatment for many anxiety disorders (e.g., NICE, 2013), and has proven effective for both PD and SAD (Hofmann & Smits, 2008). A variety of CBTs exist, encompassing a host of different therapeutic techniques. An important goal in both traditional and more contemporary CBTs is the ability to challenge existing negative thoughts and gain new perspectives (Beck, 1979; Fresco et al., 2007; Hayes, Strosahl, & Wilson, 2012; Roemer & Orsillo, 2009). The concept of event centrality may be considered a concrete manifestation of difficulty with gaining a different perspective on a negative life-event. When

a negative past event becomes self-defining, the individual could be argued to fail in finding an appropriate distance to their personal past and related internal events. Since the ability to gain new perspectives, or distance oneself from negative emotions, is specifically trained in many CBTs (e.g., Beck, 1979; Hayes et al., 2012), the perceived centrality of anxious events may be hypothesized to decrease as a result of CBT.

To date, few studies have investigated the effect of psychological interventions for anxiety disorders on perceived centrality. Boals and Murell (2016) found that the effect of Acceptance and Commitment Therapy (ACT) on symptoms of PTSD may be mediated through a decrease in perceived centrality, although the design precludes causal inference. Moreover, Boals and colleagues (2015) found a positive effect of writing exercises employing either ACT or CBT methods on both perceived centrality and symptoms of PTSD. These findings provide preliminary evidence to suggest that psychological interventions may lead to a reduction in symptoms of psychopathology through reductions in the perceived centrality of memories for negative life-events. Although it is recognized that the qualities of negative autobiographical memories also play a key role in the maintenance of anxiety disorders such as SAD (Hackmann et al., 2000; Wild, Hackmann, & Clark, 2008), there have been no investigations into changes in the centrality of anxious autobiographical memories following psychological interventions for SAD and PD.

While studies have not yet focused on event centrality directly during psychological interventions for anxiety disorder, imagery rescripting is a cognitive behavioral technique that has been demonstrated to be effective in reducing symptoms of anxiety (Frets, Kevenaar, & van der Heiden, 2014; Lee & Kwon, 2013; McEvoy & Saulsman, 2014; Nilsson, Lundh, & Viborg, 2012; Reimer & Moscovitch, 2015; Wild, Hackmann, & Clark, 2007; Wild et al., 2008).

Nilsson and colleagues (2012) investigated the impact of imagery rescripting on meaning perception (i.e., negative reflection of self, lack of competence, and unattractiveness). They found that relative to a reading control condition, imagery rescripting was associated with significantly larger decrease in negative meaning attribution and image and memory distress in socially anxious individuals. Four other studies compared the impact of imagery rescripting on *encapsulated or core beliefs* in SAD (Lee & Kwon, 2013; Reimer & Moscovitch, 2015; Wild et al., 2007, 2008). Encapsulated beliefs are defined as the relationship between the meaning of the patient's current images in terms of negative self-assumptions and a description of the associated memory linked to these assumptions (e.g., "this shows that I am a weak person"; Wild et al., 2008). These studies found that imagery rescripting successfully changed such beliefs and decreased symptoms of distress and anxiety. In summary, a number of studies have demonstrated that changes in the meaning of negative autobiographical memories and their importance for identity occurs following psychological interventions for social anxiety that directly target negative autobiographical memories (Wild et al., 2008). One question which has yet to be addressed is whether the perceived centrality of autobiographical memories is altered during CBT for social anxiety when autobiographical memories are not directly targeted during treatment. To the authors' knowledge, no studies have investigated the effect of imagery rescripting or perceived centrality in PD, although it has also been deemed relevant to target past memories in this disorder (Hackmann et al., 2011).

1.2 Aim and hypotheses

The present study is an investigation of negative autobiographical memories in individuals with SAD, PD, and healthy controls. It is an extension of a previous study, which we refer to as the *baseline study* (O'Toole et al., 2016), in which group differences in the

properties, traumatic impact, and centrality of negative autobiographical memories were explored. In the present paper, we were primarily interested in changes in the perception of event centrality in these memories following CBT. Our main hypothesis was that clinical participants would show decrease in event centrality following CBT. Furthermore, based on the relationship between perceived centrality and symptoms of psychopathology following treatment for other clinical disorders (Boals & Murrell, 2016), we expected that the magnitude of change in event centrality would be associated with change in measures of psychopathology. In addition to exploring event centrality, we investigated the traumatic impact of the event as well as specific properties of the autobiographical anxious memories as a function of time and group.

