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Behaviour Research and Therapy 44 (2006) 749–764
BEHAVIOUR RESEARCH AND THERAPY
www.elsevier.com/locate/brat

Cognitive inhibition and interference in dissociative identity disorder: The effects of anxiety on specific executive functions

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Received 12 July 2004; received in revised form 18 April 2005; accepted 16 May 2005

Abstract

Using an experimentally based, computer-presented task, this study assessed cognitive inhibition and interference in individuals from the dissociative identity disorder (DID; $n = 12$), generalized anxiety disorder (GAD; $n = 12$) and non-clinical ($n = 12$) populations. Participants were assessed in a neutral and emotionally negative (anxiety provoking) context, manipulated by experimental instructions and word stimuli. The DID sample displayed effective cognitive inhibition in the neutral but not the anxious context. The GAD sample displayed the opposite findings. However, the interaction between group and context failed to reach significance. There was no indication of an attentional bias to non-schema specific negative words in any sample. Results are discussed in terms of the potential benefit of weakened cognitive inhibition during anxious arousal in dissociative individuals.

Keywords: Dissociative identity disorder; Anxiety; Cognitive inhibition

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doi:10.1016/j.brat.2005.05.009

Introduction

Experimental investigation into memory functioning in dissociative identity disorder (DID) has centred primarily around amnesia for childhood events (Bryant, 1995; Schacter, Kihlstrom, Kihlstrom, & Berran, 1989) and implicit and explicit memory transfer across so-called ''amnesic barriers'' which often differentiate identities (e.g., Eich, Macauley, Loewenstein, & Dihle, 1997; Elzinga, Phaf, Ardon, & van Dyck, 2003; Huntjens et al., 2002; Nissen, Ross, Willingham, Mackenzie, & Schacter, 1988). Recently, several non-clinical studies using level of trait dissociation as the independent variable have empirically supported a link between various aspects of working memory functioning and dissociation (e.g., DePrince & Freyd, 1999, 2001; De Ruiter, Phaf, Veltman, Kok, & Van Dyck, 2003; Freyd, Martorello, Alvarado, Hayes, & Christman, 1998). Clinical studies are also starting to elucidate the functioning of working memory and attentional mechanisms in DID (e.g., Dorahy, Irwin, & Middleton, 2002, 2004; Dorahy, Middleton, & Irwin, 2005). As has been fruitful in other (non-dissociative) psychiatric conditions (e.g., OCD: Enright & Beech, 1993; Schizophrenia: Peters et al., 2000), the study of attentional and working memory functioning in dissociative disorders may help explicate the cognitive basis of dissociative symptoms.

Several studies have examined cognitive inhibitory functioning in DID. Cognitive inhibition refers to the ability to withhold distracting information from ongoing processing, and is central to selective attention ability (i.e., the ability to selectively attend to one stream of information while ignoring others, Neill, Valdes, & Terry, 1995). In the laboratory setting cognitive inhibitory ability is assessed through procedures designed to evoke negative priming. Negative priming is evident when participants produce slower response times to stimuli they have previously inhibited compared to stimuli not previously inhibited. Therefore, degree of negative priming is deemed to be a marker of cognitive inhibitory ability; greater negative priming indicates more effective cognitive inhibition.

Studies with DID participants suggest that cognitive inhibitory functioning may covary with the degree of anxiety elicited by the experimental situation. For example, DID participants have been found to display effective cognitive inhibitory capacities, as inferred by significant negative priming, when tested in neutral emotional contexts (Dorahy, Irwin et al., 2004; Dorahy, Middleton, & Irwin, 2004; Dorahy et al., 2005); that is, in experimental contexts where DID participants are not experiencing elevated anxiety. However, when tested in anxiety-provoking contexts (i.e., contexts where they self-report elevated anxiety), cognitive inhibitory functioning in participants with DID weakens (Dorahy et al., 2005). Thus, cognitive inhibitory processes in DID appear to operate in a state-like manner and function at a reduced level when anxiety increases. The weakening of inhibitory processes in anxiety-provoking contexts may be associated with the onset of intrusive dissociative symptoms such as flashbacks and identity alterations. This view is consistent with the belief that cognitive inhibition plays a role in the regulation of information in to and out of working memory (Bjorklund & Harnishfeger, 1995).

The same differential pattern of negative priming results across emotional contexts in DID has not been found in non-clinical and depressed samples (Dorahy et al., 2005). However, it remains unclear whether weakened inhibition in anxiety-provoking contexts in DID is a direct function of anxiety, or related more directly to dissociation. Deficits in attentional functioning have been found in independent non-clinical studies of dissociation (e.g., DePrince & Freyd, 1999; Waller,

Quinton, & Watson, 1995) and anxiety (e.g., Mansell, Ehlers, Clark, & Chen, 2002). In addition, various aspects of attentional functioning have been associated with anxiety in the clinical literature (e.g., see MacLeod, 1999). For example, recent studies of cognitive inhibition in posttraumatic stress disorder (Amir, Coles, & Foa, 2002) and high-trait anxiety samples (Wood, Mathews, & Dalgleish, 2001) indicate deficits in suppressing threat-related information. More broadly, these studies allude to general impairments in inhibitory functioning in individuals who continually experience heightened (i.e., trait) anxiety.

