Routledge
Taylor & Francis Group

Journal of Aggression, Maltreatment & Trauma

ISSN: 1092-6771 (Print) 1545-083X (Online) Journal homepage: http://www.tandfonline.com/loi/wamt20

Active Forgetting

Michael C. Anderson

To cite this article: Michael C. Anderson (2001) Active Forgetting, Journal of Aggression, Maltreatment & Trauma, 4:2, 185-210, DOI: 10.1300/J146v04n02_09

To link to this article: http://dx.doi.org/10.1300/J146v04n02_09

Active Forgetting: Evidence for Functional Inhibition as a Source of Memory Failure

Michael C. Anderson

SUMMARY. Forgetting is often assumed to be a passive process. A program of research in theoretical memory is reviewed that shows how many instances of ordinary forgetting arise from active inhibitory processes that serve a very important attentional function: Selective retrieval. These inhibitory processes have been shown to cause long-lasting forgetting of ''distracting'' memories that interfere during our attempts to retrieve a particular fact or event. It is argued that these inhibitory processes may form the basis of some instances of traumatic forgetting, and that they provide a mechanistic account of an important phenomenon in the study of amnesia for childhood sexual abuse: the greater incidence of forgetting for betrayal traumas than for abuse perpetrated by strangers. *[Article copies available for a fee from The Haworth Document Delivery Service: 1-800-342-9678. E-mail address: <getinfo@haworthpressinc.com> Website: <http://www.HaworthPress.com>*

KEYWORDS. Inhibitory processes, betrayal trauma, abuse, memory retrieval, selective retrieval

---

Address correspondence to: Michael C. Anderson, Department of Psychology, University of Oregon, Eugene, OR 97403-1227 (E-mail: mcanders@darkwing.uoregon.edu).

[Haworth co-indexing entry note]: ''Active Forgetting: Evidence for Functional Inhibition as a Source of Memory Failure.'' Anderson, Michael C. Co-published simultaneously in *Journal of Aggression, Maltreatment & Trauma* (The Haworth Maltreatment & Trauma Press, an imprint of The Haworth Press, Inc.) Vol. 4, No. 2 (#8), 2001, pp. 185-210; and: *Trauma and Cognitive Science: A Meeting of Minds, Science, and Human Experience,* (ed: Jennifer J. Freyd, and Anne P. DePrince) The Haworth Maltreatment & Trauma Press, an imprint of The Haworth Press, Inc., 2001, pp. 185-210. Single or multiple copies of this article are available for a fee from The Haworth Document Delivery Service [1-800-342-9678, 9:00 a.m. - 5:00 p.m. (EST). E-mail address: getinfo@haworthpressinc.com].

To most people, forgetting is a negative experience. It is to lose our cherished past, it is to suffer confusion where there was once understanding, or it is to neglect one's responsibilities to oneself or to others. It is something that one rarely does on purpose, but is rather a human frailty to be avoided or to be overcome. Yet, forgetting is often precisely what we want and need to do. Life is filled with unpleasant, even traumatic experiences that we would prefer to forget if we only could. To remember is to remake a past we would rather have not occurred and to disrupt our efforts to live peacefully in the present. More often than we realize, forgetting is the goal and remembering, the human frailty.

The need to forget is not limited to trauma. Indeed, sometimes good memory for once useful knowledge can thwart our goals. Very often, the world changes in ways that require us to adapt, to update our knowledge base. None of us enjoys accidentally walking to yesterday's parking spot three blocks away from today's, or misdialing an old telephone number after it has been changed. Furthermore, we all have occasions when it is difficult to concentrate on a train of thought, because recent events or thoughts (pleasant or unpleasant) call our attention too powerfully. In each of these cases, to not forget is to risk disruptions to the most basic of activities, disruptions that can have unfortunate consequences. To call one's current spouse by the name of a previous one is certainly to remember too well for one's own good.

