2000

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Publication Details

Generative Mental Processes and Cognitive Resources: Integrative Research on Adaptation and Control

Capacity and Procedural Accounts of Impaired Memory in Depression

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Findings of impaired memory in states of dysphoria or depression are summarized and subsumed under different accounts of mood-related memory deficits. Theoretical accounts based on the assumption of a storage system of limited capacity are compared to accounts which emphasize the role of procedures and strategies in attending and remembering. Two reanalyses of a recent experiment in the process-dissociation paradigm are reported. They address issues of dysphoria-related differences in automatic versus controlled uses of memory in a task of word-stem completion. The two reanalyses rest on different assumptions about the relation between automatic and controlled components, but they converge in highlighting the advantages of a procedural rather than capacity-based view of memory deficits. Finally, similarities to other research domains and theoretical approaches are outlined.

U. von Hecker et al. (eds.), Generative Mental Processes and Cognitive Resources, 283–307.

The empirical link between depressed moods and impaired performance on certain memory tasks is well documented – so well, in fact, that the news has spread beyond the earshot of traditional memory researchers to such places as workshops for memory improvement in elderly populations. A story in the June, 1998, issue of the APA Monitor described one clinic workshop's "memory building exercises", likening memory to a set of muscles (Sleek, 1998, p. 32). Presumably, these muscles benefit from deliberate exercise, particularly when the older participant is depressed and the muscles become even more sluggish. To our knowledge, the muscle metaphor has not been formalized. Moreover, the fundamental assumption that nonspecific exercise helps is questionable; evidence for effective transfer of training memory across different contexts and tasks is scarce, even though those being trained often believe that the exercises work (see Bjork, 1994). Although it might be possible to build a theoretical framework that takes the muscle metaphor seriously and harnesses it for predictive purposes, we describe it merely to show that memory metaphors are commonplace. As Roediger (1980) has documented, it is difficult to talk about memory without resorting to metaphor. In this chapter, we try to underscore the metaphorical nature of the two main frameworks for understanding depression-related difficulties in remembering – the quite prevalent capacity-based account and the less popular procedural account – as we examine their scientific merit.

First, we offer a synopsis of the empirical findings, crafted without appeal to theory. Brief histories of the frameworks are offered in the second section. For the purpose of illustrating some advantages of a procedural account, the third main section reviews a recently published experiment and reports reanalyses of those results. Finally, we briefly describe relationships between procedural accounts and other frameworks.

Synopsis of Findings

The domain of investigation is memory for emotionally neutral events experienced by people whose moods are characterized by some degree of depression, dysphoria, or sadness. These negative mood states have been operationalized in three main ways. Some studies include samples of participants who have been clinically diagnosed with major depression or dysthymia (and control groups who are comparable to the depressed groups on other indices). Other studies include convenience samples of participants who have produced high scores (or low scores in the control groups) on a self-report measure like the Beck Depression Inventory (BDI; Beck, Ward,

Mendelson, Mock, & Erbaugh, 1961); these participants are properly called "dysphoric" to denote their non-diagnosed, negative affect. Still other paradigms include experimental inductions of sad (or neutral) moods in nondepressed participants. Each method has its advantages and disadvantages. For example, the advantage of causal inference potentiated by experimental inductions is accompanied by the disadvantage of demand characteristics associated with many such techniques (see Parrott & Hertel, in press). Also, regardless of potential demand, the patterns of findings sometimes differ across the methods of operationalizing mood and thereby lead us to suspect that the type of "depressed" mood matters (e.g., Hertel & Rude, 1991b). Our purpose is neither to revisit these issues nor to provide a comprehensive review of the literature on depression-related impairments. Several good reviews have been published recently, and some of our general claims rely on findings they summarize (e.g., Burt, Zembar, & Niederehe, 1995; Gotlib, Roberts, & Gilboa, 1996; Hartlage, Alloy, Vazquez, & Dykman, 1993). Instead, what follows is the shortest possible summary of the main findings. As a matter of convenience, we refer to participants in the depressed, dysphoric, or sad-mood groups as "depressed", and ask the reader to realize that not all studies included depressed samples.

Direct tests of memory are those in which participants are asked to report (recall) a past event or to recognize whether a current event had happened previously in some specific context in the past. Tests of free recall most typically reveal lower levels of performance by depressed participants, compared to their nondepressed counterparts. Published exceptions to the rule are found in situations in which the materials to be remembered were well structured, such as intact lists of categorized words (e.g., Weingartner, Cohen, Murphy, Martello, & Gerdt, 1981) or prose passages (e.g., Hasher, Rose, Zacks, Sanft, & Doren, 1985). Another class of exception includes situations in which the task during the period of initial exposure was well structured instead of being flexible (e.g., Hertel & Rude, 1991a). Evidence of impaired performance is less consistently obtained when the task is cued recall or recognition. Some regularity in the recognition literature can be observed when theoretical issues are considered, as we do below.

Indirect tests of memory are those in which participants are *not* asked to reflect about the past as they perform a task that is designed to reveal effects of prior exposure to the test events. As yet, there is no compelling evidence of deficient performance on such tests, as long as the events are emotionally neutral (cf., Hertel, 1994b).

Those are the main findings when one takes the widest and least theoretical view. The next section describes the two main metaphors that

have been used to account for – indeed, to speak about – these and similar findings.

Metaphors for Understanding Depression-Related Impairments

Capacity Metaphors

The roots of capacity accounts of many cognitive phenomena reach at least as historically deep as the prose of Freud and James, both of whom offered "room" metaphors for mental events (Roediger, 1980). Much later, with the advent of modern cognitive psychology and its flow-chart terminology, the rooms became boxes drawn to represent different types of memory (e.g., Atkinson & Shiffrin, 1968). These theorists inherited ways of talking about mind – indeed, ways of thinking about mind – from Western philosophical traditions thoroughly embued with spatial analogies. Mind, essentially unobservable, consists of events that take place in space, the space being a brain whose structures and functions were not understood sufficiently to offer less metaphorical accounts.

Working within this framework, many modern memory researchers have maintained the Jamesian distinction between the seemingly different spaces (or types) of memory: a secondary memory to refer to stored representations of past events and knowledge and a primary memory to refer to the current contents of consciousness (James, 1890). Because it is obvious that we cannot think about very many things simultaneously, primary (or working or short-term) memory has been framed as a much smaller space than secondary or long-term memory. And so researchers began to discuss the limited capacity of short-term memory, as well as the limited capacity of attention (the procedure of holding something in consciousness). The constructs of short-term and working memory in current models of memory are much refined and differentiated, compared to our simplistic description. However, it is often not the formal model but instead the loose metaphor that provides the theoretical framework for research conducted in the interstices of cognition and emotion.