It is also unclear whether anxiety or dissociation is primarily related to interference effects (i.e., attentional bias) in studies of dissociation. Processing biases in the form of slower responding have been found in clinically anxious groups exposed to stimuli they feared (e.g., Foa, Feske, Murdock, Kozak, & McCarthy, 1991), and interference has also been related to *state* anxiety in participants with an anxiety disorder (Mathews & MacLeod, 1985). Consequently, it may be that anxiety, as an individual differences variable, is responsible for the non-schema specific threat-related interference in high dissociator (Waller et al., 1995) and DID (Dorahy et al., 2005) participants, and these groups may experience higher trait (or state) anxiety. Whilst Freyd and DePrince (2001) found no evidence for this in non-clinical high and low dissociators, anxiety should be considered a covariate in studies of information processing examining the impact of dissociation.

As well as confirming the reliability of results in a previous study of attentional functioning in DID (i.e., Dorahy et al., 2005), the aim of this study was to assess if anxiety or dissociation had the greatest impact on differential negative priming effects across emotional contexts (i.e., neutral & negative). In addition, interference effects for non-schema specific (i.e., non-child abuse related) negative words reported in DID were further assessed. A generalized anxiety disorder (GAD) sample was utilized as a clinical comparison group for the DID sample. If anxiety accounts for DID processing anomalies (e.g., Dorahy et al., 2005) no differences would be found in cognitive functioning in samples of DID and GAD participants matched on state and trait anxiety measures. As well as controlling for anxiety, the current study controlled for between-group differences in visual selective attention. Previous studies have failed to control for this variable so pre-test between-group differences in selective attention ability may account for differential results across samples.

It was hypothesized that the DID sample would display significant negative priming in the neutral test environment, but reduced negative priming in the anxiety-provoking or negative assessment context. In addition, this differential would be related to dissociative ability and therefore would not be evident in the GAD sample. Finally, following previous research (Dorahy et al., 2005), the DID sample was expected to display an attentional bias to non-schema specific (i.e., non-abuse related) negative words. As attentional bias findings have generally been limited to schema specific words in anxiety disorders (e.g., Foa et al., 1991), the GAD sample was not expected to display interference effects to general negative words.

Method

Participants

Participants were drawn from the 18–65 year old DID, GAD and non-clinical populations. All clinical participants were out-patients and individuals with a self-reported or known history of

brain injury were excluded. Three participants in the non-clinical sample had completed a similar procedure 18 months before participating in the current study. The procedure was novel for all other participants.

The DID sample contained 12 female participants with a psychiatric diagnosis of DID. This diagnosis was initially made by their treating psychiatrist or a clinician with expertise in the detection of dissociative disorders and was affirmed at the time of testing with the dissociative identity disorder section of the Dissociative Disorders Interview Schedule (DDIS). The DDIS is a structured clinical interview for detecting DSM-IV dissociative disorders. The sample was made up of volunteer participants from the United States (10) and Northern Ireland (2) who were made aware of the study through either their treating psychiatrist or advertisements posted in a hospital waiting area. The sample had a mean age of 46.33 years (SD = 8.94). Participants had been in treatment for DID from between 0 months (newly diagnosed, $n = 1$) and 12 years (M = 5.54, SD = 4.1). DID participants were instructed to complete the study in their so-called 'host personality' and this was monitored throughout the study. All DID participants were taking at least one form of psychotropic drug. Nine participants were taking anti-anxiety medication, 10 were on a course of anti-depressants, 5 were taking anti-psychotic medication and 1 was on lithium.

The GAD sample was recruited from the caseload of a Northern Irish consultant psychiatrist (C. Mulholland). Twelve female participants with a mean age of 46.34 years (SD = 11.2) completed the study. Participants had been in treatment for GAD for between 3 and 30 years. Nine of the 12 GAD participants were taking psychotropic medication; 5 were on courses of anti-anxiety drugs, 8 were on anti-depressants, and 2 were taking anti-psychotic medication.

The non-clinical sample contained 12 female participants with a mean age of 39.5 years (SD = 6.8). There was no statistical difference in age between the non-clinical sample and the 2 psychiatric groups [$F(2, 35) = 2.23$]. All participants in this sample were drawn from the Northern Irish population. Six were postgraduate students in psychology and the remaining 6 were made up of university administrative staff. All participants were informed of the study through word-of-mouth. No participant in this sample reported a history of psychiatric illness and none were taking psychotropic medication.

