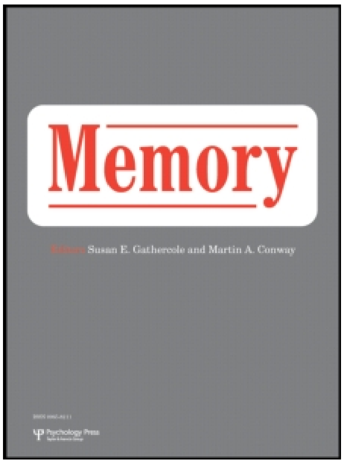
This article was downloaded by: *[Hauswald, Anne]*
On: *28 October 2008*
Access details: *Access Details: [subscription number 904797850]*
Publisher *Psychology Press*
Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Memory
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713683358

Directed forgetting of complex pictures in an item method paradigm

Anne Hauswald [a]; Johanna Kissler [a]
[a] University of Konstanz, Germany

First Published on: 27 June 2008

To cite this Article Hauswald, Anne and Kissler, Johanna(2008)'Directed forgetting of complex pictures in an item method paradigm',Memory,16:8,797 — 809

To link to this Article: DOI: 10.1080/09658210802169087

URL: http://dx.doi.org/10.1080/09658210802169087

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: http://www.informaworld.com/terms-and-conditions-of-access.pdf

This article may be used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

MEMORY, 2008, 16 (8), 797–809

Psychology Press
Taylor & Francis Group

Directed forgetting of complex pictures in an item method paradigm

Anne Hauswald and Johanna Kissler
University of Konstanz, Germany

An item-cued directed forgetting paradigm was used to investigate the ability to control episodic memory and selectively encode complex coloured pictures. A series of photographs was presented to 21 participants who were instructed to either remember or forget each picture after it was presented. Memory performance was later tested with a recognition task where all presented items had to be retrieved, regardless of the initial instructions. A directed forgetting effect—that is, better recognition of "to-be-remembered" than of "to-be-forgotten" pictures—was observed, although its size was smaller than previously reported for words or line drawings. The magnitude of the directed forgetting effect correlated negatively with participants' depression and dissociation scores. The results indicate that, at least in an item method, directed forgetting occurs for complex pictures as well as words and simple line drawings. Furthermore, people with higher levels of dissociative or depressive symptoms exhibit altered memory encoding patterns.

Keywords: Directed forgetting; Item method; Complex pictures.

Downloaded By: [Hauswald, Anne] At: 15:03 28 October 2008

Although forgetting implies a failure to recall previously available material, and as such appears detrimental, the ability to forget is important for our functioning in everyday life. We need to be able to let unnecessary information go in order to focus on currently relevant tasks. This everyday demand for forgetting gives rise to the question of the extent to which forgetting can be deliberate. Research in the area known as intentional or directed forgetting seeks answers to this question (for an overview, see Johnson, 1994; MacLeod, 1998).

Directed forgetting is studied in experiments where participants are explicitly instructed to forget some items and to remember others. Two types of paradigms are commonly used: the list method and the item method. In the item method, originally also known as the "word method" (e.g., Basden, Basden, & Gargano, 1993), items are presented separately, each followed by an instruction to either forget or remember the preceding item. In the list method the remember or forget instruction is given at the end of an entire list of items. All previously presented items of a list are to be either remembered or forgotten. In both cases directed forgetting is obtained in subsequent retrieval tests as reduced memory for to-be-forgotten items compared to to-be-remembered items. However, with the list method, directed forgetting is found only in free recall but not in recognition tests, suggesting some form of retrieval inhibition as the underlying mechanism (Basden, Basden, & Morales, 2003). With the item method, on the other hand, directed forgetting is found in both free recall and recognition. This is thought to be mainly due to selective rehearsal processes (e.g., Basden et al., 1993).

Address correspondence to: Anne Hauswald, Universität Konstanz, Fachbereich Psychologie, Fach D 25, D-78457 Konstanz, Germany. E-mail: Anne.Hauswald@uni-konstanz.de

This research was supported by the Deutsche Forschungsgemeinschaft.
We thank two anonymous reviewers for their helpful comments on an earlier version of this manuscript.

© 2008 Psychology Press, an imprint of the Taylor & Francis Group, an Informa business
http://www.psypress.com/memory DOI:10.1080/09658210802169087

Downloaded By: [Hauswald, Anne] At: 15:03 28 October 2008

Thus, the item and list methods of directed forgetting affect distinct memory processes. The list method primarily affects organisation, accessibility, and retrieval control of memories. The item method, by contrast, mainly taps into encoding processes and thus the actual memory representation itself. Participants are to hold the representation of an item on-line until the cue appears and then selectively rehearse the ''remember item'' and discard the ''forget item''. The thesis that item method directed forgetting affects the memory representation itself is supported by findings showing that the time available to build memory representations determines the strength of directed forgetting: The shorter the item–cue interval, the stronger the directed forgetting effects become, because participants are told relatively early whether to rehearse an item or not (Hourihan & Taylor, 2006; Wetzel & Hunt, 1977).

So far, most research on directed forgetting in the item method has used words (e.g., Hourihan & Taylor, 2006; Sego, Golding, & Gottlob, 2006) or other verbally processed material such as phone numbers (Gottlob, Golding, & Hauselt, 2006) or verbally presented stereotype information (Araya, Akrami, & Ekehammar, 2003). Some studies also found item method directed forgetting of line drawings depicting everyday objects, typically from the Snodgrass-Vanderwart set (Lehman, Morath, Franklin, & Elbaz, 1998), animals (Basden & Basden, 1996), or drawings of fruits, vehicles, or body parts (Lehman, McKinley-Pace, Leonard, Thompson, & Johns, 2001). However, such single-object line drawings are very easily if not automatically verbalised. Given the ease of verbalisation of such line drawings, in previous experiments the pictures may have been not only visually but also verbally encoded and then recalled or recognised by their verbal tags.

Remarkably, the only study we know of that did not use easily verbalised material did not find an effect of directed forgetting. Earles and Kersten (2002), investigating item-cued directed forgetting of self-performed compared to verbalised actions, found normal directed forgetting for the verbal encoding condition, while no intentional forgetting occurred for self-performed actions. Thus, although directed forgetting has been found for a broad range of stimuli, these materials share the crucial characteristic of being verbal or at least easily verbalised.

However, items that do not require verbal processing may not be susceptible (or may be less susceptible) to directed forgetting. Recent theories stress the role of encoding modality and perceptual systems in memory representations (Barsalou, 2008; Rubin, 2006). Rather than assuming a unitary memory store these theories—in line with neuropsychological findings from patients with ''visual memory deficit amnesia'' (Greenberg, Eacott, Brechin, & Rubin, 2005; Greenberg & Rubin, 2003; Rubin & Greenberg, 1998) and earlier theorists (Paivio, 1986; Polanyi, 1966)—assume modality-specific processing in memory. Goldstein and Chance (1974) had argued in favour of a verbal–pictorial dichotomy in recognition memory, and proposed that there may exist further subdivisions, even within the visual memory system, beyond a simple verbal–pictorial dichotomy. Therefore, it might be premature to conclude from the extant research that directed forgetting effects would generalise from verbal or easily verbalised material to memories mediated by other perceptual systems.