The earliest major formulation of a capacity account of depression-related deficits was offered somewhat as a side bar to a more comprehensive theoretical proposal. Hasher and Zacks' (1979) important contribution was to focus on the mental procedures during initial exposure to events to be remembered later. These procedures have traditionally been called "encoding" to communicate the theoretical assumption that events are represented (encoded and stored) in the place called secondary or long-term

memory. Hasher and Zacks proposed that we understand these procedures to require more or less attention, along a continuum of controlled to automatic processing. Although the proposal regarding degree of attention does not require capacity assumptions, the prevalence of spatial metaphors in the language of memory researchers no doubt was influential. Stable individual differences can easily be conceived as variations in the capacity of working memory or in the number of resources available for attending and encoding. Individuals have more or less room in which to process information, more or fewer resources to devote to a task. In short, after Kahneman (1973), the authors made the claim that depression reduces or reallocates attentional capacity.

Hasher and Zacks (1979) wrote that the distinction between reduction and reallocation was not important in their framework, and in a later capacity framework proposed by Ellis and Ashbrook (1988) the distinction grew even fuzzier. Note the core assumption described by the authors in this excerpt: "...the effect of a disruptive mood state is to reduce the amount of capacity available for processing the criterion task" (p. 26). This account rests on the assumption that emotional states affect the availability of resources for performing the orienting task or the test, so that resource-demanding strategies which usually enhance memory performance cannot be carried out. As a consequence, memory deficits are expected to be most pronounced in tasks which require cognitive effort to a large extent. The authors also proposed mediational assumptions that seem somewhat contradictory to the notion of capacity reduction: Sad moods might increase the amount of irrelevant-task and extra-task processing, thereby reducing the amount of spare resources that can be used for the task at hand. What seems unclear is whether the authors intended this resource-allocation process to be at all flexible and therefore whether there is a testable distinction between reduction and reallocation of resources.

In their later account of cognitive characteristics of aging, Hasher and Zacks (1988) revisited the capacity issue and summarized the criticisms that had emerged during the previous decade. The criticisms focused on conceptual and methodological problems related to the lack of clarity and specificity in describing the nature of the resources that are reduced or reallocated. Claims about capacity reduction in depression, for example, are rarely accompanied by independent indications of the amount of capacity required by particular tasks and tests and, arguably, many means of doing so are flawed. Nevertheless, as Hasher and Zacks observed for the domain of aging and cognition, we believe that the capacity metaphor was useful in the first round of research on depression and cognition. We now summarize the

main interpretations offered by those who have conducted research on depression and memory with some version of the capacity metaphor in mind.

First, depression-related impairments are not observed on indirect tests of memory, because these tests require few resources. Fragment completion, for example, provides a good deal of contextual support for producing the target items (see Hasher & Zacks, 1988). Other common claims (e.g., Hartlage et al., 1993) are that direct tests require more effort or resources at the time of the test and that free recall, in which depression-related deficits are mainly observed, is still more effortful than is recognition. Further, direct tests commonly show advantages of effortful or resource-demanding strategies performed during initial exposure – strategies such as semantic elaboration that establish distinctive memory representations (e.g., Ellis, Thomas, & Rodriguez, 1984). The reduction of such advantages in depressed states has been interpreted in terms of a corresponding reduction of resources or capacity for effortful processing (Ellis & Ashbrook, 1988).

Procedural Metaphors

Every spatial metaphor needs its action components – usually called processes, operations, or procedures – to denote that something happens in the boxes or rooms. However, not every procedural metaphor requires spatial assumptions more specific than brain. In the early 1970's a few memory researchers (e.g., Craik & Lockhart, 1972; Tulving & Thomson, 1973) began to emphasize the procedures of mind over its architecture. Perhaps the most radical of these theorists, Paul Kolers believed that memory could be conceptualized in terms of recapitulated procedures (for a summary, see Kolers & Roediger, 1984). If you have seen something before, for example, you will be more likely to remember ("re-member") it if the same or similar perceptual procedures are cued. You can more easily bring a thought to mind to the extent that you have done so before in the same or a similar conceptual context. Therefore, phenomena like memory for previously perceived stimuli, transfer of cognitive skills, and dissociations of task performance are explained in terms of the overlap – or nonoverlap – of cognitive procedures, instead of terms referring to storage entities with limited capacity. Of course, encoding specificity (Tulving & Thomson, 1973) and transfer-appropriate processing (Morris, Bransford, & Franks, 1977) are quite similar but less radical frameworks that have enjoyed wider application. In the 1990's the tug between an emphasis on process and an emphasis on structure has been staged as a debate about the usefulness of metaphorical systems (episodic, semantic, declarative, procedural, to name a few), with cognitive neuroscience being brought to bear on both sides; Roediger, Buckner, and

McDermott (in press) offer an excellent summary. To systems theorists, however, procedural memory is a system for remembering how to do things (e.g., tie shoe laces) and stands separate from declarative memory, a storehouse of specific episodes and general knowledge. To procedural theorists like Kolers, in contrast, all that memory is, is a set of procedures of perception and conception, experienced during the initial processing episode and re-experienced when presented with sufficiently inviting cues. Others, notably Jacoby and Dallas (1981), Jacoby, Kelley, and Dywan (1989) and Whittlesea (1993), have argued that the fluency of the procedures when reactivated provides one basis for judging whether something has previously occurred. If a process is accomplished with ease, we surmise that it might have happened before (e.g., we might have seen or heard a word earlier), especially if a past experience is a plausible source of the current processing fluency.

From a procedural point of view, how should depression-related impairments be conceptualized? One way to answer that question is found through Hasher and Zacks' (1979) continuum of controlled to automatic processing. Without appeal to a capacity metaphor, we can understand that procedures of perception and conception require more or less attention, as a function of the degree to which they have occurred previously, or the degree to which their components have occurred previously (see Moscovitch, 1994; Roediger et al., in press). New combinations of components require attention, but frequently occurring combinations can be recapitulated automatically (Logan & Etherton, 1994). Moreover, when people perform apparently attention-demanding procedures, greater activity is observed in prefrontal regions of the cerebral cortex (e.g., Posner, 1992). We also know that depression correlates inversely with the degree of activity in those regions (see Henriques & Davidson, 1991). Without appeal to physiology, however, the first author and her colleagues (e.g., Hertel, 1994a; Hertel & Rude, 1991a) have described depression-related impairments within a framework that stresses the focus of attention instead of the capacity it might require.

First formulated as the cognitive initiative account of depression-related impairments in memory (Hertel & Hardin, 1990), the notion was that depressed people have normal cognitive abilities (sufficient capacity), but they sometimes fail to initiate beneficial strategies at encoding, retention, or retrieval. Depression-related impairments typically have been revealed when the initial episode or the test allows flexibility in the focus of attention. In the initial-exposure phase of one experiment, for example, materials were presented in an 8 s trial format; a semantic decision was either permitted at any time during the 8 s or constrained to occur at the end of the trial, when

the participant also reported the target word. The requirements in the constrained condition were intended to focus attention on the task. The flexible condition resulted in a depression-related impairment on the subsequent, unexpected test of target recall, but the focused condition did not (Hertel & Rude, 1991a). Clearly, these clinically depressed participants were capable of (had sufficient resources or capacity for) attending to the target words in ways that benefited their performance on the unexpected test, but they did not seem to do so on their own initiative. Similar results were obtained when Hertel and Hardin (1990) manipulated the focus of attention during the test phase in a recognition paradigm. And we have even observed deficits on perceptual identification – an indirect test of memory – when the initial perception of the words was not required by the orienting task (Hertel, 1994b).