Materials

Participants completed the study over two assessment sessions spaced at least 1 day apart. In the first test session participants completed a pencil and paper task which assessed visual selective attention, a computer-presented task designed to assess negative priming and word-naming speed, and 3 short surveys measuring state and trait anxiety, dissociation and psychological well-being. The cognitive assessment in the first session utilized only neutral word stimuli. In the second assessment each participant completed the state anxiety scale as well as the computer-presented task of cognitive functioning. This task mimicked that used in the first session with the exception that both negative and neutral word stimuli were presented.

Selective visual attention

The pencil and paper visual attention test was the '2 and 7 selective visual attention' task (Ruff, Evans, & Light, 1986). This task was designed as an easy-to-administer pencil and paper

assessment of automatic detection versus controlled search (detection) in the visual domain. Its primary goal is as a measure of selective attention ability (Ruff et al., 1986). Participants search for the numbers '2' and '7' in two distinct conditions. The first is among other single digit numbers (controlled search) and the other is among letters (i.e., stimuli that are perceptually distinct and come from a distinct stimulus category). Each condition contains 3 rows of 50 stimuli with 10 stimulus pieces being targets (i.e., 2 or 7). Participants are given 15 s to work along the rows of each condition and mark-off the target stimuli as quickly as they can. Scoring is based on the number of targets selected minus commissions (i.e., selecting distractor rather than target). Ruff et al. (1986) have demonstrated some of the supporting psychometric properties of this assessment tool.

For the purpose of this study the 2 and 7 task was shortened from 5 to 1 min, in which four of the usual 20 blocks were completed. This was because the 2 and 7 task was utilized to assess selective rather than sustained attention ability and the full 5-min procedure was more likely to fatigue mental resources required for the successful completion of the cognitive tasks, particularly in the clinical groups.

Computer-presented cognitive assessment

The cognitive tasks assessed cognitive inhibition via a negative priming procedure and interference via a word-naming task. These tasks were randomly presented with a distractor task in the two separate 'emotional' contexts. The contexts were manipulated by the information given before testing in each session and the words used in the word-naming task as well as a distractor task. The neutral context was operationally defined by the use of emotionally neutral words and the pre-assessment instructions that all stimuli were of an emotionally neutral nature. The negative context replaced some of the words in the word naming and distractor tasks with negative words. Therefore, the anxiety-provoking condition was operationally defined by the use of negative stimuli. In addition, the pre-assessment instructions noted that some word stimuli were of a threatening nature.

Negative priming task. Cognitive inhibition assessed through tasks of negative priming require participants to select a previously ignored stimulus. The experimental condition which requires the selection of a previously ignored stimulus is referred to as *ignored repetition*. The degree of temporal retardation in the ignored repetition condition compared to a baseline condition where the target stimulus is not previously ignored represents a measure of negative priming. A greater degree of negative priming represents a better ability to engage in cognitive inhibition.

The current study used the Flanker task to assess cognitive inhibition through negative priming. The numbers between 1 and 9 (with the omission of the two-syllabled 7) were utilized as test stimuli. In the Flanker task three stimuli were presented horizontally and simultaneously. The two outside stimuli were the same and the middle stimulus was different (e.g., 1 4 1). This initial presentation is called the prime presentation. Participants were required to name the middle stimulus (e.g., '4'). Following a response to the prime target stimulus, 500 ms elapsed before the second or probe presentation was displayed (Response–Stimulus Interval; RSI). The probe presentation again required participants to respond to the middle of three simultaneously presented number stimuli.

The nature of these stimuli was dependent on whether the trial was baseline or ignored repetition. In the baseline condition the probe trial stimuli were completely distinct from the prime trial stimuli (e.g., prime: 1 4 1 followed by probe: 2 6 2). In the ignored repetition condition the probe trial target stimulus was the same as the prime trial distractor stimuli (e.g., prime: 4 8 4 followed by probe: 3 4 3). This condition allowed a stimulus to first be ignored (i.e., inhibited) and then selected (i.e., released from inhibitory control). The degree of negative priming was determined by subtracting the probe target response time in the ignored repetition condition from the probe target response time in the baseline condition. Slower responding to ignored repetition probe trials produces negative priming. In keeping with previous attempts to maximise inhibitory control of stimuli (Kane, May, Hasher, Rahhal, & Stoltzfus, 1997), the prime trial was presented for 100 ms and the probe trial for 150 ms. The target stimulus in each Flanker trial was positioned two character spaces away from the distractor stimuli. Validation of the Flanker task would be achieved if the non-clinical sample produced a significant negative priming effect in the neutral context.

Word-naming task. The word-naming task was designed to assess attentional bias in the form of slower naming speed (i.e., interference) for emotionally negative versus emotionally neutral words in focal awareness. In keeping with a previous study that examined this issue in dissociative participants (i.e., Dorahy et al., 2005), the focal word-naming task simply presented neutral or negative words in the middle of the screen for 200 ms and participants were required to pronounce the displayed word. In the neutral experimental context all stimuli were emotionally neutral words, whereas in the anxiety-provoking context half the word stimuli were emotionally neutral and the other half emotionally negative. Word stimuli for this task were those developed and used by Dorahy (2001). There were 36 words in each list. As a group, negative word stimuli were not related to a specific fear schema and all were non-abuse related words. Previous work has tended to produce attentional bias effects only to fear schema-specific stimuli (e.g., McNally, Kaspi, Reimann, & Zeitlin, 1990). Yet, Dorahy et al. (2005) reported attentional bias to non-schema-specific negative words in DID.

