Neural correlates of nonclinical dissociation

de Ruiter, M.B.

Citation for published version (APA):

General rights
It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations
If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: http://uba.uva.nl/en/contact, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.
Dissociative style and individual differences in verbal working memory span

2.1 Abstract

Dissociative style is mostly studied as a risk factor for dissociative pathology, but it may also reflect a fundamental characteristic of healthy information processing. Due to the close link between attention and working memory and the previous finding of enhanced attentional abilities with a high dissociative style, a positive relationship was also expected between dissociative style and verbal working memory span. In a sample of 119 psychology students, it was found that the verbal span of the high-dissociative group was about half a word larger than of the medium and low-dissociative groups. It is suggested that dissociative style may be one of only very few individual differences that is directly relevant to consciousness research.

2.2 Introduction

Dissociation is a construct stemming from clinical psychology that seems clearly associated with individual differences in conscious processing. It is defined as ‘a disruption in the usually integrated functions of consciousness, memory, identity, or perception of the environment’ (DSM IV, American Psychiatric Association, 1994). In Dissociative Identity Disorder (DID), for instance, mental functions appear to be disintegrated so severely that two or more distinct identities or personality states (i.e., ‘alters’) recurrently take control of behaviour. In addition to being the core symptom of the dissociative disorders, dissociation is often seen in Posttraumatic Stress Disorder (Boon & Draijer, 1993), and required in the diagnosis of Acute Stress Disorder (Morgan et al., 2001; Spiegel, Koopman, Cardeña, & Classen, 1996). Dissociative experiences, however, also frequently occur outside any clinical context (Ray, 1996; Waller, Putnam, & Carlson, 1996), when there is no indication of any traumatic experience. Within this context they regarded as harmless, as is the case for daydreaming, or even useful (dissociation has been invoked to explain why a person can competently conduct several actions simultaneously, e.g. driving a car and maintaining a conversation; Spiegel & Cardeña, 1991). We hypothesized that differences in a basic cognitive skill (i.e., working memory span) would correspond to the ability to have dissociative experiences. The working memory span of a relatively large sample of 119 nonclinical participants varying in level of dissociative tendencies was determined.

Though originally developed to screen for persons at risk for dissociative pathology, a number of questionnaires is nowadays used to determine to what extent individuals have a general tendency for dissociative experiences (e.g., DES: Bernstein & Putnam, 1986; DisQ: Vanderlinden, Van Dyck, Vandereycken, Vertommen, & Verkes, 1993). Given that dissociative experiences frequently occur in the general population (e.g., Ross, Joshi, and Currie, 1990) and that both pathological and nonpathological dissociation share a high level of genetic influences (Jang, Paris, Zweig-Frank, & Livesley, 1998) it is difficult to view dissociation as other than a fundamental information-processing mechanism. The majority of experimental studies into this mechanism has focused on memory function in high-dissociative patient groups (e.g., Cloitre, 1992; Cloitre, Cancienne, Brodsky, Duit, & Perry, 1996; Elzinga, de Beurs, Sergeant, Van Dyck, & Phaf, 2000; McNally, 1998; McNally, Metzger, Lasko, Clancy, & Pitman, 1998). Although from a clinical perspective these patients were expected to show decreased memory functioning for trauma-related stimulus material, they showed, at least under some circumstances, superior (i.e., 'hypermnesic') performance. These laboratory studies add support to the view that
dissociation may be related to a basic cognitive skill that does not have the avoidance of traumatic memories as its primary goal.

Only a few studies have been conducted that were specifically aimed at clarifying the relation between dissociation and basic cognitive functioning in a nonclinical population. Employing hybrid versions of a classical and an emotional Stroop task, Freyd, Martorello, Alvarado, Hayes, and Christman (1998) and DePrince and Freyd (1999) found that high-dissociative college students showed more classical Stroop interference and less interference in a dual-task Stroop task than low-dissociative students. DePrince and Freyd (1999) concluded that high dissociators may be more skilled at dividing attention and less skilled at focusing attention than low dissociators. In a recent event-related potential (ERP) study by our group (De Ruiter, Phaf, Veltman, Kok, & Van Dyck, 2003, see Chapter 4), however, we reasoned that the classical Stroop task might not be suited to induce dual tasking in the high dissociators as the relevant and the irrelevant stimulus feature (colour of word vs. meaning of word) interfere. Employing a paradigm in which the two features did not interfere, high-dissociative students showed indications of enhanced selective, as well as divided, attention.