For example, people are much better able to recognise faces (Ellis, Shepard, & Davies, 1980; Polanyi, 1966) and unusual forms (Attneave, 1957) than they are able to name them. A large body of research further demonstrates that verbalisation may alter and impair recall of perceptually rich visual or gustatory stimuli (Melcher & Schooler, 2004; Schooler, 2002; Schooler & Engstler-Schooler, 1990; for review see Schooler, Fiore, & Brandimonte, 1997) or motor action (Zimmer et al., 2001). Indeed, for example, performance but not verbalisation of actions abolishes directed forgetting effects (Earles & Kersten, 2002). Moreover, Hourihan, Goldberg, and Taylor (2007) showed that providing the spatial location of a previously learned item as an additional cue reduced the directed forgetting effect by enhancing recognition of to-be-forgotten items. Moreover, inhibitory mechanisms in working memory seem to differ between verbal and visuo-spatial processes (Palladino, Mammarella, & Vecchi, 2003). Also the episodic memory retrieval inhibition effect of retrieval-induced forgetting does not occur for complex photographs in the same way as it does for verbal items (Hauer, Wessel, Merckelbach, Roefs, & Dalgleish, 2007).[1] Thus, from the point of view of modality-specific memory systems, it is perfectly feasible that a memory effect

[1] Retrieval-induced forgetting refers to the phenomenon that while memory is better for practised verbal stimuli, memory for related but unpractised items is inhibited compared to unrelated and unpractised items (Anderson, Bjork, & Bjork, 1994).

Downloaded By: [Hauswald, Anne] At: 15:03 28 October 2008

that appears for verbal memories may disappear for memories mediated by other perceptual systems and some such evidence already exists (Earles & Kersten, 2002).

However, even without assuming modality-specific memory systems, directed forgetting may be reduced or even abolished when complex coloured photographs rather than words and line drawings are used as stimuli. Complex pictures are represented more strongly in memory than are words. Shepard (1967) first demonstrated better recognition memory for photographs and coloured prints than for words: the ''picture superiority'' effect. The picture superiority effect arises because pictures are encoded in a more distinctive and elaborate way than words (Dewhurst & Conway, 1994; Rajaram, 1993) and they are thought to have direct access to semantic processing, without initiating phonemic and orthographic processing or lexical access (Conway & Gathercole, 1990; Nelson, Reed, & McEvoy, 1977). Complex pictures offer more perceptual cues than words, such as colour, multiple spatial configurations, and multiple objects. For example, coloured drawings enhance memory representation compared to black and white drawings (Rossion & Pourtois, 2004; Tanaka & Presnell, 1999). The more features a stimulus has, the stronger the memory representation will be. Thus, learning of pictures that offer many cues should result in comparatively strong memory representations. Such stronger memory representations may render pictures less susceptible to the effects of directed forgetting.

So far most research on directed forgetting has entailed explicit or at least potential verbal processing. The existing studies suggest that directed forgetting can be found for written/verbal or easily verbalised items, but the research on non-verbal material has been comparatively neglected. Theoretically, two lines of reasoning suggest that memory effects found with linguistic material need not generalise across other input modalities. First, if, as recently suggested, memory performance is highly dependent on the input modality (Barsalou, 2008; Rubin, 2006), this possibility is obvious. It already finds some empirical support in that directed forgetting does not occur for self-performed motor acts, whereas verbal descriptions of these same motor acts are subject to directed forgetting (Earles & Kersten, 2002).

Second, the possibility that item method directed forgetting may not generalise to complex pictures arises from the fact that pictures are represented more strongly in memory than are words. Because representational strength is a crucial factor in item method directed forgetting, the directed forgetting effect may be reduced or even eliminated for such more strongly represented material which contains a multitude of perceptual cues for recognition. Therefore, in the present study we explore to what extent directed forgetting occurs for pictorial material that is more complex, more naturalistic, and does not trigger verbal encoding easily by displaying single objects. We chose to present complex colour photographs of social scenes, work scenes, and landscapes, and tested directed forgetting in a recognition test. Although in item method directed forgetting free recall is commonly implemented and often precedes recognition testing, we decided not to use it as it would initiate verbal processes, at least at the level of retrieval, which may impair subsequent recognition performance of perceptually complex material (see Schooler, 2002; Schooler et al., 1997).

Directed forgetting is also increasingly applied to clinical populations. The item method of directed forgetting has repeatedly been used to investigate alterations in the encoding style of different anxiety disorder patients. Particularly, previous studies have investigated whether dissociative symptoms, which often occur in acute or post-traumatic stress disorder, are related to either an avoidant (Bryant & Harvey, 1997; Moulds & Bryant, in press; Terr, 1994) or an intrusive encoding style (Shobe & Kihlstrom, 1997). Recent work focused on the directed forgetting performance of student participants with high versus low scores on dissociation questionnaires (DePrince & Freyd, 2004; DePrince, Freyd, & Malle, 2007; Devilly et al., 2007). This work was motivated by the theoretical assumption that dissociation-proneness mediates some of the memory alterations observed in anxiety disorder patients (Freyd, 1994) and as such the memory abnormalities, particularly an avoidant encoding style, should be observable in the population at large when sampling from the extremes of the distribution. An interaction between attentional deployment and an avoidant encoding style as reflected by an increased directed forgetting effect for aversive words under divided attention conditions was found by DePrince and Freyd (2001, 2004), but not replicated by Devilly et al. (2007; but see DePrince et al., 2007, for a critical discussion).

While most memory abnormalities related to dissociation, anxiety and stress have been related to specific, mostly aversive, fear- and trauma-related contents, there is also the less-investigated possibility of content-independent, process-related abnormalities (McNally, 1997). Some studies have investigated cognitive concomitants of high versus low dissociation scores in non-clinical samples: For instance, de Ruiter, Phaf, Veltman, Kok, and van Dyck (2003) reported an enhanced ability to both direct and divide attention in non-clinically high dissociators. De Ruiter, Phaf, Elzinga, and van Dyck (2004) also found better rather than worse working memory in high versus low dissociators, which was confirmed by Veltman et al. (2005) using functional neuroimaging. Another recent study in dissociative disorder patients (Elzinga et al., 2007) confirms enhanced working memory performance in these patients. These combined findings led the authors to conclude that ''dissociation as a trait reflects a constitutionally determined cognitive style'', perhaps paradoxically ''associated with enhanced attentional and memory capacities'' (Elzinga et al., 2007, p. 241). Regarding item method directed forgetting with word stimuli, this group of authors reports that dissociative disorder patients seem to lack the directed forgetting effect, and subclinically high dissociative style participants show a medium, and low dissociative style participants a normal, size effect (Elzinga, de Beurs, Sergeant, van Dyck, & Phaf, 2000). This is consistent with altered, potentially even superior, memory performance in high dissociators, but inconsistent with the above hypothesis of an avoidant encoding style.