One way to think about direct tests of memory, such as recall or recognition, is to consider the tests as situations in which we ask participants to focus attention on the past and we guide them more or less completely as they try to do so. A common intuition is that recognition tests provide more of such guidance – in the form of the actual item to be remembered – than do tests of free recall. Yet recognition decisions can be made by paying little if any attention to the past processing episode. They can be based largely on the fluency of perceiving or conceiving the test item, with high fluency giving rise to feelings of familiarity (Whittlesea, 1993). When recognition is accomplished in this way, we can say that the judgment about the item is based on more automatic use of memory and little conscious reflection on the prior processing episode (Jacoby, 1991). Thus, procedures that occur at the time of the test, like procedures at the time of initial exposure, can be understood as varying along a continuum of attention. This time, however, it is attention to the past (recollection) that is the issue. We would expect depression-related impairments to be located in attentional components of remembering, not in its automatic basis. The problem lies in how to separate the two bases.

In addressing the nature of procedures operating at test, Jacoby and his colleagues (Jacoby, 1991; Jacoby, Toth, & Yonelinas, 1993) argued that common testing situations are not process pure. Indirect tests of memory likely involve at least occasional retrospective glances and, as we described above, direct tests invite automatic uses of memory in addition to controlled reflection. What was needed was a method for empirically obtaining estimates of the two general classes of automatic and controlled components of memory. Jacoby's process-dissociation procedure was developed in various forms to suit different testing paradigms (e.g., recognition or

fragment completion). The method always entails two different experimental conditions – one that invites automatic and controlled components to work in concordance to produce a response and one that requires them to work in opposition to each other. Opposition is achieved when automatic components encourage a certain response but controlled components select against that response. By using these instructional conditions in a recognition paradigm, Hertel and Milan (1994) revealed that only the controlled or recollective component of recognition was disrupted in a depressed (dysphoric) sample, compared to the nondepressed controls. Feelings of familiarity (based on automatic uses of memory) were undisturbed in the depressed group, but their focus on the past (recollection) was somehow not as good as it could be.

In testing a procedural account of impairment, the overarching aim is to reveal the impairment in one condition and to gain experimental control sufficient to eliminate the impairment in another condition. In a few cases (e.g., Ellis, Ottaway, Varner, Becker, & Moore, 1997), researchers have offered a very weak manipulation of attentional focus as a test of the account and failed to find support. In the same vein, Hertel and Milan manipulated the degree of contextual reinstatement at the time of the test. Greater overlap with Phase 1 improved estimates of control, but equally so in both depressed and nondepressed groups. To explain why the depression-related impairment in control was not eliminated, the authors pointed to the flexibility of their initial-exposure task. Participants were given 6 s to make a semantic decision on each trial. If they did not attend well to the materials during this orienting task, their later success in "attending to the past" (or recollecting) would be impaired. Clearly, for this procedural account to be useful, however, future attempts to gain experimental control over attention must avoid the claim in hindsight that better control could have been achieved. But why is such strong external control of attention necessary in the first place?

Instead of describing the attentional difficulty by referring to a capacity metaphor, Hertel (1997, 1998) turned to some of the procedural assumptions implied by research on cognitive aspects of depression (e.g., Fennell & Teasdale, 1984; Ingram, 1984; Klinger, 1982). If depressed participants do not focus or sustain attention to the experimental materials on their own initiative, perhaps they have reason to focus elsewhere, and their own personal concerns are a likely source. As mentioned above, Ellis and Ashbrook (1988) had also emphasized self concerns in their resource-allocation framework, but assumed that a portion of processing capacity is allocated to those concerns. In the analysis presented below, we hope to illustrate the advantage in using procedural metaphors to understand the relationships among attention, self concerns, and memory in depression.

A Procedural Analysis of Difficulties in Remembering

When the task at hand does not require or inspire focused attention, depressed people might focus their attention elsewhere. The materials and tasks typically used in the laboratory – and probably in many routine situations outside the laboratory – are not particularly interesting. Nor are they often structured in ways that compel sustained attention, either during initial exposure or at the time of the memory test. In short, they allow depressed people to ruminate about their own concerns. A recent experiment (Hertel, 1998) was designed to address the issue of whether the opportunity to ruminate impairs controlled components of remembering in dysphoric compared to nondysphoric individuals. The experimental procedure consisted of a well-focused study phase (reading word pairs aloud at a 2-second rate), a 7-minute interval, and a word-fragment completion test. The test, described in more detail below, was designed to provide estimates of automatic and controlled components of memory, according to the process-dissociation procedure (Jacoby, 1991, 1996).

In the 7-minute interval between the study phase and the test the participants did one of three different things. In the key condition they were asked to sit quietly and do nothing. The reasoning was that 7 minutes is long enough for depressed participants to experience a substantial ruminative episode, and the prediction was that such an episode should impair their focus of attention backward during the subsequent memory test. If a depression-related deficit in controlled recollection were found in this condition, however, we could not confidently attribute it to ruminative tendencies. We could not rule out the possibility that depressed participants simply have less ability (or available capacity?) for controlled recollection. Therefore, two other conditions for passing the 7 minutes were included as possible models for what might be happening in the key, unconstrained condition. Dysphoric and nondepressed participants in the self-focused condition rated the clarity of personal phrases (e.g., *my character and who I strive to be*; see Nolen-Hoeksema & Morrow, 1993), whereas those in a neutral condition rated the clarity of neutral phrases (e.g., *the shape of the African continent*). If a more general impairment were responsible for deficient attentional control, all three conditions would be expected to show depression-related deficits. Alternatively, if rumination were responsible, it would be prevented in the neutral condition and performance should not show a depression-related impairment in controlled recollection. We now turn to a description of how estimates of controlled recollection were obtained, by following the procedures of Jacoby (1996).

Test items consisted of old and new word pairs, with letters in the second members of the pairs deleted to produce word fragments.[1] On half of the test trials (inclusion trials), the participants were instructed to use a target word (a word from the study phase) that would complete the fragment and be semantically related to the context word in front of it; if they could not think of such a word from the study phase they should complete the fragment with whatever word comes to mind that satisfies the requirements. On the other half of the test trials (exclusion trials), participants were told to think of a target word that would complete the fragment and fit the context but not to use that word and to use another word instead. On inclusion trials, controlled and automatic uses of memory are assumed to work in concordance to produce a target response. The probability of completing the fragment with a target word is assumed to be equal to the probability that the target is recollected, plus the probability that it comes to mind automatically in the absence of recollection: $p(\text{target}_{\text{inclusion}}) = c + (1 - c)\ a$, where c denotes the probability of controlled recollection and a denotes the probability of automatic retrieval. On exclusion trials, the probability of erroneously completing the fragment with a target word is: $p(\text{target}_{\text{exclusion}}) = (1 - c)\ a$. Thus, on exclusion trials participants complete the fragment with a target word only if they fail to recollect its prior occurrence in the study phase of the experiment. By using the above equations, estimates of the parameters c and a can be derived from the relative frequencies of target completions on inclusion and exclusion trials.