The distractor task presented participants with a single word stimulus in each of the four corners of the computer screen. The stimulus to be named was printed in red, while the other three stimuli were presented in white. The target stimulus was randomly positioned in the four locations across trials. In the neutral context the distractor and target stimuli were all neutral words. In the negative context, the distractor words and half the target words were neutral while the remaining target stimuli were negative, non-schema-specific words. The distractor task aided in the manipulation of emotion valance between contexts.

The experimental tasks were completely randomized for each participant, with a 2000 ms gap between the completion of one task trial and commencement of the next. Participants were instructed to respond to test stimuli as quickly and as accurately as possible. However, it was made clear that a record was to be kept of incorrect responses, to maximize the emphasis on accuracy. A fixation point in the form of an addition sign (+) was presented for 500 ms in the middle of the computer screen 1000 ms before the onset of each *new* trial (but not before Flanker probe presentations). As well as acting as a psychological prompt for the next trial, the fixation point demonstrated the exact location in the middle of the screen of the target number in the Flanker task and the word stimulus in the word-naming task.

Survey assessment

The DID section of the DDIS was used to verify the diagnosis of DID participants and ensure that no participant in the GAD and non-clinical control groups was positive for DID. The *Dissociative Experiences Scale* (DES) was utilized to verify the assumed difference in dissociative experience between the DID sample and the two comparison groups. The *Spielberger State-Trait Anxiety Inventory* (STAI) and the *Brief Symptoms Inventory* (BSI) were employed as co-variate measures in the statistical analyses to control for the possible confounding effects arising from between-group differences in state and dispositional anxiety, and psychopathology. Finally, the state anxiety subscale of the STAI, along with a Subjective Units of Distress Scale (SUDS) of anxiety, were used to assess the effectiveness of the emotional manipulation across test sessions.

The DDIS (Ross et al., 1989) is a 132-item structured clinical interview designed to assess for dissociative disorders and related symptoms and conditions (e.g., Schneiderian symptoms, depression, borderline personality disorder). The DDIS has displayed good sensitivity for detecting true cases of DID (Ross, 1995) and the Kappa coefficient for detecting agreement between clinical judgement and DDIS indications of DID is over .9 (e.g., Ross et al., 1989). The current study used the DID subscale of the DDIS which contains 4 items and assesses the diagnostic criteria for DID.

The DES (Carlson & Putnam, 1993) contains 28 items and is the most frequently used self-report measure of dissociation (Carlson, 1997). Items measure both non-pathological and pathological dissociation (Waller, Putnam, & Carlson, 1996). The eight items thought to best reflect pathological dissociation (items, 3, 5, 7, 8, 12, 13, 22, 27) are collectively referred to as the Dissociative Experiences Scale-Taxon (DES-T; Waller et al., 1996). Participants circle the percentage of time they experience each item on a scale ranging from 0% to 100%. The DES has a test–retest reliability between .84 and .96 and an internal consistency of .95 (Carlson, 1994). Scores on both DES and DES-T range from 0 to 100.

The STAI (Spielberger, 1983) contains 40 items, 20 of which assess state anxiety, or how anxious an individual is feeling at the very moment they complete the questionnaire, and trait anxiety, or how anxious the individual generally feels (Spielberger, 1983). Responses to each item are made along a 4-point scale ranging from 1 (not at all) to 4 (very much so). The STAI has been used in a variety of settings and with a variety of populations, and displays good psychometric properties (Spielberger, 1983).

The BSI (Derogatis, 1993) is a 53 item scale which provides a global measure of mental health via items that create nine orthogonal sub-scales. The BSI has demonstrated excellent overall, and subscale, psychometric properties in both clinical and non-clinical groups (Derogatis, 1993).

Procedure

In the *first assessment session*, participants read and signed the information and consent form and responded to questions about daily medication intake, diagnosis, psychiatric history, and length of time in treatment for either DID or anxiety. All participants were then asked diagnostically specific questions related to DID. Participants then completed the '2 and 7 selective visual attention' task, were informed about the different aspects of the computer-presented cognitive task and instructed on how to respond. They were also told that all words presented would be "normal, everyday, emotionally neutral words, like books, note and make." Following a set of practice trials the STAI State Anxiety subscale was completed. Moreover, participants were

asked to rate their current level of anxiety on the SUDS that ranged from 1 (''no anxious feelings, no anxiety'') through 5 (''butterflies in my stomach, quite worried about doing the task'') to 10 (''unable to be involved in the study due to my level of anxiety''). This SUDS rating was taken again in the middle and at the end of the computer-presented cognitive assessment. The three scores were averaged to provide a marker of self-reported anxiety for completing the task. On finishing the computer task, participants completed the trait anxiety measure, the DES and the BSI. Before leaving the laboratory and after being debriefed, an appointment was made for the next session and participants were told that the computer task would contain both neutral and negative word stimuli.