Because of the controversial findings on clinical concomitants of different degrees of directed forgetting, we chose to assess clinical variables as covariates and measure their influence on the ability to segregate and selectively rehearse memory traces as reflected in item method directed forgetting for complex pictures. Our primary focus was on the role of dissociation scores as measured by the FDS (Fragebogen zu Dissoziativen Symptomen; Spitzer, Stieglitz, & Freyberger, 1994), a German version of the DES (Bernstein & Putnam, 1986). Based on the above literature, two competing hypotheses were tested: (1) based on the avoidant encoding hypothesis, the amount of directed forgetting could be positively related to dissociation scores; (2) the amount of directed forgetting might be unrelated (Zoellner, Sacks, & Foa, 2003) or, on the basis of intrusive encoding style (Shobe & Kihlstrom, 1997), inversely related to dissociation scores (Elzinga et al., 2000). This analysis is rather exploratory in that a failure to find a correlative relationship between these measures may be due to restrained variance in a randomly sampled student population.

As people with high dissociation scores often also exhibit elevated anxiety (Elzinga et al., 2007) and depression (Maaranen et al., 2005) scores, we also measured the relationship between state and trait anxiety (STAI; Laux, Glanzmann, Schaffner, & Spielberger, 1981) as well as self-reported depression (BDI; Hautzinger, Bailer, Worall, & Keller, 1994) and item method directed forgetting. Moreover, because of the previously discussed association between attention capacities and dissociation, we also assessed speeded selective attention with the d2 letter cancellation task (d2 Aufmerksamkeitsbelastungstest; Brickenkamp, 1994).

In sum, we investigated whether and to what extent item method directed forgetting occurs for recognition of complex colour photographs. Complex coloured pictures may result in qualitatively different memory representations from verbal material, which may alter directed forgetting patterns. Moreover complex pictures offer more cues than words or simple line drawings, resulting in a stronger memory representation of those items compared to verbal material, and may consequently quantitatively reduce or eliminate the directed forgetting effect. Item method directed forgetting manipulates encoding and thus the actual stimulus representation, and allows testing for retrieval in a language-free recognition paradigm eliminating potential interference from verbal recall. Reliance on recall of perceptual stimulus features was encouraged by presenting distractor and target pictures with related con-

Downloaded By: [Hauswald, Anne] At: 15:03 28 October 2008

tents, likely resulting in the same verbal labels. Finally, we assessed whether control of memory encoding as reflected by the magnitude of item method directed forgetting is correlated with dissociative symptoms, measures of anxiety, depressive symptoms, or attention performance.

METHOD

Participants

A total of 21 students (15 female) of the University of Konstanz with a mean age of 22.9 years participated in this experiment. The participants provided informed consent and received either course credit or payment of €5. Data from one participant were excluded from the analyses because the recognition rates differed more than two standard deviations from the mean of the other participants. Thus, data from 20 participants were analysed.

Stimuli, design, and procedure

A set of 100 visually complex colour photographs was used, including 32 pictures from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2005). The pictures showed landscapes, work environments, street scenes, neutral faces, or social scenes. Two sets of pictures were established, with each picture set having an image with related content in the other set (see Figure 1 for an illustration). The to-be-remembered and to-be-forgotten items were drawn from one set, while the pictures of the other set served as distractors in the recognition task. The two picture sets did not differ with regard to valence, $F(1, 98) = .649$, $p = .422$, arousal, $F(1, 98) = .007$, $p = .934$, or jpg file-size as a measure of complexity, $F(1, 98) = .029$, $p = .865$. Moreover, the pictures were rated by 20 independent participants, who did not take part in this study, for their complexity according to the procedure introduced by Bradley, Hamby, Low, and Lang (2007). Bradley and colleagues measured the complexity of photographs in terms of subjective perception of the picture composition. Pictures were rated on a 9-point Likert scale with "figure–ground" at one end, reflecting a clear composition of one figure or object against a background, and "scene" at the other end of the scale, reflecting a complex scenic arrangement with multiple elements and no clear figure–ground composition. IAPS pictures 7009 and 2560 were given as anchoring examples for the extremes. In our study, this complexity measure did not differ for the two picture sets, $F(1, 98) = .041$, $p = .839$.

Participants completed the Beck Depression Inventory (BDI, German version; Hautzinger et al., 1994), the dissociative symptoms questionnaire FDS (Fragebogen zu dissoziativen Symptomen; Spitzer et al., 1994), and the State-Trait Anxiety Inventory (STAI, German version; Laux et al., 1981) to assess clinical variables. The BDI (Hautzinger et al., 1994) is a self-report questionnaire to index depressive symptoms. The FDS (Spitzer et al., 1994) is a self-report screening instrument used in both clinical and research environments. It assesses dissociative phenomena such as amnesia, absorption, derealisation, and conversion. The FDS is the German adaptation of the Dissociative Experience Scale (DES; Bernstein & Putnam, 1986) and includes a DES score. The STAI (Laux et al., 1981) is a clinical and

Figure 1. Illustration of the picture sets used. To view this figure in colour, please visit the online version of this issue.

Downloaded By: [Hauswald, Anne] At: 15:03 28 October 2008

Downloaded By: [Hauswald, Anne] At: 15:03 28 October 2008

scientific instrument used to assess both state and trait anxiety.[2]

The 50 pictures from the learning set were presented in a continuous sequence for 2000 ms each. Directly after each picture either a "VVV" ("*vergessen*" forget) cue indicating that the previous picture could be forgotten, or an "MMM" ("*merken*" remember) cue indicating that the previous picture was to be remembered, appeared for another 2000 ms. Then a fixation cross was shown for 1500 ms before the next picture was presented. A total of 25 pictures had a "VVV" cue and 25 an "MMM" cue. The assignment of the cues to the pictures was pseudorandom in that no more than three identical cues appeared in sequence. All participants were instructed to try to memorise the pictures with the "MMM" cue and to forget those followed by the "VVV" cue. After the learning phase the participants performed the "d2" digit cancellation test (Brickenkamp, 1994) as a measure of selective attention. The d2 test requires participants to identify target letters in arrays of target and distractor letters.

In the subsequent recognition test all 50 pictures from the learning phase and the set of 50 new pictures were presented in random order for 300 ms each. Participants had to perform an old–new decision by clicking the left or the right mouse button with the index or middle finger of the right hand. The finger assignment was balanced across participants. Participants were instructed to react as quickly and accurately as possible. After the old–new decision the next picture appeared. As there was no time limit for the responses, the reaction time data were corrected by excluding responses differing more than two standard deviations from the individual mean score from the analyses.

RESULTS

Recognition data were statistically analysed using repeated-measures ANOVAs with picture type as the within factor (F instruction, R instruction, new pictures). Post-hoc comparisons were carried out using *t*-tests. Pearson correlations were used to assess the relationship between clinical measures and the magnitude of directed forgetting (difference between the recognition rate of to-be-remembered and to-be-forgotten items). All statistical analyses of data were calculated with an alpha level of .05.