The analysis of estimates of controlled recollection revealed a reliable interaction between the participants' mood and the way they spent the 7-minute interval between study and test. A reliable dysphoria-related deficit was obtained in the unconstrained condition; it was mimicked in the self-focused condition, but eliminated in the neutral condition. Thus, the self-focusing task appeared to be a reasonably good model for the ways in which deficient control is experienced under unconstrained conditions. The experiment therefore provided indirect support for the hypothesis that rumination makes it difficult to focus and to sustain attention to the past. Because the neutral rating task completely removed the disadvantage of

[1] The full design used by Hertel (1998) included a factor for whether the words in each pair were semantically related to each other during the study phase; during the test the related context word was used to cue the fragment. In general, low levels of performance in terms of both automatic and controlled uses of memory were obtained when unrelated context words accompanied target words in the study phase. No reliable interactions with the interval task were found. Therefore, in the subsequent reanalyses, results from only the related trials are described.

dysphoria in controlled recollection, the impairment cannot be understood in terms of a fixed reduction of capacity or resources. Furthermore, this conclusion is not qualified by the possibility that negative moods were lessened by the potentially distracting task of rating neutral phrases. A mood inventory administered immediately after the test revealed slightly more negative moods (although not reliably so) in the neutral condition than in the other two dysphoric groups.

What was found concerning automatic memory processes? Hertel (1998) had anticipated no reliable depression-related differences in automatic uses of memory; depressed mood should exert effects similar to those of experimentally divided attention, and the latter manipulation typically affects controlled components of memory while leaving the estimates of automatic influences invariant (Jacoby et al., 1993; see also Hertel & Milan, 1994). With respect to the interval manipulation, a larger automatic component in the unconstrained condition, compared to the other two conditions, could be understood on the basis of less interference from reading other words on the computer screen during the retention interval. The fluency of processing simply might be greater without other similar perceptual events intervening between the study pairs and their fragmented counterparts. These hypotheses, however, were not examined by Hertel (1998), because the dysphoric participants' base rates differed across inclusion and exclusion trials and thereby rendered an interpretation of estimates of a impossible. In the remainder of this chapter, we offer two different routes for understanding the procedures used by dysphoric participants. The first, favored by Hertel, is a reanalysis based on generate/recognize equations; the second, favored by Meiser, is a reanalysis through the use of an extended measurement model proposed by Buchner, Erdfelder, and Vaterrodt-Plünnecke (1995). The two reanalyses rest on different assumptions concerning the relation of automatic and controlled processes. However, they converge in the general interpretation that a process-oriented view allows a more fine-grained understanding of memory deficits in depression than does a capacity view.

Reanalysis Via Generate/Recognize Equations

Perhaps one of the most important contributions emanating from the process-dissociation approach is that it has encouraged researchers (both its users and its critics) to formalize the assumptions being made about memory procedures. Jacoby's (1991, 1996) equations for obtaining estimates of the two types of components (as described above) capture the assumption that the components operate independently: The probability of their joint occurrence is equal to the product of the probabilities of their separate occurrences.

Clearly, this assumption should not characterize all situations in which memory operates, not even all situations that use some version of inclusion and exclusion instructions. For example, some versions of those instructions might encourage generate/recognize strategies for performing the tasks. In this case, possible completions are generated via the automatic use of memory for their prior occurrence in the context of the experiment. Then controlled processes act as a filter to select the appropriate response from the set of generated words in a second step. Because the controlled recollection of a completion word as a previously presented target strictly depends on the completion word's prior automatic generation, as far as generate/recognize strategies are concerned, the independence assumption is necessarily violated. Although the use of generate/recognize strategies thereby violate the typical assumptions made within the process-dissociation paradigm, nevertheless these strategies may be invoked by the use of word-stem completion tests with inclusion and exclusion instructions (see Curran & Hintzman, 1995; Russo, Cullis, & Parkin, 1998): Participants may be encouraged to generate a word to complete the fragment and to use that word on inclusion trials, but to reject it on exclusion trials if they recognize it from the study phase. Recently, Jacoby (1998) has shown that generate/recognize instructions resulted in higher base rates during inclusion trials than during exclusion trials, presumably due to false recognition of completions generated for new fragments. For this reason, when base rates differ in this way, one might suspect that generate/recognize instructions or strategies had been used and, as a consequence, that the independence assumption had been violated (Jacoby, 1998).

In the recognition experiment by Hertel and Milan (1994) base rates did not reliably differ; nor did they differ for nondysphoric participants in the fragment-completion experiment (Hertel, 1998). The dysphoric participants in that experiment, however, responded to new word pairs with target words (words that were studied by participants in other counterbalancing conditions) less often under exclusion instructions than under inclusion instructions. If dysphoric participants produced more conservative base rates in exclusion, one might assume that they used the same conservative strategy for studied items as well. For this reason, c might have been overestimated in the dysphoric groups and the deficit in c thereby underestimated. Moreover, perhaps the base-rate difference in the dysphoric group was an indication that these participants used a generate/recognize strategy during the test. Indeed, when estimates of a are computed and analyzed, the results resemble what some authors have termed a *paradoxical dissociation* in the unconstrained condition, in that the absence of dysphoria is associated with an increase in

controlled procedures but a decrease in automatic uses of memory. As Jacoby (1998) discussed, a paradoxical dissociation can result from instructions that emphasize the generation of fragment solutions, followed by a check to ensure against prior occurrence on exclusion trials (instructions to generate and then recognize). Hertel's (1998) instructions seemed to be appropriate for use of the independence assumption, as was evident in the data from the nondysphoric participants. However, the dysphoric participants might have responded to those instructions quite differently. On the possibility that generate/recognize assumptions might be the better representation of their approach to the task, estimates of those two parameters are described next.