Minimal group differences were identified between the SAD and PD groups across anxious memories in the baseline study (O'Toole et al., 2016), and completers of the present study in the two groups did not differ on any of the psychopathological or dependent variables ($ps > .1$; see measure descriptions below). Furthermore, event centrality is not specific to certain diagnoses or psychopathology but is a general concept that pertains to the perception of past events (Bertnsen & Rubin, 2006b; Hackmann, Bennett-Levy, & Holmes, 2011). Therefore, the two groups were combined into one clinical group in the present study. These two groups provided self-report measures of properties, impact, and centrality of negative autobiographical memories at two distinct time points. The clinical group provided recordings before and after CBT, and the control participants were assessed before and after a 3-month period.

2. Methods

2.1 Participants and procedures

Participants with SAD and PD were recruited from an outpatient anxiety clinic at Aarhus University Hospital, Denmark. At the first appointment at the clinic, patients were informed about the investigation and gave consent. As a part of routine care, all patients at the clinic were evaluated diagnostically according to DSM-IV criteria following the Anxiety Disorders Interview Scale for DSM-IV (ADIS-IV; Brown, DiNardo, & Barlow, 1994). These interviews were conducted by a team of clinicians who met on a weekly basis to peer supervise diagnoses. Inclusion criteria were a primary diagnosis of SAD or PD (i.e., the most salient condition as evaluated by the team of clinicians), age ≥ 18 years, and Danish language proficiency. Exclusion criteria were a severe mental illness, including bipolar disorders, psychotic disorders, and severe depression (according to ICD-10 diagnostic criteria; WHO, 1992). All patients fulfilling the inclusion criteria (SAD: N =103, PD: N=27) were e-mailed a link to an online survey prior to the beginning of treatment. Seventy-eight individuals (60%) responded; 58 with SAD and 20 with PD. All participants that had taken part in the baseline study (time 1) and completed treatment were e-mailed a questionnaire following treatment termination (time 2), typically corresponding to a timeframe of three months. A participant was considered a treatment completer if they had not formally dropped-out, either on their own initiative or due to changes in their condition. Seven participants with PD and 19 participants with SAD did not complete treatment. Only treatment completers were e-mailed a questionnaire at time 2. Ten out of 13 individuals with PD (77%) and 29 out of 39 participants with SAD (74%) responded at time 2. Reasons for treatment drop-out were not available. See Figure 1 for participant flow.

Thirty-six controls were screened for psychiatric disorders with the same instrument as the clinical participants. Controls were recruited from a pool of volunteer college students.

They were matched on gender to the clinical participants but it was not possible to match for education. The controls were selected with the intent of keeping the age difference as small as possible. Diagnostic assessments were provided by the first author, who had received formal clinical training in diagnostic assessment. Inclusion criteria were Danish language proficiency and age ≥ 18 years. Individuals were excluded if they had any current or prior psychiatric disorder, except for a major depressive disorder of mild or moderate severity that ended more than 6 months prior to inclusion. Thirty-three controls were included and 29 completed the baseline questionnaire. All controls who responded at time 1 were asked to complete the questionnaires again three months after time 1. Twenty-eight out of 29 controls responded (97%). See Figure 1 for participant flow. All questionnaires were answered online.

2.2 Materials

2.2.1 Measures of psychopathology

Cronbach's alphas are provided for time1/time2.

Depressive symptoms were assessed by The Beck Depression Inventory-2nd version (BDI-II), which is a 21-item self-report questionnaire rated on a 4-point scale (Beck, Steer, & Brown, 1996). In this study, the scale obtained a Cronbach's α of .94/.94. This questionnaire was filled out by all participants.

Anxiety symptoms were measured using The Beck Anxiety Inventory (BAI), which is a 21-item self-report instrument (Beck, Epstein, Brown, & Steer, 1988). Items were rated on a 4-point scale and obtained a Cronbach's α of .95/.96 in this study. This questionnaire was filled out by all participants.