If we accept that forgetting is sometimes a positive goal, we must ask how people accomplish it, when successful. Two approaches that someone might take to goal-directed forgetting will be briefly outlined, only one of which will be developed in detail. The first approach is to deliberately foster the conditions necessary for passive forgetting mechanisms to take effect. To the extent that someone has a sense of how their memory works, they might engineer their life situation to encourage the operation of these mechanisms. A simple example would be of someone who moves out of an apartment or a city to help them avoid the environmental cues that remind them of something they wish to forget. If the change in environment is substantial, people will be less likely to be spontaneously reminded of the undesired memories. Indeed, the memories may ultimately become more difficult to recall even when they are sought, as suggested by basic research on context-dependent memory (Godden & Baddeley, 1975). Such an approach, though deliberate, makes use of processes that are passive in the sense that they do not involve mechanisms that directly act on the memories themselves.

The second approach involves the more controversial notion that we can forget by suppressing information directly. In this article, a program of research on theoretical memory that suggests that people do indeed have such mechanisms, inhibitory processes that deactivate mental representations and that, as a result, make us forget will be reviewed. In the first part of the article, research on the role of inhibitory processes in episodic forgetting will be

reviewed. In particular, the empirical phenomenon of retrieval-induced forgetting, and the methodology by which it is studied in the laboratory will be described. Then the experimental findings that have led to the conclusion that retrieval-induced forgetting arises from active inhibitory processes that suppress intrusive mental representations: cross category inhibition will be described. Finally, several properties of retrieval-induced forgetting will be described that may prove important in appreciating the significance of this phenomenon in understanding traumatic amnesia.

In the second part of this article, some preliminary ideas on how these memory inhibition processes may contribute to some instances of traumatic amnesia are presented. In particular, how retrieval-induced forgetting may be applied to understanding an important phenomenon, the greater incidence of amnesia for betrayal traumas than for abuse by strangers will be described. Far from being a complete theoretical work, this portion of the paper should be regarded as a springboard for new research on how experimental studies of inhibitory processes might inform and be informed by people seeking to understand the causes of traumatic amnesia.

INHIBITORY PROCESSES AND THE FORGETTING OF EVENTS

Most of the work that I have conducted concerns how human beings retrieve particular events from their past. Our approach to studying episodic retrieval has been to ask people to recall simple events (typically words that were studied in a laboratory procedure) and to later measure any side effects that retrieval may have caused. Of particular concern have been the effects of retrieval on the later ability to recall other memories that may be related to the retrieved event. Studying the side effects of retrieval on other things in memory allows us to make inferences about the basic mechanisms underlying the retrieval process. To illustrate this approach, the theoretical perspective guiding our empirical work will first be discussed. The experimental paradigm used to explore this perspective, as well as some typical results will then be presented.

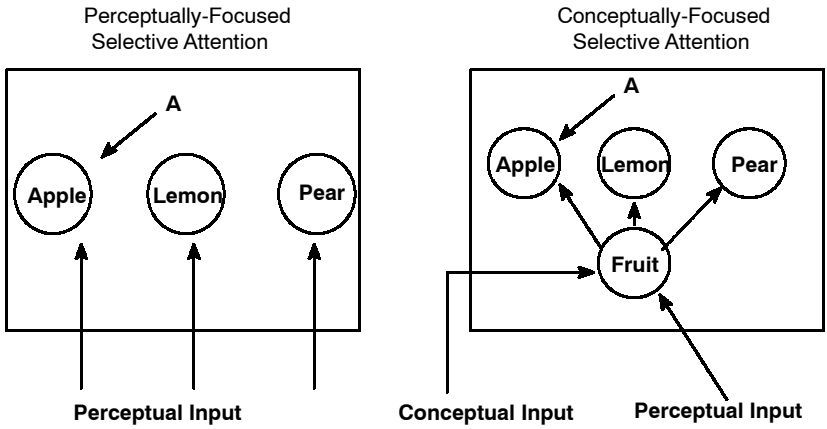
Theoretical Background

A concept that guides much of the work conducted in the author's laboratory is the idea that retrieval can be regarded as a case of conceptually focused attention. This idea is illustrated in Figure 1, taken from Anderson and Spellman (1995), which contrasts the case of perceptually-focused attention on the left side, with that of conceptually-focused selective attention, or retrieval, on the right side. When we focus attention on the perceptual world,

our aim is to focus on or isolate one representation from the many that have been activated by perceptual input. This aim is illustrated in Figure 1. Suppose we are looking at a bowl of fruit, and we wish to focus on the apple. The function of attention is one of isolating the mental representation of the apple from the mental representations of other objects that have been "activated" in parallel by external perceptual input.