Clinical questionnaires

Questionnaire mean scores and standard errors are displayed in Table 1. The DES score is given as an index of the number of various dissociative events and the frequency of those events. The mean score here was similar to previous reports (Maaranen et al., 2005; Waller & Ross, 1997). The BDI score indexes depressive symptoms and the score here was lower than in other studies of nonclinical samples (Arnault, Sakamoto, & Moriwaki, 2006; Bostanci et al., 2005). The STAI scores give measures of state anxiety (STAI-S) and trait anxiety (STAI-T). The scores in this study were comparable to scores of American students (Iwata & Higuchi, 2000).

Recognition rate

The mean proportion of correct recognition of to-be-forgotten, to-be-remembered, and new pictures is displayed in Table 2. A one-way repeated-measures ANOVA was calculated for the factor picture type (R instruction, F instruction, new pictures) and revealed a significant main effect, $F(2, 38) = 5.42$, $MSE = .003$ $p < .01$, indicating that correct responses to old to-be-remembered (R) and to-be-forgotten (F) pictures and new pictures differed. Most correct responses were made for old R pictures, followed by new pictures, and least correct responses were made for old F pictures. The correct responses to old R and F pictures differed significantly, $t(19) = -4.05$, $p < .001$,

[2] BDI: Internal consistency ranges between .73 and .95, depending on the sample. Retest reliability ranges between .75 for 1 week and .68 for 2 weeks. Coefficients for calculation of reliability are .84 (Spearman-Brown), .84 (Guttman), and .72 (split-half). The BDI correlates (.76) with other self-report scales of depressive symptoms. The BDI discriminates clearly between depressive and healthy, between depressive and psychosomatic, and between depressive and alcohol-dependent patients. The BDI is further sensitive to symptom change (Hautzinger et al., 1994). FDS: Internal consistency (Cronbach's Alpha) is .94 and between .77 and .82 for the subtests. Retest reliability is .82 and between .58 and .83 for the subtests. Split-half reliability ranges between .83 and .90. Coefficients of convergent and discriminative validity range between .53 and .80 (Spitzer et al., 1994). STAI: Internal consistency of the two scales is .90. Retest reliability of the trait scale ranges between .77 and .90 and for the state scale between .22 and .53. The trait scale correlates (between .73 and .90) with other measures of anxiety. Convergent validity is about .80 (Laux et al., 1982).

TABLE 1
Questionnaire scores

	DES	*BDI*	*STAI-T*	*STAI-S*	*d2 GZ-F*	*d2 percentile*	*d2 omission error*	*d2 commission error*
Mean	9.20	4.00	36.30	34.20	501.00	89.36	17.11	7.41
SE	1.91	0.70	1.96	1.24	17.40	3.30	5.51	6.54

Means and standard errors (SE) for the questionnaire scores of the Dissociative Experience Scale (DES), the Beck Depression Inventory (BDI), the state and trait anxiety scores (STAI-S and STAI-T), and of the d2 attention test (d2 GZ-F = error corrected score).

reflecting a directed forgetting effect: Recognition of F pictures was significantly reduced. Correctly categorised new pictures differed neither from correctly classified F pictures, $t(19) = -1.84$, $p = .082$, nor from correctly classified R pictures, $t(19) = 1.23$, $p = .23$.

Clinical correlates

The magnitude of the directed forgetting effect was negatively correlated with the BDI score ($r = -.46$, $p < .05$) and the total DES score ($r = -.53$, $p < .05$), as well as the DES subscales amnesia ($r = -.52$, $p < .05$) and absorption ($r = -.53$, $p < .05$). There was no significant correlation with STAI anxiety measures (STAI-T: $r = -.34$, $p = .15$; STAI-S: $r = .06$, $p = .81$) or d2 attention measures [error-corrected d2 score, GZ-F (sum score – error score): $r = .12$, $p = .72$; d2 omission errors: $r = .12$, $p = .63$; d2 commission errors: $r = .08$, $p = .75$].

Reaction times

The mean reaction times for the different conditions are shown in Table 2. A two-way ANOVA with the factors response type (correct, incorrect) and picture type (F instruction, R instruction, new pictures) revealed no effects [effect of response type: $F(1, 19) = 0.011$, $p = .92$; effect of picture type: $F(2, 38) = 2.50$, $p = .10$; interaction response type × picture type: $F(2, 38) = 1.03$, $p = .37$].

DISCUSSION

We explored whether item method directed forgetting occurs for complex coloured pictures in the same way as it does for words or line drawings and if so whether its magnitude is related to clinical or attention measures. Following an item-cued encoding phase, memory for coloured photographs was tested with a recognition test. Directed forgetting has previously been shown for words (Hourihan & Taylor, 2006; Sego et al., 2006) or simple line drawings (Basden & Basden, 1996; Lehman et al., 1998), but no such effect has been found for one's own actions (Earles & Kersten, 2002). Investigations of other memory processes suggest that complex pictures are not necessarily encoded and retrieved in the same way as verbal material. For example, false memory is less likely to occur when complex pictures are used (Garry & Wade, 2005; Israel & Schacter, 1997; Schacter, Cendan, Dodson, & Clifford, 2001). Additionally, retrieval-induced forgetting of complex visual material was found to be absent in a modified retrieval-induced

TABLE 2
Recognition rate and reaction times

	Hits F	*Hits R*	*CR N*	*Miss F*	*Miss R*	*FA N*
Recognition rate						
Mean	0.84	0.90	0.87	0.16	0.10	0.13
SE	0.02	0.02	0.02	0.02	0.02	0.02
Reaction time						
Mean	812.35	790.44	859.17	879.32	747.24	844.80
SE	32.92	32.88	39.40	46.14	76.47	63.53

Means and standard errors (SE) of the recognition rate and reaction times for correctly classified items in the recognition task. F = to-be-forgotten, R = to-be-remembered, N = new, CR = correct rejection, FA = false alarm.

Downloaded By: [Hauswald, Anne] At: 15:03 28 October 2008

forgetting procedure: Retrieval practice on certain details of a complex picture from the IAPS slides enhanced recall of those details but did not impair recall of other, unpractised, details (Hauer et al., 2007). Retrieval-induced forgetting did not emerge, regardless of whether central or peripheral details were retrieval practised.

Here we found a small but consistent effect of item-based directed forgetting in the recognition data. Complex pictures that had to be remembered were recognised correctly more often than pictures followed by a forget instruction. These results contrast with reports of no directed forgetting for actions (Earles & Kersten, 2002) and qualitatively, albeit not quantitatively, correspond to previous item method research using words (e.g., MacLeod, 1999) and line drawings (e.g., Lehman et al., 2001) that also found an advantage in recognition of to-be-remembered items compared to to-be-forgotten items.