In the *second assessment session*, participants were again informed that some of the test stimuli would be ''emotionally negative words like hate, kill and hell.'' Following a set of practice trials, participants completed the STAI State anxiety subscale and before, in the middle and at the end of the computer task, participants rated their level of anxiety on the SUDS. On completion of the computer task in the second session, participants were debriefed and informed more fully about the goals and nature of the study.

In both the first and second sessions, the DID participants were asked to complete the whole task in their so-called 'host' personality. DID participants were encouraged to try to resist switching identities or giving over to influences from other identities. Changes in vocal tone, behaviour and body language were monitored throughout testing and the 'host' personality was invited to 're-engage' if an alteration in identity had taken place. Following the completion of the computer task in both sessions, DID participants were asked if they had 'lost' any time, had felt the influence of other 'parts', had felt they had 'switched' identity or had experienced commenting 'voices.' They were also asked to describe their experience while doing the task. All testing was conducted by the first author who had no prior or ongoing clinical input in the treatment of any participant.

Analysis

A Multivariate Analysis of Variance (MANOVA) was used to assess group differences on the 2 & 7 visual selective attention task, the SUDS ratings across context and the questionnaire measures.

Omnibus Analysis of Covariance (ANCOVA) tests were used to assess hypotheses with the assistance of planned simple effects analyses. To increase the statistical power lost when using the traditional Bonferroni adjustment on multiple comparisons, the simple effects analyses on priming effects utilized Keppel's (1991) modified Bonferroni adjustment on p [probability value (.05) $\times$ group degrees of freedom (2) $\div$ number of comparisons (6)]. The modified p was set at .016. Co-variates were used in each analysis to isolate dissociation as the core variable differentiating the DID and GAD samples.

Reaction times below 200 ms were omitted. In addition, trial times outside 2.5 standard deviations for each participant in each trial were omitted to deal with outlying response times.

Results

Table 1 presents the means and standard deviations for each group on the selective attention task, the SUDS ratings in each context and the questionnaire measures.

Table 1
Means and standard deviations (in parentheses) for the selective attention task, the SUDS ratings and the questionnaire measures

Assessment measures	DID	GAD	Non-clinical
Selective attention	44.5 (14.4)	40.2 (13.0)	60.8 (7.0)
DES	54.0 (18.6)	29.9 (18.2)	12.33 (6.9)
DES-T	50.9 (17.5)	26.2 (20.1)	4.3 (2.9)
SUDS (neutral)	4.2 (1.5)	3.7 (1.5)	1.7 (.5)
SUDS (negative)	4.8 (1.6)	4.7 (1.4)	1.7 (.6)
STAI State (neutral)	52.4 (15.9)	56.1 (10.1)	29.9 (9.9)
STAI State (negative)	53.7 (13.6)	54.9 (13.7)	29.8 (7.6)
STAI Trait	63.8 (9.9)	63.7 (8.6)	35.5 (5.9)
BSI	2.1 (.8)	2.3 (.9)	.58 (.5)

Selective attention = 2 & 7 visual selection attention task; DES = Dissociative Experiences Scale; DES-T = Dissociative Experiences Scale-Taxon; SUDS (neutral) = Subjective Units of Distress Scale in neutral context; SUDS (negative) = Subjective Units of Distress Scale in negative context; STAI State (neutral) = Spielberger State Anxiety Inventory in neutral context; STAI State (negative) = Spielberger State Anxiety Inventory in negative context; STAI Trait = Spielberger Trait Anxiety Inventory, BSI = Brief Symptoms Inventory.

The DID sample did not differ from the GAD sample on selective attention ability, SUDS ratings in the neutral and negative contexts, STAI state anxiety scores in the neutral and negative contexts, trait anxiety and general psychiatric symptoms as measured by the BSI. However, the two clinical groups differed from the non-clinical sample on all these variables (Selective attention: DID—$p<.01$; GAD—$p<.001$; SUDS neutral context: DID—$p<.001$; GAD—$p<.01$; SUDS negative context: DID—$p<.001$; GAD—$p<.001$; STAI State anxiety neutral context: DID—$p<.001$; GAD—$p<.001$; STAI State anxiety negative context: DID—$p<.001$; GAD—$p<.001$; STAI trait anxiety: DID—$p<.001$; GAD—$p<.001$; BSI: DID—$p<.001$; GAD—$p<.001$). The DID sample displayed significantly higher trait (i.e., DES) and pathological (i.e., DES-T) dissociation scores than the GAD ($p<.01$; $p<.01$, respectively) and non-clinical ($p<.001$; $p<.001$, respectively) groups.