Symptoms of panic anxiety were measured using the Panic Disorder Severity Scale self-report version (Houck, Spiegel, Shear, & Rucci, 2002; PDSS; Shear et al., 1997). It consists of seven items where participants are asked to rate the severity of panic symptoms on a 5-point scale. It obtained a Cronbach's α of .98/.90 in this study. This questionnaire was only filled out by individuals with PD and controls.

Symptoms of social anxiety were assessed by the self-report version of the Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987). The LSAS consists of 24 items concerning fear and avoidance of specific social situations; all rated on a 4-point rating scale. It obtained a Cronbach's α of .98/.99 in this study. This questionnaire was only filled out by individuals with SAD and controls.

2.2.2 Measures of anxious memories

At baseline, participants were asked to generate four negative memories of specific events in their past; two characterized by social anxiety (SA) and two characterized by panic (PA). "Specific" was defined as an event that took place within a 24-hour period and examples were given. The following instructions were given: "We would like you to think of one of or the most anxiety-provoking memory that you can recall that was characterized by one or more of these emotions [verbal, emotional prompts]". Prompts were "embarrassment", "humiliation", "mortification", and "shame" for the SA-cued memories, and "loss of control", "panic", "fear of dying", and "fear of going crazy" for PA-cued memories. The cues were chosen based on prototypical emotional descriptors of the two disorders (e.g., American Psychiatric Association, 2000; Clark & Beck, 2010) and presented in a counterbalanced order (cf. O'Toole et al., 2016). At time 2, they were given the title they had provided for the memory at time 1 and asked to

recall the event. The questionnaires below were answered for each of the recalled events unless the participant indicated that they did not remember the specific event.

Centrality of event was measured for each of the four memories using the short 7-item Centrality of Event Scale (CES; Berntsen & Rubin, 2006b), which addresses how central an event is to a person's identity and life story, rated on a 5-point scale. We report the mean score, consistent with Berntsen and Rubin (2006b). Cronbach's α for the four memories ranged from .93 to .95 at Time 1 and from .93 to .95 at Time 2.

Past overall emotional intensity was assessed with the question "how emotionally intense was the situation?" and rated on a 7-point scale from 1 to 7, with 7 referring to "extremely intense" and 1 "not at all intense."

Autobiographical memory properties were assessed with 14 questions regarding the participants' experience when being asked to deliberately recall the event. Furthermore, participants were asked about voluntary and involuntary recall of the event in their everyday lives. The items were modified from Rubin, Schrauf, and Greenberg (2003) and Berntsen and Rubin (2006b), and were all rated on a 7-point scale (See Table 1).

Current traumatic impact was measured by the first 7 items of the PTSD self-report checklist (PCL; Weathers, Litz, Herman, Huska, & Keane, 1993) that could meaningfully be repeated for each of the memories (cf. O'Toole et al., 2016). Cronbach's α ranged for the four memories from .90 to .93 at Time 1 and from .89 to .92 at Time 2.

Focus in therapy was rated on a 5-point scale, where the participant indicated to what extent the negative memories had been of focus during the sessions.

All questionnaires were filled out online via a link e-mailed to the participants.

2.3 Intervention

All clinical participants had undergone a course of CBT between time 1 and time 2. The clinic offered two different modes of treatments; group and individual CBT. Individual and group therapy followed the same manualized CBT program for SAD or PD, depending on their primary diagnosis. The programs drew upon programs developed by Clark and Wells, (1995), Heimberg and Becker (2002), and Clark and colleagues (1994)¹. The program consisted of 10 sessions, including psychoeducation, cognitive restructuring, attentional training, gradual exposure, and behavioral experiments. Homework exercises consisted of symptom diaries, cognitive restructuring exercises and individualized exposure/behavioral experiments. Imagery rescripting and similar methods were not a part of the manual.

2.4 Analytic strategy

The memory cues were originally generated to elicit memories with either PA- and SA-related contents, two of each kind per participant (see O'Toole et al., 2016). However, although the memories were generated in response to different instructions, it turned out that the clinical participants recalled memories congruent with their disorder. Because of this lack of cue sensitivity, resulting in disorder specific memory content, we averaged across the four recorded autobiographical memories, leaving one aggregate variable per participant reflective of "anxious memories". This was the case for all dependent variables concerning the memory ratings. Thus, whenever referring to a memory variable, reference is made to this composite score or aggregate variable.