In using a generate/recognize strategy on inclusion trials, participants would respond with the target word if it came to mind, whether or not they recognized it from the study phase. Therefore, the probability of completing the fragment with a target word on inclusion trials serves as an estimate of the generation parameter, which is akin to automatic use of memory and represents the fluency with which the target word comes to mind. There were no reliable differences in estimates of generation (inclusion proportions) across the three interval conditions for the dysphoric participants (means were .60, .52, and .65 in the unconstrained, self-focused, and neutral conditions, $F(2,33) = 2.25$).[2]

Under generate/recognize assumptions, the probability of completing fragments with targets on exclusion trials is equal to the probability that the target is generated (the automatic component) and then not recognized: $p(\text{target}_{\text{exclusion}}) = a\ (1 - r)$. Because $p(\text{target}_{\text{inclusion}})$ is an estimate of a, estimates of recognition (r) can be computed as $r = 1 - p(\text{target}_{\text{exclusion}})/p(\text{target}_{\text{inclusion}})$. The dysphoric group's mean recognition estimates were .42, .60, and .73 in the unconstrained, self-focused, and neutral conditions, respectively ($F(2,33) = 4.04$). Only the unconstrained and neutral means were reliably different according to Tukey's *post-hoc* tests (or even when all pairwise comparisons were treated as planned comparisons). Again, the conclusion is obvious regarding the lack of usefulness of capacity metaphors. If dysphoric participants had sufficient resources for the more controlled, recognition procedure in the neutral interval condition, those in the unconstrained condition must have had them as well.

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[2] The level of significance was set at .05 for all statistical tests reported in the chapter; individual p-values are not reported.

Reanalysis Via an Extended Measurement Model for Process-Dissociation Data

Next, we reconsider the finding of base-rate differences between inclusion and exclusion trials and their implications for the estimation of controlled and automatic processes within the process-dissociation paradigm. An extended measurement model recently developed by Buchner et al. (1995) allows for estimates of controlled and automatic processes that are unbiased by differential guessing. Therefore, the second reanalysis is based on the extended measurement model and provides an alternative account of the Hertel (1998) data.

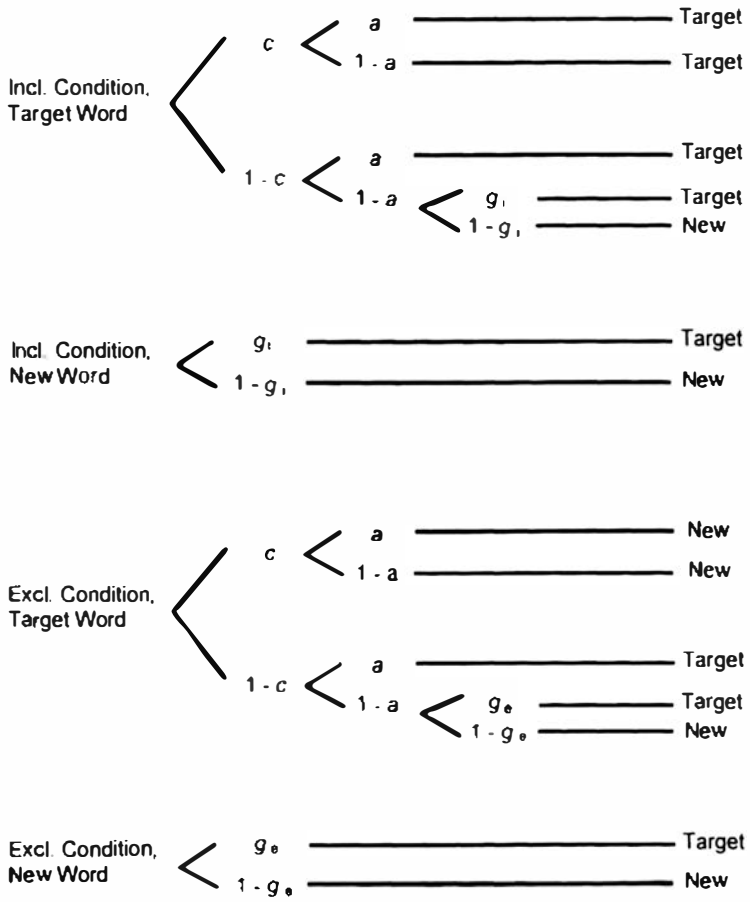

Figure 1. Processing-tree representation of the extended process-dissociation model according to Buchner, Erdfelder, and Vaterrodt-Plünnecke (1995); c: probability of controlled recollection of a word from the target phase; a: probability of automatic retrieval of a word from the target phase; g_i, g_e: base rates of target completions in the inclusion and exclusion condition, respectively.

The extended measurement model is specified as a multinomial processing-tree model (cf. Hu & Batchelder, 1994; Riefer & Batchelder, 1988). The model is displayed in Figure 1. The figure shows separate processing trees for fragments corresponding to target words presented in the study phase and for fragments corresponding to new words under inclusion and exclusion instructions, respectively, as indicated on the left-hand side. On the right-hand side, the response to a given fragment is displayed as target or new-word completion. The processing trees connecting the status of the fragment to the response categories indicate which cognitive states lead to a particular response. Thus, on inclusion trials both controlled processes (with probability c) and automatic processes (with probability a) result in target completions, whereas a new-word completion occurs only in the absence of both controlled and automatic processes. On exclusion trials controlled processes lead to new-word completions, and in the absence of controlled processes automatic uses of memory lead to target completions. Since the parameter a for automatic processes is specified to be invariant across the mental states of recollection and of non-recollection, that is across branches labelled c and 1-c, the model maintains the assumption of stochastic independence of controlled and automatic processes. As mentioned above, base-rate parameters for inclusion and exclusion trials, g_i and g_e, are considered explicitly in the extended measurement model. These parameters reflect the baseline use of target words to complete fragments that give rise to neither automatic retrieval nor conscious recollection.

For dysphoric and for nondysphoric participants, the parameters c, a, g_i, and g_e were estimated for the three interval conditions using the program MBT (Hu & Batchelder, 1996). In the analysis of data from both dysphoric and nondysphoric participants, the base-rate parameters were constrained to be equal across interval conditions but were free to differ between inclusion and exclusion trials. These specifications resulted in a testable model that showed an excellent fit to the data in terms of the likelihood-ratio statistic G^2, which is asymptotically chi-square distributed (G^2 = 1.23, 4 *df*, for dysphoric participants, and G^2 = 1.86, 4 *df*, for nondysphoric participants). The base-rate parameters of the model differed significantly between inclusion and exclusion trials for dysphoric individuals, g_i = .30 and g_e = .23 (G^2 = 6.97, 1 *df*), but not for nondysphoric individuals, g_i = .26 and g_e = .26 (G^2 = 0.15, 1 *df*). The unbiased parameter estimates for controlled and automatic processes are depicted in Figure 2.