Thus, in principle, item method directed forgetting also occurs—in addition to words (e.g., Hourihan & Taylor, 2006) or easily verbalised single-object line drawings (e.g., Lehman et al., 1998)—for complex visual stimuli such as coloured scenic photographs that have stronger memory representations and cannot be reduced to a one-word verbalisation. The picture sets used were constructed in such a way that single-word labels for a target and its distractor would likely be the same, rendering the use of a verbal strategy very unlikely. The test format, a recognition test, likewise requires no verbalisation of the material, as a recall test would have. In sum, the results suggest that item method directed forgetting is not dependent on verbal encoding and extends to complex pictures, which are usually much better encoded then words.

In order to prevent participants from relying on verbal strategies at test, we created a distractor set for the recognition phase in which each old item (regardless of initial "forget" or "remember" instruction) had its own thematically similar new distractor item (see Figure 1). The old and new pictures are clearly perceptually discriminable, but the possibility that this relatedness could have affected the pattern of results merits discussion. So far, there is no research on the impact of item similarity at recognition test on directed forgetting, but data exist on the effect of item similarity at encoding on item-cued directed forgetting. Studies on the effect of item-cued directed forgetting on false memory using associatively and categorically related material showed that directed forgetting reduced both veridical and false recall, suggesting a differential spread of activation to the related associates of remember and forget words (Lee, 2008; Marche, Brainerd, Lane, & Loehr, 2005). A similar mechanism might be operational when new distractors are presented that are semantically related to the old items. A differential pre-activation of the associative networks may result in the directed forgetting effect spilling over to these new distractor items. This assumption clearly requires a further explicit test. Still, the fact that recognition of our new items was a little below the recognition of old "remember" items, although new items are often classified most accurately on recognition tests (Johansson, Mecklinger, & Treese, 2004; Kissler & Hauswald, 2008; Smith, Dolan, & Rugg, 2004), provides some support for this thesis.

On the basis of recent theories stressing separate, perceptual-system-dependent memory systems (Barsalou, 2008; Rubin, 2006), we had hypothesised that a memory effect occurring in verbal memory need not generalise to visual memories. The present pattern of results does not bear on the issue of different perceptual memory systems. However if such distinctions exist, our results show that, for visual memories, item method directed forgetting occurs, while it may not for motor memories (Earles & Kersten, 2002).

A different line of argument was based on superior encoding of pictorial over verbal information within a unitary memory store (Paivio, 1986; Paivio, Rogers, & Padric, 1968; Shepard, 1967). Previous work had demonstrated that the item method directed forgetting effect crucially depends on the delay between item presentation and encoding cue and is reduced or eliminated for long delays (Hourihan & Taylor, 2006; Wetzel & Hunt, 1977). Although we did find directed forgetting for complex pictures in our study, its magnitude was reduced compared to previous reports using similar item–cue delays (e.g., Dumont, 2000), which may well be due to superior picture encoding within a given interval. Previous studies yielded much larger effects compared to the one we found,[3] but the present reduction in

[3] The differences between the recognition proportions of to-be-remembered and to-be-forgotten items found in other studies were, for example, 0.202 (control participants in Dumont, 2000) or 0.297 (MacLeod, 1999) for word studies and 0.15 for line drawings (college students in Lehman et al., 1998) while we found a smaller, albeit statistically quite reliable, difference of 0.06.

Downloaded By: [Hauswald, Anne] At: 15:03 28 October 2008

Downloaded By: [Hauswald, Anne] At: 15:03 28 October 2008

effect size is not due to an increase in variance or due to the fact that few people carried the effect. Of our 20 participants, 15 exhibited a directed forgetting effect. Across all participants the directed forgetting effect ranged between $-.08$ and .17.

The smaller effect obtained with the complex photographical material may be due to its stronger memory representation. Generally, item representation affects item-cued directed forgetting in that strong representations lead to reduced directed forgetting, as suggested by studies that found larger effects of directed forgetting with short delay of instruction compared to long delays (Hourihan & Taylor, 2006; Lee, Lee, & Tsai, 2007; Wetzel & Hunt, 1977). As we did not use longer delays than other studies (Lehman et al., 1998, 2001; Sego et al., 2006) the item–cue delay explanation does not account for our smaller effect; rather the stimulus attributes might explain this outcome, as coloured complex pictures might lead to stronger memory representations.

For instance, colour affects object representation (Rossion & Pourtois, 2004; Tanaka & Presnell, 1999) and therefore improves object recognition (Tanaka, Weiskopf, & Williams, 2001). The more potent representation of complex pictures is also supported by reliable picture superiority effects in recognition and recall found in studies comparing verbal and pictorial memory (Paivio et al., 1968; Shepard, 1967). In spite of the various cues offered by a complex photograph and the resulting stronger object representation, in the present study directed forgetting was not eliminated but reduced in comparison with word studies using similar item–cue delays. This relative reduction appears in line with picture superiority at encoding and may be due to the fact that a picture can be better encoded than a word within the same amount of time (Dewhurst & Conway, 1994; Rajaram, 1993). Future studies may offer more formal tests of this assumption.

Our results support the view that the mechanisms involved in the item method are mostly retrieval independent, as we showed that the recognition task, which is thought to release retrieval inhibition, did not abolish the directed forgetting effect. Indeed, the effect occurred even for recognition of pictures that offer a multitude of perceptual retrieval cues. Although theoretically participants may not have forgotten the to-be-forgotten items but withheld them on purpose because they guessed what they were expected to do, previous studies found that offering a reward specifically for recalled to-be-forgotten items did not improve memory performance (MacLeod, 1999).

In line with other studies, we found clinical correlates of the directed forgetting effect (DePrince & Freyd, 2001, 2004; Elzinga et al., 2000). The higher our participants scored on the BDI and the FDS, the less pronounced was the directed forgetting effect. A reduction of the directed forgetting effect with higher dissociation levels is consistent with another study (Elzinga et al., 2000) that also found a negative relationship between directed forgetting and the level of dissociation. These results are inconsistent with the notion of an avoidant encoding style in people with higher dissociation scores (Moulds & Bryant, in press; Terr, 1994) which would have predicted the inverse relationship. If operational, an avoidant encoding style may be restricted to particular situations, e.g., divided attention tasks, and certain types of materials, potentially specifically emotionally highly arousing aversive ones. However, even for these materials, reduced rather than enhanced directed forgetting effects have been reported (e.g., McNally, Metzger, Lasko, Clancy, & Pitman, 1998).