In addition to attentional abilities, dissociation may also be related to working memory abilities. Many theorists have postulated strong bidirectional links between attention and working memory (e.g., Awh & Jonides, 2001; de Fockert, Rees, Frith, & Lavie, 2001; Downing, 2000; Kane & Engle, 2003). Elzinga et al. (2000) suggested that also the superior memory performance of their high-dissociative participants was due to increased elaborative learning, for which a high working memory capacity is a prerequisite. Conway, Cowan, and Bunting (2001) have, for instance, suggested that a low working memory span corresponds with a difficulty of inhibiting distracting information in attentional tasks. Low-dissociative participants have similarly been found (DePrince & Freyd, 1999) to show more Stroop interference than high-dissociative persons under dual-task conditions (i.e., when working memory is loaded). If the ability to divide attention is indeed related to working memory span and high-dissociative persons possess enhanced attentional abilities, these persons would also be expected to have larger working memory spans than low-dissociative persons. From this starting point, we collected verbal working memory spans and dissociation scores in the course of three different experiments within a nonclinical sample of psychology students.
2.3 Method

A group of 119 Psychology students at the University of Amsterdam participated either for course credit or for a financial reward in one of three experiments involving memory performance and priming with neutral and emotional material. They all consented to perform the working memory task and to complete the dissociation questionnaire at the end of the experiment. For two of the three experiments extreme scorers were selected on the basis of previously collected scores. The experimenters were, however, blind to these scores and administered the questionnaire again at the end of the experiment. To obtain sufficient participants also additional non-selected students were enrolled in the experiments. Only final scores are presented here. Due to the mixed nature of the group, participants were divided in high, medium, and low dissociative groups (see Table 1).

The working memory test was immediately followed by the Dissociation Questionnaire (DIS-Q) and was administered at the end of the experiment. Verbal working memory span was determined with a Dutch version of the word span test of Daneman and Carpenter (1980). The test was composed of monosyllabic, relatively familiar, Dutch words (e.g., ‘arm’, ‘bed’, ‘was’) which were as semantically and phonetically unrelated as possible. Two sets of two, three, four, five, six, and seven different words each were formed. The smallest set was first read out and the participant had to recall these words aloud in the exact order of presentation. After the two sets of two words, two sets of three words followed. Each time the subsequent two word lists had one word more. The number of words increased to maximally seven or until the participant made an error. If the error was, for instance, made in the first five-word list, the span was scored as 5. If it was made in the second five-word list, a span of 5.5 was scored. All words in the successive word lists were different and presented in the same order to all participants.

The Dissociation Questionnaire (DIS-Q; Vanderlinden et al., 1993) is a Dutch self-report measure of dissociative experiences. It consists of 63 items and has four subscales: Identity confusion, Loss of control, Amnesia, and Absorption. A respondent could indicate on a five-point scale (1 = not at all; 2 = a little bit; 3 = moderately; 4 = quite a bit; 5 = extremely) to what extent the item or statement was applicable. Identity confusion (25 items), or fragmentation, refers to experiences of depersonalisation and derealisation. Loss of control (18 items) is associated with impulsiveness and relates to experiences of losing control over behaviour, thoughts, and feelings. The subscale of Amnesia (14 items) indicates apparent memory loss and sudden lacunas in conscious recollection. Absorption (6 items), finally, measures experiences of enhanced concentration and attention. Internal consistency of the DIS-Q is good (Cronbach’s alpha is 0.96 for the total scale). The test-retest reliability is 0.94 for the total score. In a sample of 374 respondents from the general population the average total score was 1.61 (SD = 0.40). In the same study (Vanderlinden,
Van Dyck, Vandereycken, & Vertommen, 1991) dissociative style was also found to decline with age, but no gender differences were obtained. In the clinical context, persons scoring above 2.2 are recommended for screening for dissociative or other mental pathology. Finally, a congruent validity ($r = 0.85$) between DIS-Q and another dissociation questionnaire (DES; Bernstein & Putnam, 1986) was obtained by Vanderlinden et al. (1993).