A 3 (group) by 2 (context) mixed ANOVA on SUDS anxiety ratings produced a main effect for group [$F(2,33)=24.53$, $p<.001$] and anxiety [$F(1,33)=19.05$, $p<.001$]. Anxiety was significantly higher in the negative context. The main effects were qualified by a significant interaction between group and context [$F(2,33)=4.77$, $p<.05$]. Simple effects analyses showed that both the DID [$t(11)=-4.6$, $p<.01$] and GAD [$t(11)=-2.57$, $p<.05$] samples displayed significantly higher self-reported anxiety in the negative (DID = 5.2; GAD = 4.7) compared to neutral (DID = 4.2; GAD = 3.7) context. Importantly, these results validated the experimental manipulation for emotional context and indicated that the clinical samples were more anxious in the negative context. The non-clinical sample showed no difference in anxiety across the two contexts [Neutral = 1.7; Negative = 1.7: $t(11)=.001$]. The heightened self-reported anxiety for the DID and GAD samples in the negative context was not replicated with the more objective STAI measure of state anxiety. There was no main effect for anxiety [$F(1,33)=.001$) nor a significant interaction between group and context on STAI State Anxiety scores.

Table 2 presents the priming effects (baseline probe − ignored repetition probe), standard deviations and probability statistics for each group in the neutral and negative contexts.

A 3 (group) by 2 (context) ANCOVA on priming effects with selective attention, BSI, trait anxiety, and SUDS and STAI state anxiety in both contexts used as covariates, failed to produce a significant main effect for group [$F(2,26) = .95$] or context [$F(1,26) = 1.2$]. The low statistical power for the interaction effect (Eta squared = .062, power = .182) ensured it was also non-significant [$F(2,26) = .86$]. Importantly, none of the co-variates accounted for a significant amount of the variance in negative priming scores, although self-reported anxiety (SUDS) in the negative context displayed a non-significant trend [SUDS negative context: $F(1,26) = 3.4$, $p = .08$; selective attention: $F(1,26) = 1.30$; SUDS neutral context: $F(1,26) = .42$; state STAI neutral context: $F(1,26) = .76$; state STAI negative context: $F(1,26) = 2.53$; trait STAI: $F(1,26) = .981$; BSI: $F(1,26) = .48$].

Despite the failure to produce a significant group by context interaction, simple effects analyses (z-tests) were conducted on this effect. Such analyses were undertaken as they represent the only direct means of determining if any group displayed significant negative priming in each context (i.e., this is not directly assessed by the group by context analysis). In addition, the Eta-squared result for the interaction between group and context suggested a small effect that would require a considerably larger sample size to reach significance. Finally, Howell (1992) has argued that a significant overall F is not required for further statistical evaluation for an effect if such an evaluation is relevant to hypothesis testing. As can be seen in Table 2, the DID sample produced significant negative priming in the neutral context, but not in the negative context. The GAD sample displayed the opposite results; significant negative priming in the negative context but no evidence of negative priming in the neutral context. The non-clinical sample produced significant negative priming in both contexts.

Table 3 displays the interference effect for each group in the neutral and negative contexts. This effect represents negative minus neutral word response speed in the negative context, so effects in the positive directions signify slower responding to negative stimuli.

The one-way ANCOVA showed no significant effect for group [$F(2,29) = .58$], suggesting that the samples did not differ on interference effect. Moreover, z-tests with adjusted p-values displayed no significant interference effect for the DID [$z(11) = .89$], GAD [$z(11) = -.51$] and non-clinical [$z(11) = 2.64$] groups.

Table 2
Priming effects (i.e., baseline condition probe trials minus ignored repetition condition probe trials) in milliseconds for each group across neutral and negative emotional contexts

Sample	Priming effect in neutral context	Priming effect in negative context
DID	−18.4*	−6.7
	[SD: 23.1; $z(11) = -2.8$, $p = .009$]	[SD: 19.2; $z(11) = -1.2$]
GAD	−9.7	−16.2*
	[SD: 22.7; $z(11) = -1.5$]	[SD: 19.1; $z(11) = -2.9$, $p = .006$]
Non-clin.	−12.9*	−16.8*
	[SD: 15.3; $z(11) = -2.9$, $p = .007$]	[SD: 12.4; $z(11) = -4.7$, $p = .0005$]

Note: *Significant, $p < .016$ (Modified Bonferroni adjustment).