Conversely, the present results may be in line with the notion of superior, rather than impaired, working memory function in people with high dissociation scores (de Ruiter et al., 2004; Veltman et al., 2005): Some people may need less time to build memory representations and will have already sufficiently encoded the stimulus in the item–cue interval, resulting in reduced directed forgetting as the additional time devoted to selective rehearsal after the cue is not needed for successful item recognition. Alternatively, inattention and absorption may also reduce directed forgetting levels as participants may fail to attend to the cues and fail to differentially rehearse the cue. Indeed, we observed a significant negative correlation between the absorption subscale of the DES questionnaire and the magnitude of directed forgetting. While we found no association between attention performance and magnitude of directed forgetting, there is the possibility that such a relationship may arise in different or larger samples. Curiously, we also observed a negative relationship between the DES amnesia subscale and the magnitude of item method directed forgetting. Although this finding may appear contradictory to the above suggestion of potentially superior working memory in people with higher dissociation scores, it should be noted that the DES amnesia subscale by no means measures general memory functioning, but rather the frequency with which people encounter episodes that must have occurred but of which they have no recollection. Elzinga et al.'s (2003) finding of directed forgetting between, but not within, dissociative personality states (one of which was an amnesic state for which memory was generally reduced) may serve to reconcile these observations.

Overall the present study, as well as several previous ones that addressed the relationship between dissociation and selective encoding using item method directed forgetting in patient populations, failed to produce evidence for avoidant encoding resulting in increased directed forgetting in people with high levels of dissociation (for a review see Geraerts & McNally, 2008). Instead, the reverse, i.e., reduced directed forgetting with higher dissociation scores, has been reported more often. This latter pattern may result from at least two different mechanisms: First, as detailed above, people with higher dissociation scores may have superior working memory capacity, resulting in more efficient rehearsal. Second, as also repeatedly suggested, although perhaps better tested in other experimental designs, high dissociators may suffer from reduced inhibitory functioning (see e.g., Anderson, 2005). Although in the domain of directed forgetting research inhibitory functions might be studied more adequately using the list method, contributions of inhibitory processes to item method directed forgetting have also been suggested (Paz-Caballero & Menor, 1999; Paz-Caballero, Menor, & Jimenez, 2004; Ullsperger, Mecklinger, & Muller, 2000). If so, the present results would be in line with the thesis that higher dissociation scores are associated with reduced memory inhibition.

Empirically, high scores on dissociation scales are often associated with elevated scores on depression scales in both clinical and non-clinical samples (Grabe, Rainermann, Spitzer, Gansicke, & Freyberger, 2000; Maaranen et al., 2005; Rubin & Greenberg, 1998). Therefore we assessed depressive symptoms and, extending other studies using the item method (Dumont, 2000), we also found a negative correlation between the magnitude of the directed forgetting effect and the BDI score. Previous studies of directed forgetting of verbal material in clinical depression (Power, Dalgleish, Claudio, Tata, & Kentish, 2000) reported impaired directed forgetting particularly for negative and self-referentially processed material, but the present results indicate that the relationship might be more general than previously thought. Overall, our data are suggestive of a relationship between specific clinical variables and the ability to intentionally control memory. At present, no relationship between state or trait anxiety levels or attentional capacity and item-cued directed forgetting was found.

In conclusion, the present study showed directed forgetting for complex visual material in an item-cued directed forgetting paradigm. The findings build the basis for further investigations of directed forgetting using complex pictorial and scenic material that may approximate real-life episodes more closely. Furthermore, emotional dimensions may be implemented and additional variants of intentional forgetting may be tested. Further studies should also further investigate the dynamics of directed forgetting in clinical groups that suffer from a lack of memory control.

Manuscript received 21 September 2007
Manuscript accepted 25 April 2008
First published online 27 June 2008

REFERENCES

Anderson, M. C. (2005). The role of inhibitory control in forgetting unwanted memories: A consideration of three methods. In C. M. MacLeod & B. Uttl (Eds.), *Dynamic cognitive processes*. Tokyo: Springer-Verlag.

Anderson, M. C., Bjork, R. A., & Bjork, E. L. (1994). Remembering can cause forgetting: retrieval dynamics in long-term memory. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *20*(5), 1063–1087.

Araya, T., Akrami, N., & Ekehammar, B. (2003). Forgetting congruent and incongruent stereotypical information. *Journal of Social Psychology*, *143*(4), 433–449.

Arnault, D. S., Sakamoto, S., & Moriwaki, A. (2006). Somatic and depressive symptoms in female Japanese and American students: A preliminary investigation. *Transcultural Psychiatry*, *43*(2), 275–286.

Attneave, F. (1957). Transfer of experience with a class-schema to identification-learning of patterns and shapes. *Journal of Experimental Psychology*, *54*(2), 81–88.

Barsalou, L. W. (2008). Grounded cognition. *Annual Review of Psychology*, *59*, 617–645.

Basden, B. H., & Basden, D. R. (1996). Directed forgetting: Further comparisons of the item and list methods. *Memory*, *4*(6), 633–653.

Basden, B. H., Basden, D. R., & Gargano, G. J. (1993). Directed forgetting in implicit and explicit memory tests: A comparison of methods. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *19*(3), 603–616.

Downloaded By: [Hauswald, Anne] At: 15:03 28 October 2008

Downloaded By: [Hauswald, Anne] At: 15:03 28 October 2008

Basden, B. H., Basden, D. R., & Morales, E. (2003). The role of retrieval practice in directed forgetting. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *29*(3), 389–397.

Bernstein, E. M., & Putnam, F. W. (1986). Development, reliability, and validity of a dissociation scale. *Journal of Nervous and Mental Disease*, *174*(12), 727–735.

Bostanci, M., Ozdel, O., Oguzhanoglu, N. K., Ozdel, L., Ergin, A., Ergin, N., et al. (2005). Depressive symptomatology among university students in Denizli, Turkey: Prevalence and sociodemographic correlates. *Croatian Medical Journal*, *46*(1), 96–100.

Bradley, M. M., Hamby, S., Low, A., & Lang, P. J. (2007). Brain potentials in perception: Picture complexity and emotional arousal. *Psychophysiology*, *44*(3), 364–373.

Brickenkamp, R. (1994). *d2 Aufmerksamkeits-Belastungs-Test*. Göttingen: Hogrefe.

Bryant, R. A., & Harvey, A. G. (1997). Acute stress disorder: A critical review of diagnostic issues. *Clinical Psychology Review*, *17*(7), 757–773.

Conway, M. A., & Gathercole, S. E. (1990). Writing and long-term memory: Evidence for a ''translation'' hypothesis. *The Quarterly Journal of Experimental Psychology*, *42*(3), 513–527.

de Ruiter, M. B., Phaf, R. H., Elzinga, B. M., & van Dyck, R. (2004). Dissociative style and individual differences in verbal working memory span. *Consciousness and Cognition*, *13*(4), 821–828.

de Ruiter, M. B., Phaf, R. H., Veltman, D. J., Kok, A., & van Dyck, R. (2003). Attention as a characteristic of nonclinical dissociation: An event-related potential study. *Neuroimage*, *19*(2 Pt 1), 376–390.

DePrince, A. P., & Freyd, J. J. (2001). Memory and dissociative tendencies: The role of attentional context and word meaning in a directed forgetting task. *Journal of Trauma & Dissociation*, *2*(2), 67–82.

DePrince, A. P., & Freyd, J. J. (2004). Forgetting trauma stimuli. *Psychological Science*, *15*(7), 488–492.