2.4 Results

High-dissociative students had a higher span (see Table 1) than medium or low-dissociative students ($F(2, 116) = 5.33, p < 0.01$). Post-hoc tests confirmed that only the high-dissociative group differed significantly ($p < 0.05$) from the other groups. Though the relationship is probably nonlinear, a significant positive correlation was found between total DIS-Q score and working memory span ($r = 0.222, p < 0.05$). The results suggest that only extreme high scorers on the DIS-Q, approaching the pathological range, show an enlarged verbal working memory span.

<table>
<thead>
<tr>
<th>Dissociative group</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>22.7 (6.2)</td>
<td>23.4 (7.1)</td>
<td>22.5 (6.6)</td>
</tr>
<tr>
<td>Average DIS-Q</td>
<td>1.24 (0.06)</td>
<td>1.58 (0.14)</td>
<td>2.27 (0.27)</td>
</tr>
<tr>
<td>Minimum DIS-Q</td>
<td>1.063</td>
<td>1.330</td>
<td>1.900</td>
</tr>
<tr>
<td>Maximum DIS-Q</td>
<td>1.317</td>
<td>1.830</td>
<td>2.980</td>
</tr>
<tr>
<td>Identity confusion</td>
<td>1.07 (0.07)</td>
<td>1.34 (0.16)</td>
<td>2.01 (0.44)</td>
</tr>
<tr>
<td>Loss of control</td>
<td>1.48 (0.15)</td>
<td>1.94 (0.26)</td>
<td>2.88 (0.52)</td>
</tr>
<tr>
<td>Amnesia</td>
<td>1.14 (0.10)</td>
<td>1.38 (0.19)</td>
<td>2.02 (0.51)</td>
</tr>
<tr>
<td>Absorption</td>
<td>1.47 (0.36)</td>
<td>1.96 (0.45)</td>
<td>2.39 (0.67)</td>
</tr>
<tr>
<td># Female</td>
<td>28</td>
<td>28</td>
<td>31</td>
</tr>
<tr>
<td># Male</td>
<td>10</td>
<td>13</td>
<td>9</td>
</tr>
<tr>
<td>Span</td>
<td>4.78 (0.84)</td>
<td>4.89 (0.80)</td>
<td>5.36 (0.90)</td>
</tr>
</tbody>
</table>

Working memory span was primarily related to Identity confusion ($r = 0.20, p < 0.05$), but also showed a significant correlation with Loss of control ($r = 0.19, p < 0.05$). A marginally significant correlation with Amnesia ($r = 0.16, p = 0.09$) occurred. No apparent relationship was found with Absorption ($r = 0.05, NS$). Probably due to the homogeneity in age of the
students, no correlation was found of age with total DIS-Q score \((r = -0.064, \text{NS})\), nor with span \((r = -0.081, \text{NS})\).

### 2.5 Discussion

High dissociators showed a larger verbal working memory span than medium or low dissociators. Though the difference is small (about half a word between extreme groups), it is reliable, and, moreover, supported by results of a recent fMRI study by our group (Veltman et al., 2005). In the latter study, a sample of nonclinical participants selected on their extreme scores on the DIS-Q, performed a Sternberg task (e.g., Awh et al., 1996) and an n-back task (e.g., Jonides et al., 1997). In the first task, participants are instructed to memorize a letter string of varying length. In the second task, participants are shown a sequence of letters and for each letter have to decide whether it matches a letter preceding it \(n\) places in the series. The Sternberg task is more similar to the word span task that we employed in the present study, emphasizing the importance of maintaining information in working memory. In the n-back task, efficiency of working memory updating is more important than working memory span proper (Fletcher & Henson, 2001). For both tasks, high dissociators performed better than low dissociators in the difficult task conditions. In line with these behavioural results, high dissociative participants showed greater task load related activity in several brain regions, particularly the left middle dorsolateral prefrontal cortex. This structure has consistently been associated with higher cognitive functions like working memory (Fletcher & Henson, 2001).

Similarly, de Ruiter et al. (2003, see Chapter 4) obtained evidence for a higher capacity to both divide and pay attention in high than in low dissociators. We conclude that nonpathological dissociative tendencies correspond to both enhanced attentional and working memory abilities, which appear to have a strong genetic basis (Jang et al., 1998). Attention may not only specify the contents of working memory (e.g., Conway et al., 2001), but these (concurrently available) contents may subsequently also serve to direct attention (e.g., Downing, 2000). The two functions are so heavily intertwined that it seems impossible to argue that only one of them provides the basic process underlying dissociative tendencies.