Main analyses consisted of paired-samples t-tests, testing the difference from pre to post therapy within the clinical group on the CES (primary outcome) and the traumatic impact of

¹ For a copy of the manual materials please email the corresponding author.

the event as well as specific properties of the autobiographical anxious memories (secondary outcomes). In order to control for ordinary fading or change of memory accessibility over time, a number of mixed 2 x 2 ANOVAs with the factors Time (time 1 vs. time 2) and Group (clinical vs. control) were conducted, where a significant interaction effect between time and group would indicate that change was not simply due to the passage of time.

To explore if the magnitude of change in centrality was associated with change in psychopathology, a reliable change index was calculated (cf. Jacobson & Truax, 1991) on the disorder specific symptom measures (i.e., LSAS for individuals with SAD and PDSS for individuals with PD). Based on this categorization, a mixed 2 x 2 ANOVAs with the factors Time (time 1 vs. time 2) and Group (reliable change vs. not reliable change) was conducted within the clinical group, where a significant interaction effect between time and group would point to differences in the magnitude of change over time on perceived centrality in the two subgroups.

All analyses were performed in IBM SPSS version 21.

3. Results

3.1 Participant and memory descriptives

In total, 67 of the 107 individuals who completed the time 1 assessment also completed the time 2 assessment, corresponding to an overall study dropout rate of 37%. However, this number included 26 patients who had dropped out during the therapy. Among patients who completed the therapeutic intervention, the response rate for the current study was 75%. Among controls, one out of 29 (3%) dropped out of the study. In the clinical group, 29 out of 58 (50%) patients with SAD and 10 out of 20 patients with PD (50%) failed to complete time 2 measures. Due to the larger dropout rate in the clinical group, differences between dropouts and completers were explored. More men dropped out $\chi^2(1) = 5.6, p = .018$, and there was a

trend towards time 2 clinical completers reporting higher levels of social anxiety (LSAS), $t(56) = 2.0, p = .051$. There were no differences between completers and non-completers regarding BDI, BAI, PDSS, age or gender ($ps > .1$). Finally, there were no differences concerning the memory-related variables ($ps > .1$).

There was a tendency for controls to be younger than the clinical participants, $t(60.6) = 2.0, p = .053$. The two groups did not differ in terms of gender, $X^2(1) = <.1, p = .856$. Twenty-two and 17 clinical participants underwent group and individual CBT, respectively. There were no differences in measures of psychopathology either before or after therapy between the two forms of delivery ($ps > .1$). An interaction was found for anxiety symptoms as measured by the BAI, $F(1,65) = 5.0, p = .030, \eta_p^2 = .07$, where the clinical group, $t(38) = 2.2, p = .032$, but not the controls, $t(27) = 1.4, p = .187$, showed a significant decrease in anxiety symptoms. Similarly, there was a significant interaction between time and group, $F(1,65) = 5.3, p = .025, \eta_p^2 = .08$, for depressive symptoms as measured by the BDI-II, where the clinical group showed a significant decrease in depressive symptoms $t(38) = 2.5, p = .017$, which was not the case for the controls, $t(27) = .8, p = .426$. These findings reflect reductions in the clinical participants' symptoms of psychopathology over time while these symptoms remained at floor level in the control participants. See Table 2 for participant descriptives.

At time 1, no participants had any missing memory recordings. At time 2, one control participant only recorded one SA-memory, one recorded only one PA-memory, and three recorded no SA-memories. As for participants with SAD, seven recorded only one SA-memory, one recorded no SA-memories, three recorded only one PA-memory and four recorded no PA-memories. Four participants with PD reported only one SA-memory, and two recorded only

one PA-memory. In total, 34 memory recordings (13%) were missing at time 2. In these cases, the composite scores were made up of the means of the recorded memories. It was also explored if there was a between-group difference in the participants' ability to, at time 2, remember which event the self-provided title from time 1 referred to. There was no such difference, $F(1,60) = 1.0$, $p = .313$, $\eta_p^2 = .02$. Finally, the clinical participants indicated that the negative memories generally had been of minimal focus in therapy ($M=2.1$, $SD=1.0$).