Table 3
Interference effects (negative–neutral stimuli in the negative context) in milliseconds for each group

Sample	Word-naming effect
DID	28.1 (SD: 109.8)
GAD	−3.2 (SD: 21.8)
Non-clinical	12.9 (SD: 16.9)

Discussion

The findings from the negative priming task, as indicated by the simple effects analyses, supported the hypothesis that the DID sample would display a weakening in cognitive-inhibitory functioning in an anxiety-provoking experimental context. The DID sample displayed significant negative priming, and therefore effective cognitive inhibition, in the neutral context. However, this sample failed to display effective cognitive inhibition in the negative context. Conversely, the GAD sample displayed no negative priming in the neutral context but significant negative priming in the negative context. The GAD sample's failure to display negative priming in the neutral context is consistent with the view of general inhibitory deficits in anxiety disorders (Amir et al., 2002; Wood et al., 2001). The current findings were based on simple effects analyses of the group by context interaction and they clearly show that the DID sample displayed negative priming in the neutral but not negative condition, while the GAD sample displayed the opposite results. However, the failure of the interaction to reach significance means that there is no evidence to suggest that the groups statistically showed different effects across context (i.e., the groups cannot be directly compared to show differences, but *within* each group comparisons can be made across the two contexts to show differences [i.e., based on the simple effects analyses]). The results are discussed, and should be understood, with these considerations in mind.

Both the DID and GAD groups reported greater SUDS anxiety in the negative context. From the simple effects analyses, the DID group showed no negative priming when their anxiety was evaluated, but showed significant negative priming when it was reduced. When anxiety was elevated in the GAD group negative priming was evident, however, there was no demonstrable negative priming in this group when anxiety was reduced. While direct comparisons and conclusions across groups are not warranted (in the absence of a significant interaction), there appears to be evidence that anxiety has a direct impact on inhibitory processes within groups. Across the two contexts the non-clinical sample demonstrated no difference in self-reported anxiety and showed effective cognitive inhibition (i.e., significant negative priming). Contrary to a previous study (Dorahy et al., 2005), the DID sample displayed no significant slowing in response time for negative non-schema-specific (i.e., non-abuse) focal words compared to neutral focal words.

Several non-clinical studies have shown that dissociation impacts on the processing of threat stimuli (e.g., DePrince & Freyd, 1999; Waller et al., 1995) even with anxiety factored out (De Ruiter et al., 2003; Freyd & DePrince, 2001). The current task used schema non-specific stimuli. This strategy was adopted to assess the merits of previous findings (Dorahy et al., 2005—that study used a mixture of DID in- and out-patients while the current study used only out-patients).

In addition, these words were chosen over schema specific words to reduce the likelihood of individuals with DID experiencing dissociative episodes in reaction to negative words; thereby providing no experimentally measurable response to those stimuli. However, this study showed no evidence for an attentional bias to non-schema specific words in DID. While inconsistent with the previous DID study (Dorahy et al., 2005), this finding is consistent with the wealth of data in the anxiety disorders literature showing that attentional bias is generally limited to threat-schema specific information (e.g., Foa et al., 1991).

Dorahy et al. (2005) found the same pattern of change in cognitive inhibitory functioning across emotional contexts (i.e., weakened inhibition in negative but not neutral contexts) in a different DID sample. However, in that study a depressed sample failed to display effective inhibition in both contexts (though, they also self-reported no difference in anxiety across contexts). Whilst provisional at this stage, it appears that the weakening of inhibitory functioning in DID in situations of increased anxiety is not directly related to depression. From the current study, it can be tentatively argued that the reduced inhibition in DID in anxiety arousing contexts is also not related to anxiety, per se (though this conclusion is based on a different pattern of results in the simple effects analyses when comparing the GAD and DID sample, and not on the more powerful interaction effect).

The DID and GAD samples displayed no differences on the self-report measures of selective attention (2 & 7 tests), state and trait anxiety (SUDS & STAI), and psychopathology (BSI). In addition, these co-variates were not statistically associated with negative priming. The only measured variable that the two clinical samples differed on, and which was not used as a co-variate, was dissociation, as measured by the DES. In studies of non-clinical participants dissociation proneness has been found to make an independent contribution to the operation of attentional processes (Freyd & DePrince, 2001; De Ruiter et al., 2003). In addition, divided or dual attention tasks produce better performance in high versus low dissociators (e.g., DePrince & Freyd, 1999; Freyd & DePrince, 2001). With dissociation being understood as divisions in consciousness (e.g., Van der Hart & Dorahy, 2005), it has been proposed that high dissociators are better able to simultaneously process two or more streams of information (DePrince & Freyd, 1999). Consequently, this dissociative ability produces heightened divided attention performance in high dissociators. Such findings may offer an explanation for reduced cognitive inhibition in DID, now found in two studies using different DID samples from different countries; one from Australia (Dorahy et al., 2005) and the other from the US/Northern Ireland (i.e., the current study).

Whilst speculative, it seems likely that weakened inhibition may be related to divided attention ability (i.e., the processing of multiple streams of information) in dissociative-prone individuals. Before selection of specific information takes place, physical and basic semantic processing is given to the vast amount of stimuli impinging on the senses (Cowan, 1997). Following automatic assessment based on factors such as novelty and significance (e.g., threatening; Mathews & MacLeod, 1985), attention is focused on a very limited set of stimuli through the excitation of relevant information (i.e., that selectively attended to) and the inhibition of information to be ignored (Tipper, Bourque, Anderson, & Brehaut, 1989). The mental representations of inhibited stimuli do not undergo further analysis so cognitive resources can be selectively directed to specific information; thus allowing attention to be focused. With reduced inhibition more streams of information can be given more extensive processing.