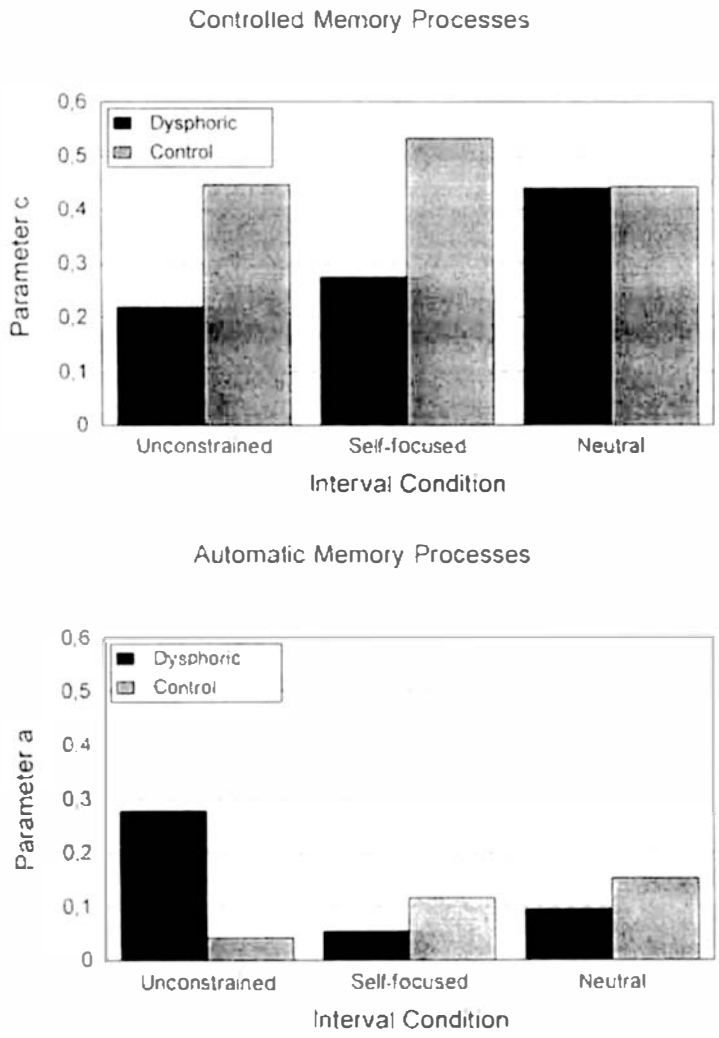

Figure 2. Estimates of controlled and automatic processes in the reanalysis of the word-fragment completion data via the extended measurement model.

The results for controlled recollection (Figure 2, upper panel) closely resembled the results from the original analysis by Hertel (1998). For the group of nondysphoric participants, controlled recollection did not vary significantly as a function of interval condition (G^2 = 3.61, 2 *df*). For dysphoric individuals, the probability of controlled recollection did not differ between the unconstrained and the self-focused condition (G^2 = 0.56, 1 *df*), but was significantly larger in the neutral condition (G^2 = 9.49, 1 *df*). Moreover, an inspection of the confidence intervals of parameter estimates

for dysphoric and nondysphoric participants revealed that controlled recollection differed between dysphoric and nondysphoric participants in the unconstrained and self-focused conditions, but not in the neutral condition.

More important for the present purposes are the results of the reanalysis concerning automatic components of memory (Figure 2, lower panel). Whereas there were no significant differences among interval conditions for nondysphoric participants (G^2 = 3.08, 2 *df*), estimates for dysphoric participants were higher in the unconstrained condition than in the self-focused and neutral conditions (G^2 = 13.51, 1 *df*), without a significant difference between the latter two (G^2 = 0.34, 1 *df*). Inspection of confidence intervals showed that automatic processes differed between dysphoric and nondysphoric participants only in the unconstrained condition.

In summary, the second reanalysis suggests that the combination of dysphoric mood and an unfilled interval between the study and the test phase was associated with a decrease in the use of controlled processes and an increase in automatic uses of memory, compared to the outcomes from nondysphoric individuals and those dysphoric individuals who rated neutral phrases during the 7-minutes interval. This pattern of results can hardly be accounted for in terms of a capacity notion of memory deficits in depression, because the deficit in control was absent in the neutral condition. Although the relatively high estimate of automatic components for dysphoric participants in the unconstrained-interval condition is a unique result and therefore must be interpreted with caution, it may be seen as a hint at an incomplete processing strategy (cf., Yonelinas & Jacoby, 1994) that makes less use of the criterial information that is required to inhibit target responses in the exclusion condition (see Gruppuso, Lindsay, & Kelley, 1997).

Discussion of the Reanalyses

The two reanalyses rest on different assumptions concerning the relation of automatic and controlled processes that guide the word-fragment completions. The first analysis drops the assumption of stochastic independence and is based on another, by no means less restrictive assumption, namely the assumption that controlled recollection processes depend on the prior automatic generation of target stimuli. The second analysis maintains the original assumption of stochastic independence, although its validity cannot be tested in the multinomial model (see Buchner et al., 1995).

The assumption of stochastic independence is crucial for parameter estimation in the process-dissociation paradigm, as already pointed out in Jacoby's (1991) initial article on this procedure. Because *stochastic*

independence – the restriction that the probability of automatic retrieval does not vary as a function of controlled recollection and vice versa – cannot be explicitly tested, the debate about the validity of the independence assumption has been widely concerned with *experimental* independence – the demonstration of an effect on one parameter of a manipulation that, at the same time, leaves the other parameter unaffected. Although correlations between automatic and controlled processes might lead to so-called paradoxical or artifactual dissociations between automatic and controlled processes as argued by Curran and Hintzman (1995), and although generate/recognize instructions can result in different base rates for the inclusion and the exclusion conditions as demonstrated by Jacoby (1998), neither dissociations nor base-rate differences force the conclusion that stochastic independence has been violated. The two reanalyses presented herein and the original analysis by Hertel (1998) represent different ways to take into account base-rate differences in estimating parameters of controlled and automatic components of memory. Despite the different assumptions, however, the substantive conclusions converged, in that all analyses rendered results that support a procedural view of mood-related memory deficits.

Conclusions and Similarities to Other Perspectives

The reanalyses we have described yielded results that support the use of procedural metaphors of memory impairments in dysphoria and depression, rather than explanations expressed in terms of fixed reductions of mental resources or capacity. The results are in line with the first author's emphasis on reduced cognitive initiative in depression (Hertel & Hardin, 1990). Although the term *initiative* was intended to refer to the *initiation* of cognitive procedures and strategies that are not compelled directly by the task, it often invites motivational interpretations (e.g., Ellis et al., 1997; Hartlage et al., 1993). Indeed, the results from Hertel (1998), regardless of the analysis performed, suggest that motivation is central to an understanding of impaired performance, but not in the way one would assume by equating initiative and motivation. Instead, the dysphoric participants might have been *quite* motivated to attend to their own personal concerns during the unconstrained interval, such that they subsequently showed poorer control of attention to the study phase as they took the memory test.

More generally, a procedural approach to the interaction of motivation and cognition in depression is compatible with findings from research in domains other than the study of memory. Examples in the field of social

cognition include Weary's research on control motivation in depression (see Weary, Marsh, Gleicher, & Edwards, 1993). Depressed individuals seem to think harder than do others when social control is at issue; they focus their attention appropriately to the source of their concerns. Notice that a capacity metaphor cannot easily incorporate these findings. Other examples include studies that have demonstrated the mediating role of motivational factors in the effect of mood on social categorization and stereotyping (e.g., Bless, Schwarz, & Wieland, 1996; Forgas & Fiedler, 1996; Lambert, Khan, Lickel, & Fricke, 1997). If mood states reduce available cognitive resources by a fixed amount, motivational factors – like the manipulations of task constraint in memory experiments – would not be able to change their effects.