3.2 Centrality of event

Our main hypothesis was confirmed in that clinical participants showed a decline in centrality of event from pre to post therapy, $t(38)=3.1$, $p=.005$. This analysis was supported by a significant time x group interaction effect, $F(1,64)=9.6$, $p=.003$, $\eta_p^2 = .13$.

Since the control group consisted of healthy controls with lower time 1 scores than the clinical group, we explored potential floor effects. Therefore, we conducted a mixed 2 x 2 ANOVA with the factors Time (time 1 vs. time 2) and Group (clinical vs. control) but limited the control group to individuals with scores of at least 1.4 on the CES at time 1, thereby making sure that they potentially could change as much as the clinical group who on average changed from 3.2 to 2.8 ($\Delta=0.4$). This reduced the control group by 10. The mixed ANOVA revealed a trend-wise significant interaction effect between group and time, $F(1,54)=2.8$, $p=.073$, $\eta_p^2 = .09$, showing a larger decrease on the CES in the clinical group.

Fourteen out of the 39 (36%) individuals in the clinical group experienced reliable change on the symptom measures specific to their primary disorder (i.e., PDSS for individuals with PD and LSAS for individuals with SAD). A mixed ANOVA with Time (time 1 vs. time 2) and Group (reliable change vs. not reliable change) revealed a trend-wise interaction, $F(1,$

36)=3.1, $p=.086$, $\eta_p^2 = .08$, with individuals having experienced reliable change showing the largest decrease on the CES.

3.3 Autobiographical memory properties

Seventeen out of the 19 secondary variables pertaining to the experience of the autobiographical memories all moved in the expected direction in the clinical group. There was a significant change in four of these within the clinical group, namely *past intensity* ($t(38)=2.5$, $p=.019$), *experience of the same feelings* ($t(38)=2.5$, $p=.019$), *valence* ($t(38)=-2.4$, $p=.023$), and *involuntary recall* ($t(38)=2.9$, $p=.008$). Only the results concerning the experience of the same feelings, $F(1,64)=6.4$, $p=.014$, $\eta_p^2 = .09$, and involuntary recall, $F(1,64)=6.8$, $p=.011$, $\eta_p^2 = .10$, were supported by significant interactions with group, not past intensity, $F(1,64)=3.4$, $p=.073$, $\eta_p^2 = .07$, or valence, $F(1,64)=2.4$, $p=.127$, $\eta_p^2 = .04$.

4. Discussion

Perceived centrality of SAD and PD participants' most negative autobiographical memories decreased over the course of therapy. This decrease in perceived centrality was larger, although at the trend level, for individuals who experienced reliable change on disorder-specific symptoms. It should be underscored that the direction of causality cannot be claimed due to the correlational design of the study. Despite this limitation, this is the first study to demonstrate that reductions in the perceived centrality of negative autobiographical memories are positively related to reductions in symptoms of psychopathology in this particular population. Future studies should further investigate the potential causal link between reductions in perceived centrality of event and symptoms of psychopathology. This could be done in intervention studies with more measuring points, thereby being able to map

the timeline of change (cf. Kazdin, 2007). In addition, an experimental set-up, where change in perceived centrality is directly targeted with imagery rescripting techniques (Wild et al., 2008), could be investigated.

The study adds to an emerging body of literature showing that perceived event centrality can decrease following psychotherapeutic interventions (Boals & Murrell, 2016; Boals et al., 2015). Importantly, the change in perceived centrality did not correspond to the degree to which the negative events had been of focus in therapy, nor did the CBT manual used prescribe explicit therapeutic work with past negative events (e.g., rescripting). Therefore, the results of the study indicate that reductions in perceived centrality are associated with reductions in psychopathology even when negative autobiographical memories are not directly targeted during a psychological intervention. However, without a clinical control group not undergoing CBT, one cannot be certain that the effects are in fact due to the therapy provided. Keeping this limitation in mind, a number of factors could be responsible for the decrease in perceived centrality during CBT. Working specifically with cognitive restructuring, although not in relation to the negative events, may help clients in using this technique when they recall such events from their past. Likewise, work on modifying basic assumptions (e.g., I'm a failure) may also be hypothesized to have a spillover effect on the recall of the negative events. One may speculate that an individual may be less likely to interpret the negative event as reflective of such basic assumptions, if they have worked on modifying basic assumptions in other situations.