A similar situation arises when we try to retrieve a particular thing from long-term memory, a specific event or concept, for instance. Suppose we wish to recall a particular type of fruit that begins with the letter A. When we search for a specific representation in this way (e.g., "Apple"), we typically confront interference, even if momentarily, from the many irrelevant representations (e.g., Orange, Banana) that may be activated by the retrieval cues (e.g., Fruit) guiding memory search. In this situation, the function of attention is to isolate the desired memory from the many distracting items activated by the cues we are using, that is, to overcome interference. The main difference between memory retrieval and the case of perceptually-focused selective attention is that in the latter, interference is initiated by sensory input, and the output of attentional mechanisms is a

FIGURE 1. Relationship Between Externally and Internally Focused Attention. The "A" Represents Attention Being Focused on a Representation. Focusing Attention Externally (Left) onto a Particular Object Requires Us to Ignore Other Objects in the Surrounding Environment (e.g., a Lemon, a Pear). Focusing Attention Internally (Right), to Recall a Particular Fruit (e.g., an Apple) Requires Us to Ignore Highly Similar Items in Memory (Lemon, Pear) That May Be Activated by the Cue "Fruit."



Source: Anderson & Spellman (1995).

consciously experienced percept; in the case of retrieval, however, interference is initiated conceptually by thinking of the retrieval cues, and the output of attentional mechanisms is a consciously experienced memory or idea.

If retrieval can be seen as a case of internally focused attention, then we need to ask the question: how does attention come to isolate the desired representation? Is attentional focus achieved by facilitating the desired memory? Or is focus achieved by inhibiting the competing representations? This critical question guides many of the experiments reviewed in this article.

Experimental Approach and Basic Findings

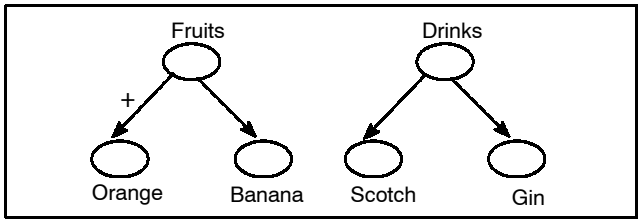
All of the experiments reviewed in this article used variations on the same basic procedure, which is referred to as the retrieval practice paradigm. The retrieval practice paradigm capitalizes on a very simple implication of the attentional focusing view described previously: If recalling something from long-term memory entails the suppression of competing representations, suppressed items should become more difficult to recall on a delayed test. The suppressed competitors should be more difficult to recall, relative to items from a baseline category that was also studied, but none of whose members were repeatedly retrieved. This logic can be illustrated with the example given in Figure 2. If repeatedly recalling the item ''Orange'' suppresses related items like ''Banana,'' then delayed recall performance on ''Banana'' should be impaired relative to the recall performance for items in an unrelated category (Drinks) that was also studied, but that was not practiced.

To test this prediction, subjects participated in the retrieval-practice procedure depicted in the bottom half of Figure 2. In this procedure, subjects studied a number of categories (Phase I), typically around eight, like ''Fruits'' and ''Drinks,'' with six members in each, and were then asked to do ''retrieval practice'' on some of the items they studied (Phase II). The aim of this retrieval practice phase was to have subjects repeatedly recall some of the items from some of the categories they studied, with the ultimate aim of examining the impact of that repeated practice on the long-term retention of related items, like ''Banana.'' To foster selective retrieval of ''Orange,'' we provided subjects with cues like ''Fruit or___,'' which directed them to recall the particular example they studied before that corresponded to those retrieval cues. Each practiced item was typically practiced three times by the person, to ensure that the retrieval-practice manipulation was fairly strong.