Increases in the quantity of mental representations getting higher-quality processing will have deleterious effects on attention in individuals not prone to dividing consciousness (i.e., low dissociators). However, individuals with the capacity to dissociate (divide consciousness) may be assisted by reduced inhibitory functioning. Weakened inhibition and the resultant quantitative and qualitative increase in elaborative processing will have less taxing effects on cognition if multiple streams of information can be simultaneously processed. Individuals prone to dissociation seemingly have this ability. Both dual attention tasks and anxiety increase cognitive demands (e.g., Mathews & Mackintosh, 1998) and may produce a concomitant weakening of inhibition in dissociative-prone individuals so as to generate more cognitive 'fuel' (stimuli requiring processing) to allow multiple streams of information processing to operate in those capable of this ability.

DePrince and Freyd (1999) have demonstrated superior selective attention ability in low compared to high dissociative-prone non-clinical participants. However, high dissociators display superior performance to low dissociators on divided attention tasks. It is proposed here that (1) reduced inhibition creates the psychological conditions for divided attention (processing multiple streams of information), and (2) divided attention (i.e., dividing consciousness) provides a more effective cognitive architecture for information processing in high dissociators (DePrince & Freyd, 1999). Following from these two premises, the reduced inhibition displayed by the DID group in the heightened anxiety condition can be seen as an adaptive cognitive operation. Reduced inhibition in DID in potentially threatening environments generates greater cognitive demands which creates the more efficient divided attention processing style. With more information being given greater processing potentially threatening stimuli are more likely to be detected quicker (though not necessarily responded to quicker).

The function of reduced inhibition in anxiety-provoking situations for individuals with DID may be to provide the psychological architecture for processing multiple streams of information, by increasing cognitive demands. Reduced inhibition in DID may represent an adaptive functional reorganisation of cognitive operations in contexts perceived as threatening.

This study has several limitations. The samples were non-randomly selected, which may have implications for the generalizability of findings. Moreover, the non-clinical sample failed to report differences in anxiety across the two contexts. It is therefore uncertain whether anxiety in the general population has any impact on inhibitory functioning, and if so, whether it acts as a suppressor or facilitator. The methodological difficulty in testing DID and non-clinical participants across emotional contexts is finding stimuli that elevate the anxiety levels of both groups but minimise dissociative episodes during testing in the dissociative sample.

Whilst the clinical samples self-reported increased anxiety across emotional contexts, there was no objective evidence for this change using the State Anxiety subscale of the STAI. Although the STAI was anchored to anxiety for completing the task, several items were incongruent with this goal (e.g., item 6, "I feel upset"; item 7, "I am presently worrying over possible misfortunes"; item 8, "I feel satisfied"). The STAI was not used to monitor changes in anxiety during the task and it is perhaps not sensitive enough as a complete tool to detect subtle changes in anxiety. Future work should adopt a more satisfactory strategy for objectively assessing changes in anxiety, such as physiological measures.

A further limitation relates to possible confounding effects of psychotropic medication. The effect of psychotropics, especially neuroleptics, on cognitive inhibition is unclear. Some studies

show no effects, while other studies demonstrate an effect (cf., David, 1995; Salo, Robertson, Nordahl, & Kraft, 1997; Williams, 1996). The assessment of psychotropic medication is difficult in studies with other goals. Equivalence calculations are imprecise and therefore correlations utilizing them are prone to inaccuracy. It is unlikely that medication could explain the different patterns between the DID and GAD samples in inhibitory functioning, especially given the majority in each sample were taking anxiolytics and anti-depressants and a smaller number in each group were taking an antipsychotic. Nonetheless, explanations based on medication need to be ruled out before psychological accounts of the current results are confidently adopted.

The current study assessed working memory and attentional functioning in DID identities not fixated on trauma material. Weakened inhibition appeared to be a cognitive concomitant of increased anxiety in these dissociative identities. This reduced functioning may not be directly accounted for by anxiety, as a GAD sample matched on state and trait anxiety with the DID group displayed a different pattern of priming effects across neutral and anxiously aroused contexts (though the interaction failed to reach significance). Dissociative ability appeared to offer a better account of the weakened inhibitory functioning in DID. No evidence was found for an attentional bias to non-schema-specific negative word stimuli. The effects of dissociation appear to be evident at a relatively early stage of information processing (i.e., relating to inhibition around the time of selection). The possibility that later stages of processing are affected by dissociation awaits more sensitive empirical assessment.

Acknowledgements

The authors would like to thank Billy Neil and Martin Sawey, Ph.D for technical assistance and Mark Shevlin, D. Phil, for his statistical advice.

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