In addition to testing our primary hypothesis concerning event centrality, comparisons were made concerning changes in autobiographical memory characteristics. A number of significant results emerged. First, CBT appeared to reduce involuntary recall of past negative

events. Individuals with anxiety disorders are often bothered by intrusive thoughts and images. Furthermore, such thoughts and images are suggested to be involved in the onset and maintenance of such disorders (O'Toole et al., 2016; Wild & Clark, 2011). The possibility that CBT can result in reduced involuntary recall is a very promising finding, considering that working with the negative events was not an explicit part of the treatment program. Furthermore, the reduction in event centrality was accompanied by a number of reductions in the emotional response to the memories, including past intensity, experiencing the same feelings and valence. A reduction in these variables can be thought of in a number of ways. One is that these reductions may be reflecting emotional reactivity to events in one's personal past, indicating that individuals with anxiety disorders exhibit an attenuated emotional response to the anxious memories. Another interpretation could be that the emotional content is more effectively downregulated following CBT, for instance through the use of cognitive restructuring when recalling the events post CBT.

A number of limitations of the present study should be underscored. First, although a change in centrality of event was associated with a change in psychopathology, other variables that also index accessibility of the memory would likely show similar patterns due to relatively high correlations between such measures and centrality (e.g., Berntsen & Rubin, 2006a; Newby & Moulds, 2011). This would be consistent with the theory underlying the conception of event centrality (Berntsen & Rubin, 2006b). Second, all measures were based on self-report measures, which have known limitations. Third, we did not include memories cued by neutral phrases as a control memory. Fourth, although we included a control group, it was not a clinical control group. This is a limitation since without a clinical control group not undergoing CBT, one cannot be certain that the detected effects are due to CBT. Also,

measures of depression and anxiety were low at both measurement times in the control group, which means that interactions with time and group might reflect a floor effect in the control group for these variables. Concerning the CES, the control and clinical group had 50% and 10% mean scores below 2 (range 1 through 5), respectively. It would thus have strengthened the study had we had a control group of clinical participants. Fifth, with only two time points it remains unknown if the detected effects would be maintained past the end of treatment. Sixth, all clinicians were trained in CBT and received regular supervision, but without adherence ratings it cannot be ascertained that CBT was appropriately delivered. Finally, the number of comparisons increases the risk of a Type I error, and results should be interpreted with regard to their effect sizes.

5. Conclusions

Taken together, CBT effectively reduced perceived centrality of the SAD and PD participants' negative autobiographical anxious memories. This decrease in perceived centrality was larger, although at the trend level, for individuals who experienced reliable change on disorder-specific symptoms. At this point, however, no causal inference can be made, since the study is correlational by design. The present study adds to the emerging body of literature, investigating changes in centrality of event following psychotherapy, and is the first study to investigate the effect of CBT for SAD and PD on perceived centrality. Future studies should look further into potential causal mechanisms. This could be achieved both by including more measuring points during the therapeutic course, and by conducting experiments in which the variables of interest can be isolated and manipulated.

Declaration of interest

The authors declare that there is no conflict of interest relevant to the content of the article.