After a 20-minute delay, subjects' memory for all of the items was tested (Phase III). Each category name was provided in turn, and subjects were instructed to recall as many members that they remembered having studied before as they could. Figure 3 illustrates typical results obtained with the retrieval practice procedure. Each of these diagrams represents a category that subjects studied, and the numbers in the circles are the average percentage of items

FIGURE 2. The Retrieval-Practice Paradigm. The Top Panel Represents the Mental Structures Assumed to Be Formed by Subjects After Studying the Pairs "Fruit Banana, Fruit Orange, Drinks Scotch, and Drinks Gin." Category Exemplars (Circles at Bottom) Are Assumed to Be Linked to Their Category (Circle at Top) Through Associations (Lines in Diagram). The Bottom Panel Lists the Three Phases of the Retrieval-Practice Procedure–the Study Phase, During Which Subjects Study Category Exemplar Pairs; The Retrieval-Practice Phase and a Final Category-Cued Recall Phase. Retrieval Practice Is Assumed to Strengthen the Practiced Items (Orange in this Example), Which Is Depicted by a + Next to the Practiced Association.

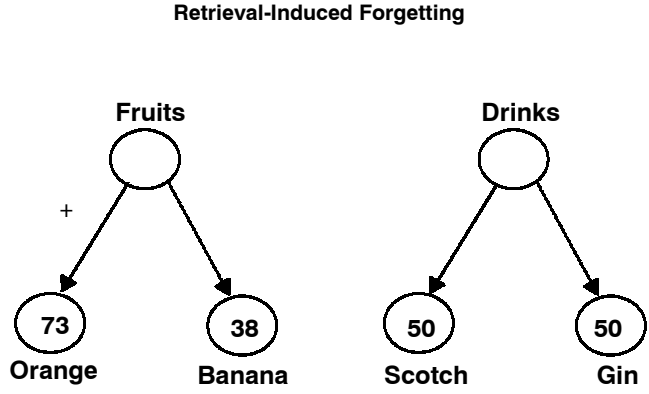
The Retrieval-Practice Paradigm



I. Study Phase
II. Retrieval Practice Phase ----e.g., Fruit or_____
- - - - - - - -
20 Minute Delay
- - - - - - - -
III. Final Category-Cued Recall Phase

correctly recalled by subjects on the final category cued recall test at the end of the experiment (Phase III). The first thing to note about these results is that practicing items like "Orange" significantly facilitated their performance on the final test, relative to performance on baseline items, a sizable effect, though not particularly surprising because practice tends to, in general, improve performance. Of greater interest is the fact that the earlier retrieval practice impaired the long-term retention of semantically related items like "Banana," which are clearly recalled more poorly than items from the baseline condition (Drinks). In other words, repeatedly remembering or recalling some items caused long-lasting forgetting of related items, a phenomenon that we have termed Retrieval-induced forgetting. This finding was first reported by Anderson, Bjork, and Bjork (1994), but has since been replicated on dozens of occasions in my own laboratory and many others across the world.

FIGURE 3. Typical Results Obtained Using the Retrieval Practice Procedure. The Numbers Next to Each Example Are the Percentages of That Type of Item That Were Correctly Recalled on the Final Category-Cued Recall Test at the End of the Experiment. Items That Were Given Retrieval Practice Are on the Far Left (Orange), and Baseline Study Items That Were Unpracticed Are on the Right (Drinks). Inhibition of Nonpracticed Items That Were Related to the Ones That Were Practiced Is Seen by Comparing Performance on Banana to the Baseline on the Right.