DePrince, A. P., Freyd, J. J., & Malle, B. F. (2007). A replication by another name: A response to Devilly et al. (2007). *Psychological Science*, *18*(3), 218–219.

Devilly, G. J., Ciorciari, J., Piesse, A., Sherwell, S., Zammit, S., Cook, F., et al. (2007). Dissociative tendencies and memory performance on directed-forgetting tasks. *Psychological Science*, *18*(3), 212–217; discussion 218–221.

Dewhurst, S. A., & Conway, M. A. (1994). Pictures, images, and recollective experience. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *20*(5), 1088–1098.

Dumont, M. (2000). Directed forgetting and memory bias for emotion-congruent information in clinical depression. *Current Psychology of Cognition*, *19*, 171–188.

Earles, J. L., & Kersten, A. W. (2002). Directed forgetting of actions by younger and older adults. *Psychonomic Bulletin and Review*, *9*(2), 383–388.

Ellis, H. D., Shepard, J. W., & Davies, G. M. (1980). The deterioration of verbal descriptions of faces over different delay intervals. *Journal of Police Science and Administration*, *8*, 101–106.

Elzinga, B. M., Ardon, A. M., Heijnis, M. K., de Ruiter, M. B., van Dyck, R., & Veltman, D. J. (2007). Neural correlates of enhanced working-memory performance in dissociative disorder: A functional MRI study. *Psychological Medicine*, *37*(2), 235–245.

Elzinga, B. M., de Beurs, E., Sergeant, J. A., van Dyck, R., & Phaf, R. H. (2000). Dissociative style and directed forgetting. *Cognitive Therapy and Research*, *24*(3), 279–295.

Elzinga, B. M., Phaf, R. H., Ardon, A. M., & van Dyck, R. (2003). Directed forgetting between, but not within, dissociative personality states. *Journal of Abnormal Psychology*, *112*(2), 237–243.

Freyd, J. J. (1994). Betrayal trauma: Traumatic amnesia as an adaptive response to childhood abuse. *Ethics & Behavior*, *4*(4), 307–329.

Garry, M., & Wade, K. A. (2005). Actually, a picture is worth less than 45 words: Narratives produce more false memories than photographs do. *Psychonomic Bulletin and Review*, *12*(2), 359–366.

Geraerts, E., & McNally, R. J. (2008). Forgetting unwanted memories: Directed forgetting and thought suppression methods. *Acta Psychologica (Amst)*, *127*(3), 614–622.

Goldstein, A. G., & Chance, J. (1974). Some factors in picture recognition memory. *Journal of General Psychology*, *90*(1st Half), 69–85.

Gottlob, L. R., Golding, J. M., & Hauselt, W. J. (2006). Directed forgetting of a single item. *Journal of General Psychology*, *133*(1), 67–80.

Grabe, H. J., Rainermann, S., Spitzer, C., Gansicke, M., & Freyberger, H. J. (2000). The relationship between dimensions of alexithymia and dissociation. *Psychotherapy and Psychosomatics*, *69*(3), 128–131.

Greenberg, D. L., Eacott, M. J., Brechin, D., & Rubin, D. C. (2005). Visual memory loss and autobiographical amnesia: A case study. *Neuropsychologia*, *43*(10), 1493–1502.

Greenberg, D. L., & Rubin, D. C. (2003). The neuropsychology of autobiographical memory. *Cortex*, *39*(4-5), 687–728.

Hauer, B. J., Wessel, I., Merckelbach, H., Roefs, A., & Dalgleish, T. (2007). Effects of repeated retrieval of central and peripheral details in complex emotional slides. *Memory*, *15*(4), 435–449.

Hautzinger, M., Bailer, M., Worall, H., & Keller, F. (1994). *Beck-Depressions-Inventar (BDI)*. Bern: Huber.

Hourihan, K. L., Goldberg, S., & Taylor, T. L. (2007). The role of spatial location in remembering and forgetting peripheral words. *Canadian Journal of Experimental Psychology*, *61*(2), 91–101.

Hourihan, K. L., & Taylor, T. L. (2006). Cease remembering: Control processes in directed forgetting. *Journal of Experimental Psychology: Human Perception and Performance*, *32*(6), 1354–1365.

Israel, L., & Schacter, D. L. (1997). Pictorial encoding reduces false recognition of semantic associates. *Psychonomic Bulletin and Review*, *4*(4), 577–581.

Iwata, N., & Higuchi, H. R. (2000). Responses of Japanese and American university students to the STAI items that assess the presence or absence of anxiety. *Journal of Personality Assessment*, *74*(1), 48–62.

Johansson, M., Mecklinger, A., & Treese, A. C. (2004). Recognition memory for emotional and neutral faces: An event-related potential study. *Journal of Cognitive Neuroscience*, *16*(10), 1840–1853.

Johnson, H. M. (1994). Processes of successful intentional forgetting. *Psychological Bulletin*, *116*(2), 274–292.

Kissler, J., & Hauswald, A. (2008). Neuromagnetic activity during recognition of emotional pictures. *Brain Topography*, *20*(4), 192–204.

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (2005). *International affective picture system (IAPS): Affective ratings of pictures and instruction manual. Technical Report A-6*. Gainesville, FL: The Center for Research in Psychophysiology, University of Florida.

Laux, L., Glanzmann, P., Schaffner, P., & Spielberger, C. D. (1981). *STAI: Das State-Trait-Angstinventar. Theoretische Grundlagen und Handanweisungen*. Weinheim: Beltz Test GmbH.

Lee, Y. S. (2008). Can intentional forgetting reduce false memory? Effects of list-level and item-level forgetting. *Acta Psychologica*, *127*(1), 146–153.

Lee, Y. S., Lee, H. M., & Tsai, S. H. (2007). Effects of post-cue interval on intentional forgetting. *British Journal of Psychology*, *98*(Pt 2), 257–272.

Lehman, E. B., McKinley-Pace, M., Leonard, A. M., Thompson, D., & Johns, K. (2001). Item-cued directed forgetting of related words and pictures in children and adults: Selective rehearsal versus cognitive inhibition. *Journal of General Psychology*, *128*(1), 81–97.

Lehman, E. B., Morath, R., Franklin, K., & Elbaz, V. (1998). Knowing what to remember and forget: A developmental study of cue memory in intentional forgetting. *Memory & Cognition*, *26*(5), 860–868.

Maaranen, P., Tanskanen, A., Honkalampi, K., Haatainen, K., Hintikka, J., & Viinamaki, H. (2005). Factors associated with pathological dissociation in the general population. *Australian and New Zealand Journal of Psychiatry*, *39*(5), 387–394.

MacLeod, C. M. (1998). Directed forgetting. In J. M. Golding & C. M. MacLeod (Eds.), *Intentional forgetting: Interdisciplinary approaches* (pp. 1–57). Mahwah, NJ: Lawrence Erlbaum Associates Inc.

MacLeod, C. M. (1999). The item and list methods of directed forgetting: Test differences and the role of demand characteristics. *Psychonomic Bulletin and Review*, *6*(1), 123–129.