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Table 1

Autobiographical memory questions

1. (Reliving) While remembering the event, I feel as though I am reliving the original event (1 = not at all; 7 = to a very high degree)
 2. (Visual) While remembering the event, I can see it in my mind (1 = not at all; 7 = to a very high degree)
 3. (Auditory) While remembering the event, I can hear it in my mind (1 = not at all; 7 = to a very high degree)
 4. (Olfactory) While remembering the event, I can smell or taste it in my mind (1 = not at all; 7 = to a very high degree)
 5. (Surroundings) While remembering the event, I recall the physical surroundings (1 = not at all; 7 = to a very high degree)
 6. (Vividness) This memory is vivid (1 = not at all; 7 = to a very high degree)
 7. (Bodily sensations) While remembering the event, I feel the particular bodily sensations I felt then (1 = not at all; 7 = to a very high degree)
 8. (Emotions) While remembering the event, I feel the particular emotions, I felt then (1 = not at all; 7 = to a very high degree)
 9. (Valence) The emotions I have when I recall the episode are (-3 = extremely negative; 3 = extremely positive)
 10. (Current intensity) The emotions I have when I recall the episode are intense (1 = not at all; 7 = to a very high degree)
 11. (Perspective) When I recall the event, I primarily see what happened from a perspective as seen through (1 = my own eyes; 7 = an observer's eyes)
 12. (Belief) I believe that the event really took place the way I remember it, and that I did not imagine anything or invent anything that did not take place (1 = 100% fantasy; 7 = 100% real).
 13. (Words) When I recall the event, it comes to me in words (1 = not at all; 7 = to a very high degree)
 14. (Worry) When I recall the event, I worry about it happening again (1 = not at all; 7 = to a very high degree)
 15. (Voluntary recall) Since it happened, I have deliberately chosen to think back to the event in my mind (1 = not at all; 7 = to a very high degree)
 16. (Involuntary recall) Since it happened, this memory has popped into my mind by itself, that is without me trying to recall it (1 = not at all; 7 = to a very high degree)
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Table 2

Means and standard deviations for the two groups at the two time points for measures of psychopathology and autobiographical memories

	CTRL M(SD)		CLIN M(SD)	
	N=28		N=39	
	Time 1	Time 2	Time 1	Time 2
Psychopathology				
LSAS	13.5 (11.1)	15.4 (10.4)	90.6 (27.2)	78.2 (29.3)
PDSS	.2 (.6)	.3 (.6)	12.1 (6.3)	6.7 (5.1)
BDI	2.4 (3.7)	3.2 (4.6)	21.6 (11.3)	16.9 (12.9)
BAI	2.7 (3.2)	3.5 (3.3)	21.0 (11.8)	17.5 (11.8)
Autobiographical memory				
Centrality of event	1.9 (.8)	1.8 (.7)	3.2 (.8)	2.8 (1.0)
Traumatic impact	1.5 (.6)	1.5 (.7)	3.4 (1.2)	3.0 (1.4)
Intensity (past)	5.5 (.8)	5.8 (.7)	6.4 (.6)	6.0 (1.0)
Reliving	2.9 (1.5)	2.8 (1.6)	4.5 (1.6)	3.9 (1.8)
Visual	4.5 (1.2)	4.8 (1.4)	5.6 (1.1)	5.2 (1.3)
Auditory	2.3 (1.3)	2.5 (1.5)	3.2 (1.6)	3.0 (1.5)
Olfactory	1.5 (.9)	1.6 (1.1)	2.3 (1.3)	2.2 (1.2)
Surroundings	4.9 (1.3)	4.9 (1.3)	5.3 (1.3)	5.0 (1.4)
Vividness	4.2 (1.5)	4.4 (1.6)	5.4 (1.2)	5.0 (1.5)
Bodily sensations	2.1 (1.4)	2.2 (1.4)	3.8 (1.6)	3.5 (1.7)
Feelings (same)	2.5 (1.3)	2.6 (1.6)	4.4 (1.5)	3.6 (1.6)

Valence	-1.0 (.8)	-8 1.1)	-2.1 (.8)	-1.7 (1.0)
Current intensity	2.8 (1.3)	3.2 (1.4)	4.7 (1.7)	4.3 (1.6)
Perspective	3.1 (1.6)	3.0 (1.6)	2.9 (1.6)	3.2 (1.6)
Words	2.3 (1.3)	2.3 (1.5)	2.7 1.4)	2.7 (1.5)
Belief	6.1 (.9)	6.1 (1.1)	6.5 (.6)	6.1 (1.3)
Worry	2.3 (1.1)	2.3 (1.2)	5.3 (1.3)	4.5 (1.6)
Voluntary recall	2.2 (1.0)	2.2 (1.1)	3.1 (1.4)	2.8 (1.2)
Involuntary recall	2.6 (1.1)	2.7 (1.3)	4.2 (1.3)	3.4 (1.2)
Contribution to present condition			4.6 (1.6)	4.1 (1.7)

Note. BAI=Beck Anxiety Inventory; BDI=Beck Depression Inventory; CLIN=clinical participants; CTRL=control participants; LSAS=Liebowitz Social Anxiety Scale; PDSS =Panic disorder severity scale.