It might seem somewhat surprising that the subscale that is most closely related to attention and therefore also working memory, i.e., the absorption scale, showed the lowest correlation with working memory span. It should be noted however, that SDs for scores on the absorption scales are higher than scores on the other scales, which may have led to the absence of a significant correlation. Furthermore, Cronbach’s alpha and test-retest
reliability coefficients have been found to be remarkably lower for absorption than for the other subscales (Vanderlinden et al., 1991). This may be due to the fact that this subscale only consists of six items. Moreover, some items that are categorized into other subscales are clearly related to absorption. For instance, one item of the subscale ‘amnesia’ reads as follows: “When I watch television, I do not notice anything that goes on around me”. Finally, it should be noted that the reported number of factors for dissociation questionnaires varies, ranging from one to seven (Kihlstrom, Glishky, & Angiulo, 1994). We therefore attach less value to the participants’ scores on the subscales than to their overall DIS-Q score.

Another point of consideration that should be mentioned is that the positive correlation between dissociation and working memory might be carried by a trait that is highly correlated with dissociation, rather than the measure itself. Two findings in the literature are particularly worth mentioning in this respect. Firstly, significant correlations between dissociation and fantasy proneness have been found (Hyman & Billings, 1998; Merckelbach, Horselenberg, & Schmidt, 2002; Merckelbach, Muris, Horselenberg, & Stougie, 2000). Although this relation has been invoked as an argument against the veracity of recovered memories in dissociative patients, it can not explain the higher working memory capacity in high dissociators. An alternative, interesting view however, is that a high working memory capacity is a prerequisite for the ability to engage in fantasizing. Another relevant trait to be considered is anxiety. It has been demonstrated that low levels of stress-induced norepinephrine release in the prefrontal cortex have beneficial effects on working memory (Arnsten, 1998). Higher levels of anxiety in the high dissociators might therefore be put forward as an alternative explanation for their increased working memory capacity. Anxiety, however, has been found to be only modestly correlated with dissociation (e.g., Jang et al, 1998; Kwapi, Wrobel, & Pope, 2002). When covarying out anxiety, sometimes the effects of dissociation disappear (Elzinga et al, 2000), but in other studies the effects of dissociation remained significant (Cloitre et al., 1996, Veltman et al, 2005). It therefore seems that anxiety may partly explain the effect of dissociation on working memory span. Future studies are clearly needed to provide more insight into this issue.

Although we do not rule out the possibility that some of our high dissociative participants were traumatized by, for instance, childhood abuse, which might have heightened their dissociation scores, we do not consider this a major concern in this study. Even if some of the high dissociative participants in our study were traumatized, it seems unlikely that their heightened working memory span is the result of adverse life events instead of their innate dissociative capacities. Even though we want to stress that the present study was aimed at studying dissociation as a healthy information processing style in nonclinical participants, an attempt can be made to explain how this capacity might be functional in patients with dissociative disorders. The ability to divide attention may be
stretched to the point that different ‘alters’ arise. If it is assumed that the disorder is caused by early traumatic experiences, the ability to inhibit distracting traumatic memories by loading working memory with different ‘alters’ is highly functional (see also DePrince & Freyd, 1999). This may also solve the paradox of intrapersonality ‘hypermnnesia’ (e.g., Elzinga et al., 2000) and interpersonality ‘amnesia’ (Eich, Macauley, Loewenstein, & Dihle, 1997) in DID patients. Due to the higher attentional focusing and the larger working memory span, memories are stored more strongly by these patients than by low-dissociative individuals. The same ability can be used to ‘compartmentalize’ the contents of working memory and to focus on a compartment that does not contain the (strongly stored) painful memories. This explanation is supported by our recent finding with twelve DID patients (Elzinga, Phaf, Ardon, & Van Dyck, 2003) of a directed forgetting effect between different personality states, but a similar absence of this effect within personality states as was obtained by Elzinga et al. (2000). In the dissociative disorder, stronger storage can, thus, be compensated by increasing the division of attention and a higher working memory load at retrieval.