Marche, T. A., Brainerd, C. J., Lane, D. G., & Loehr, J. D. (2005). Item method directed forgetting diminishes false memory. *Memory*, *13*(7), 749–758.

McNally, R. J. (1997). Implicit and explicit memory for trauma-related information in PTSD. *Annals of the New York Academy of Science*, *821*, 219–224.

McNally, R. J., Metzger, L. J., Lasko, N. B., Clancy, S. A., & Pitman, R. K. (1998). Directed forgetting of trauma cues in adult survivors of childhood sexual abuse with and without posttraumatic stress disorder. *Journal of Abnormal Psychology*, *107*(4), 596–601.

Melcher, J. M., & Schooler, J. W. (2004). Perceptual and conceptual training mediate the verbal overshadowing effect in an unfamiliar domain. *Memory & Cognition*, *32*(4), 618–631.

Moulds, M. L., & Bryant, R. A. (in press). Avoidant encoding in acute stress disorder: A prospective study. *Depression and Anxiety*.

Nelson, D. L., Reed, V. S., & McEvoy, C. L. (1977). Learning to order pictures and words: A model of sensory and semantic encoding. *Journal of Experimental Psychology: Human Learning and Memory*, *3*(5), 485–497.

Paivio, A. (1986). *Mental representations: A dual coding approach*. New York: Oxford University Press.

Paivio, A., Rogers, T. B., & Padric, C. (1968). Why are pictures easier to recall than words? *Psychonomic Science*, *11*(4), 137–138.

Palladino, P., Mammarella, N., & Vecchi, T. (2003). Modality-specific effects in inhibitory mechanisms: The interaction of peripheral and central components in working memory. *Brain and Cognition*, *53*(2), 263–267.

Paz-Caballero, M. D., & Menor, J. (1999). ERP correlates of directed forgetting effects in direct and indirect memory tests. *European Journal of Cognitive Psychology*, *11*(2), 239–260.

Paz-Caballero, M. D., Menor, J., & Jimenez, J. M. (2004). Predictive validity of event-related potentials (ERPs) in relation to the directed forgetting effects. *Clinical Neurophysiology*, *115*(2), 369–377.

Polanyi, M. (1966). *The tacit dimension*. Garden City, NY: Doubleday.

Power, M. J., Dalgleish, T., Claudio, V., Tata, P., & Kentish, J. (2000). The directed forgetting task: Application to emotionally valent material. *Journal of Affective Disorders*, *57*, 147–157.

Rajaram, S. (1993). Remembering and knowing: Two means of access to the personal past. *Memory & Cognition*, *21*(1), 89–102.

Rossion, B., & Pourtois, G. (2004). Revisiting Snodgrass and Vanderwart's object pictorial set: The role of surface detail in basic-level object recognition. *Perception*, *33*, 217–236.

Rubin, D. C. (2006). The basic-systems model of episodic memory. *Perspectives on Psychological Science*, *1*(4), 277–311.

Rubin, D. C., & Greenberg, D. L. (1998). Visual memory-deficit amnesia: A distinct amnesic presentation and etiology. *Proceedings of the National Academy of Sciences of the United States of America*, *95*(9), 5413–5416.

Schacter, D. L., Cendan, D. L., Dodson, C. S., & Clifford, E. R. (2001). Retrieval conditions and false recognition: Testing the distinctiveness heuristic. *Psychonomic Bulletin and Review*, *8*(4), 827–833.

Schooler, J. W. (2002). Verbalisation produces a transfer inappropriate processing shift. *Applied Cognitive Psychology*, *16*, 989–997.

Schooler, J. W., & Engstler-Schooler, T. Y. (1990). Verbal overshadowing of visual memories: Some things are better left unsaid. *Cognitive Psychology*, *22*(1), 36–71.

Schooler, J. W., Fiore, S. M., & Brandimonte, M. A. (1997). At a loss from words: Verbal overshadowing of perceptual memories. In D. L. Medin (Ed.), *The*

Downloaded By: [Hauswald, Anne] At: 15:03 28 October 2008

psychology of learning and motivation. San Diego, CA: Academic Press.

Sego, S. A., Golding, J. M., & Gottlob, L. R. (2006). Directed forgetting in older adults using the item and list methods. *Neuropsychology Development Cognition Section B: Aging Neuropsychology Cognition*, *13*(1), 95–114.

Shepard, R. N. (1967). Recognition memory for words, sentences, and pictures. *Journal of Verbal Learning and Verbal Behavior*, *6*, 156–163.

Shobe, K. K., & Kihlstrom, J. F. (1997). Is Traumatic Memory Special? *Current Directions in Psychological Science*, *6*(3), 70–74.

Smith, A. P., Dolan, R. J., & Rugg, M. D. (2004). Event-related potential correlates of the retrieval of emotional and nonemotional context. *Journal of Cognitive Neuroscience*, *16*(5), 760–775.

Spitzer, C., Stieglitz, R. D., & Freyberger, H. J. (1994). *FDS: Fragebogen zu Dissoziativen Symptomen*. Bern: Huber.

Tanaka, J., Weiskopf, D., & Williams, P. (2001). The role of color in high-level vision. *Trends in Cognitive Sciences*, *5*(5), 211–215.

Tanaka, J. W., & Presnell, L. M. (1999). Color diagnosticity in object recognition. *Perception & Psychophysics*, *61*(6), 1140–1153.

Terr, L. C. (1994). *Unchained memories: True stories of traumatic memories, lost and found*. New York: Basic Books.

Ullsperger, M., Mecklinger, A., & Muller, U. (2000). An electrophysiological test of directed forgetting: The role of retrieval inhibition. *Journal of Cognitive Neuroscience*, *12*(6), 924–940.

Veltman, D. J., de Ruiter, M. B., Rombouts, S. A., Lazeron, R. H., Barkhof, F., Van Dyck, R., et al. (2005). Neurophysiological correlates of increased verbal working memory in high-dissociative participants: A functional MRI study. *Psychological Medicine*, *35*(2), 175–185.

Waller, N. G., & Ross, C. A. (1997). The prevalence and biometric structure of pathological dissociation in the general population: Taxometric and behavior genetic findings. *Journal of Abnormal Psychology*, *106*(4), 499–510.

Wetzel, C. D., & Hunt, R. E. (1977). Cue delay and the role of rehearsal in directed forgetting. *Journal of Experimental Psychology: Human Learning and Memory*, *3*(2), 233–245.

Zimmer, H. D., Cohen, R. L., Guynn, M. J., Engelkamp, J., Kormi-Nouri, R., & Foley, M. A. (2001). *Memory for action: A distinct form of episodic memory?*. Oxford, UK: Oxford University Press.

Zoellner, L. A., Sacks, M. B., & Foa, E. B. (2003). Directed forgetting following mood induction in chronic posttraumatic stress disorder patients. *Journal of Abnormal Psychology*, *112*(3), 508–514.

Downloaded By: [Hauswald, Anne] At: 15:03 28 October 2008