Motivational issues, particularly when raised in the context of cognitive strategies, also invite the consideration of the cognitive exhaustion hypothesis (Sedek & Kofta, 1990; Sedek, Kofta, & Tyszka, 1993). The hypothesis claims that the experience of uncontrollable events produces a transitory mental state in which constructive information processing is reduced and the generation of elaborate solution strategies is diminished. In fact, the experimentally induced experience of noncontingency has been shown to reduce performance in difficult avoidance problems, to inhibit the generation of hypotheses in a discrimination task (Sedek & Kofta, 1990), and to diminish the focus on relevant information in a difficult decision task (Sedek et al., 1993). The hypothesized mental state of cognitive exhaustion is considered to be a building block of learned helplessness and might therefore also characterize depressive cognition (see von Hecker, Sedek & McIntosh, this volume). A depressed person's focus on sometimes seemingly insoluble problems might well impair self-initiated cognitive control in unconstrained situations and resemble cognitive exhaustion.

Our final parallel harkens back to our introductory comments. Perhaps it is no coincidence that workshops on depression and memory are offered to older people. As others have noted (e.g., Stuss & Benson, 1984), cognitive impairments in elderly samples resemble those experienced by younger people with frontal dysfunction, although they are usually much less severe. Noting the parallel between depression and frontal hypoactivation, still others might say that being depressed, being old, or having slight frontal impairments are indistinguishable in cognitive tasks. With further research, such correspondences might well develop and it will be tempting to continue talking about them as limitations on capacity. The capacity metaphor, after all, is very easy to picture and to understand. Yet, cognitive impairments associated with aging have been described in terms of difficulties with self-initiated procedures (Craik, 1986), controlled processes (Jacoby, Jennings, &

Hay, 1996), and inhibitory processes (Hasher & Zacks, 1988). In this chapter, we have illustrated the usefulness of procedural metaphors in accounting for experimental phenomena, but they likely have a different advantage as well: Unlike capacities, procedures can be trained. Successful training techniques with the elderly or the chronically depressed will probably not consist of generalized mnemonic exercises currently used in clinics, as if memory were a set of muscles used for multiple purposes. Instead, the route to successful training likely resides in understanding the specificity of the procedures involved.

References

Atkinson, R. C. & Shiffrin, R. M. (1968). Human memory: A proposed system and its control processes. In K. W. Spence & J. T. Spence (Eds.), *The psychology of learning and motivation* (pp. 89-195). New York: Academic Press.

Beck, A. T., Ward, C., Mendelson, M. Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry, 4*, 561-571.

Bjork, R. A. (1994). Memory and metamemory considerations in the training of human beings. In J. Metcalf & A. P. Shimamura (Eds.), *Metacognition* (pp. 185-206). Cambridge, MA: MIT Press.

Bless, H., Schwarz, N., & Wieland, R. (1996). Mood and the impact of category membership and individuating information. *European Journal of Social Psychology, 26*, 935-959.

Buchner, A., Erdfelder, E., & Vaterrodt-Plünnecke, B. (1995). Toward unbiased measurement of conscious and unconscious memory processes within the process dissociation paradigm. *Journal of Experimental Psychology: General, 124*, 137-160.

Burt, D. B., Zembar, M. J., & Niederehe, G. (1995). Depression and memory impairment: A meta-analysis of the association, its pattern, and specificity. *Psychological Bulletin, 117*, 285-305.

Craik, F. I. M. (1986). A functional account of age differences in memory. In F. Klix & H. Hagendorf (Eds.), *Human memory and cognitive capabilities, mechanisms and performances* (pp. 409-422). Amsterdam: Elsevier North-Holland.

Craik, F. I. M. & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior, 11*, 671-684.

Curran, T. & Hintzman, D. L. (1995). Violations of the independence assumption in process dissociation. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21*, 531-547.

Ellis, H. C. & Ashbrook, P. W. (1988). Resource allocation model of the effects of depressed mood states on memory. In K. Fiedler & J. Forgas (Eds.), *Affect, cognition and social behavior* (pp. 25-43). Toronto: Hogrefe.

Ellis, H. C., Ottaway, S. A., Varner, L. J., Becker, A. S., & Moore, B. A. (1997). Emotion, motivation, and text comprehension: The detection of contradictions in passages. *Journal of Experimental Psychology: General, 126,* 131-146.

Ellis, H. C., Thomas, R. L., & Rodriguez, I. A. (1984). Emotional mood states and memory: Elaborative encoding, semantic processing, and cognitive effort. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 10,* 470-482.

Fennell, M. J. V. & Teasdale, J. T. (1984). Effects of distraction on thinking and affect in depressed patients. *British Journal of Clinical Psychology, 23,* 65-66.

Forgas, J. P. & Fiedler, K. (1996). Us and them: Mood effects on intergroup discrimination. *Journal of Personality and Social Psychology, 70,* 28-40.

Gotlib, I. H., Roberts, J. E., & Gilboa, E. (1996). Cognitive interference in depression. In I. G. Sarason, G. R. Pierce, & B. R. Sarason, (Eds.), *Cognitive interference: Theories, methods, and findings* (pp. 347-377). Mahwah, NJ: Erlbaum.

Gruppuso, V., Lindsay, D. S., & Kelley, C. M. (1997). The process-dissociation procedure and similarity: Defining and esimating recollection and familiarity in recognition memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 23,* 259-278.

Hartlage, S., Alloy, L. B., Vazquez, C., & Dykman, B. (1993). Automatic and effortful processing in depression. *Psychological Bulletin, 113,* 247-278.

Hasher, L., Rose, K. C., Zacks, R. T., Sanft, H., & Doren, B. (1985). Mood, recall, and selectivity in normal college students. *Journal of Experimental Psychology: General, 114,*104-118.

Hasher, L. & Zacks, R. T. (1979). Automatic and effortful processes in memory. *Journal of Experimental Psychology: General, 108,* 356-388.

Hasher, L. & Zacks, R. T. (1988). Working memory, comprehension, and aging: A review and a new view. In G. H. Bower (Ed.), *The psychology of learning and motivation* (Vol. 22, pp. 193-225). New York: Academic Press.

Henriques, J. B. & Davidson, R. J. (1991). Left frontal hypoactivation in depression. *Journal of Abnormal Psychology, 100,* 535-545.

Hertel, P. T. (1994a). Depression and memory: Are impairments remediable through attentional control? *Current Directions in Psychological Science, 3,* 190-193.

Hertel, P. T. (1994b). Depressive deficits in word identification and recall. *Cognition and Emotion, 8,* 313-327.

Hertel, P. T. (1997). On the contribution of deficient cognitive control to memory impairments in depression. *Cognition and Emotion, 11,* 569-583.

Hertel, P. T. (1998). Relation between rumination and impaired memory in dysphoric moods. *Journal of Abnormal Psychology, 107*, 166-172.

Hertel, P. T. & Hardin, T. S. (1990). Remembering with and without awareness in a depressed mood: Evidence of deficits in initiative. *Journal of Experimental Psychology: General, 119*, 45-59.

Hertel, P. T. & Milan, S. (1994). Depressive deficits in recognition: Dissociation of recollection and familiarity. *Journal of Abnormal Psychology, 103*, 736-742.

Hertel, P. T. & Rude, S. S. (1991a). Depressive deficits in memory: Focusing attention improves subsequent recall. *Journal of Experimental Psychology: General, 120*, 301-309.

Hertel, P. T. & Rude, S. S. (1991b). Recalling in a state of natural or induced depression. *Cognitive Therapy and Research, 15*, 103-127.

Hu, X. & Batchelder, W. H. (1994). The statistical analysis of general processing tree models with the EM algorithm. *Psychometrika, 59*, 21-47.

Hu, X. & Batchelder, W. H. (1996). *MBT - Statistical inference for multinomial binary tree models* (Computer program). Irvine, CA: University of California at Irvine.

Ingram, R. E. (1984). Toward an information processing analysis of depression. *Cognitive Therapy and Research, 8*, 443-478.

Jacoby, L. L. (1991). A process dissociation framework: Separating automatic from intentional uses of memory. *Journal of Memory and Language, 30*, 513-541.

Jacoby, L. L. (1996). Dissociating automatic and consciously controlled effects of study/test compatibility. *Journal of Memory and Language, 35*, 32-52.

Jacoby, L. L. (1998). Invariance in automatic influences of memory: Toward a user's guide for the process-dissociation procedure. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 24*, 3-26.

Jacoby, L. L. & Dallas, M. (1981). On the relationship between autobiographical memory and perceptual learning. *Journal of Experimental Psychology: General, 110*, 306-340.

Jacoby, L. L., Jennings, J. M., & Hay, J. F. (1996). Dissociating automatic and consciously controlled processes: Implications for diagnosis and rehabilitation of memory deficits. In D. Herrmann, C. McEvoy, C. Hertzog, P. Hertel, & M. K. Johnson (Eds.), *Basic and applied memory research: Theory in context* (pp. 161-194). Mahwah, NJ: Erlbaum.

Jacoby, L. L., Kelley, C. M., & Dywan, J. (1989). Memory attributions. In H. L. Roediger & F. I. M. Craik (Eds.), *Varieties of memory and consciousness* (pp. 391-422). Hillsdale, NJ: Erlbaum.

Jacoby, L. L., Toth, J., & Yonelinas, A. (1993). Separating conscious and unconscious influences of memory: Measuring recollection. *Journal of Experimental Psychology: General, 122*, 139-154.

James, W. (1890). *The principles of psychology*. Vol. I. New York: Holt.

Kahneman, D. (1973). *Attention and effort.* Englewood Cliffs, NJ: Prentice Hall.

Klinger, E. (1982). On the self-management of mood, affect, and attention. In P. Karoly & F. H. Kanfer (Eds.), *Self-management and behavior change* (pp. 129-164). Elmsford, NY: Pergamon.

Kolers, P. A. & Roediger, H. L. (1984). Procedures of mind. *Journal of Verbal Learning and Verbal Behavior, 23,* 425-449.

Lambert, A. J., Khan, S. R., Lickel, B. A., & Fricke, K. (1997). Mood and the correction of positive versus negative stereotypes. *Journal of Personality and Social Psychology, 72.* 1002-1016.

Logan, G. D. & Etherton, J. L. (1994). What is learned during automatization? The role of attention in constructing an instance. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 20,* 1022-1050.

Morris, C. D., Bransford, J. P., & Franks, J. J. (1977). Levels of processing versus transfer appropriate processing. *Journal of Verbal Learning and Verbal Behavior, 16,* 519-533.

Moscovitch, M. (1994). Memory and working with memory: Evaluation of a component process model and comparisons with other models. In D. L. Schacter & E. Tulving (Eds.), *Memory systems 1994* (pp. 269-310). Cambridge, MA: MIT Press.

Nolen-Hoeksema, S. & Morrow, J. (1993). The effects of rumination and distraction on naturally occurring depressed moods. *Cognition and Emotion, 7,* 561-570.

Parrott, W. G. & Hertel, P. T. (in press). Research methods in cognition and emotion. In T. Dalgleish & M. Power (Eds.), *The handbook of cognition and emotion.* Chichester: Wiley.

Posner, M. I. (1992). Attention as a cognitive and neural system. *Current Directions in Psychological Science, 1,* 11-14.

Riefer, D. M. & Batchelder, W. H. (1988). Multinomial modeling and the measurement of cognitive processes. *Psychological Review, 95,* 318-339.

Roediger, H. L. (1980). Memory metaphors in cognitive psychology. *Memory & Cognition, 8,* 231-246.

Roediger, H. L. Buckner, R., & McDermott, K. B. (in press). Components of processing. In J. K. Foster & M. Jelicic (Eds.), *Unitary versus multiple systems accounts of memory.* Oxford University Press.

Russo, R., Cullis, A. M., & Parkin, A. J. (1998). Consequences of violating the assumption of independence in the process dissociation procedure: A word fragment completion study. *Memory & Cognition, 26.* 617-632.

Sedek, G. & Kofta, M. (1990). When cognitive exertion does yield cognitive gain: Toward an informational explanation of learned helplessness. *Journal of Personality and Social Psychology, 58,* 729-743.

Sedek, G., Kofta, M., & Tyszka, T. (1993). Effects of uncontrollability on subsequent decision making: Testing the cognitive exhaustion hypothesis. *Journal of Personality and Social Psychology, 65,* 1270-1281.

Sleek, S. (1998, June). University program helps elderly adults improve their mood and memory. *APA Monitor,* p. 32.

Stuss, D. T. & Benson, D. F. (1984). Neuropsychological studies of the frontal lobes. *Psychological Bulletin, 95,* 3-27.

Tulving, E. & Thomson, D. (1973). Encoding specificity and retrieval processes in episodic memory. *Psychological Review, 80,* 352-373.

Weary, G., Marsh, K. L., Gleicher, F., & Edwards, J. A. (1993). Depression, control motivation, and the processing of information about others. In G. Weary, F. Gleicher, & K. L. Marsh (Eds.), *Control motivation and social cognition* (pp. 255-287). New York: Springer-Verlag.

Weingartner, H., Cohen, R. M., Murphy, D. L., Martello, J., & Gerdt, C. (1981). Cognitive processes in depression. *Archives of General Psychiatry, 38,* 42-47.

Whittlesea, B. W. A. (1993). Illusions of familiarity. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 19,* 1235-1253.

Yonelinas, A. P. & Jacoby, L. L. (1994). Dissociations of processes in recognition memory: Effects of interference and response speed. *Canadian Journal of Experimental Psychology, 48,* 516-534.

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