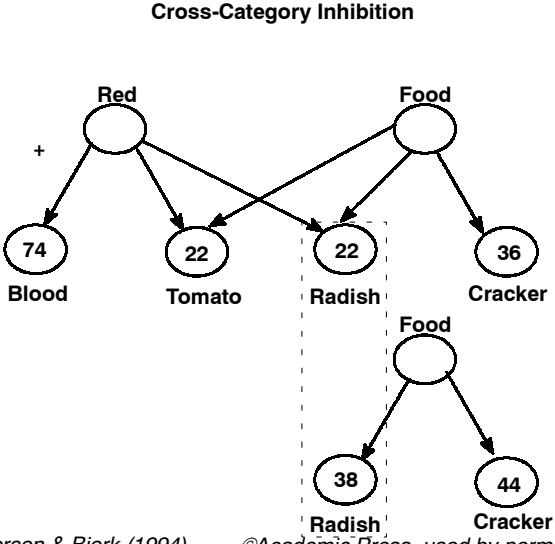
Source: Anderson, Bjork, & Bjork (1994)

Is Retrieval-Induced Forgetting Caused by Active Suppression?

Retrieval-induced forgetting would seem to provide very strong support for the idea that recalling information from long-term memory involves the suppression of competing representations. Although these findings are supportive, the conclusion that retrieval-induced forgetting is caused by inhibitory processes cannot rest on these results alone. The reason is that retrieval-induced forgetting of this sort can be produced by mechanisms that do not involve active suppression (see Anderson & Bjork, 1994; Anderson & Neely, 1996, for reviews). For instance, the impaired recall of ''Banana'' illustrated in Figure 2 might simply reflect greater interference on the final recall test from strengthened category mates like ''Orange.'' That is, perhaps while trying to recall the item ''Banana'' on the final test, subjects are only able to think of ''Orange'' because it has been made hyper-accessible by the earlier retrieval practice manipulation. ''Orange'' may ''get in the way'' or block access to ''Banana,'' even if ''Banana'' is not itself suppressed as we have assumed. Because these sorts of blocking mechanisms can explain retrieval-induced forgetting, we need a different form of evidence to provide unique support for the existence of active suppression processes.

To show that items like ''Banana'' are truly suppressed, we need a method for separating out the effects of suppression from the effects of other non-inhibitory sources of impairment, such as blocking. In collaboration with my colleague, Barbara Spellman, I devised a method for separating out these factors, called the independent probe method. The basic logic of this method is illustrated in Figure 4. The independent probe method makes use of the retrieval practice procedure outlined previously, but requires different categorical materials with special properties. In this method, subjects study new

FIGURE 4. Stimuli Used to Study Cross-Category Inhibition, and Typical Results. In this Example, Subjects Study Red Things and Foods. Although Each Item Is Only Studied Under One Category, Some Items (e.g., Tomato and Radish) from Each Studied Category Implicitly Fall Under the Other Category as Well (Depicted by Dotted Lines Crossing Between the Categories). After Studying Items Such as These, Subjects Perform Retrieval Practice on Some Exemplars (Red-Blood in this Example, as Depicted by the + Sign). Of Key Interest Is the Effect of that Practice on Subjects' Later Ability to Recall the Red Things That Were Studied Under the Unpracticed Food Category (e.g., Radish). Inhibitory Models Predict that Final Recall Performance on ''Radish'' Should Be Worse After ''Red Blood'' Has Been Practiced (Top) than for a Control Condition in which ''Food Radish'' Is Studied, but the Related Red Items Are Omitted from the Experiment (Bottom) (Compare the Two Recall Percentages Enclosed in the Dotted Box to See Cross-Category Inhibition).



Source: Anderson & Bjork (1994) *©Academic Press, used by permission.*

categories like Red things and Foods, with examples like ''Blood,'' ''Tomato,'' ''Radish'' and Crackers (see Figure 4). They then do retrieval practice on some of the examples, as in the standard retrieval practice paradigm. In the example depicted in Figure 4, subjects would practice ''Red Blood,'' which we would expect to impair the later recall of related items like ''Tomato,'' replicating the basic retrieval-induced forgetting phenomenon.

The new question in this method is whether practicing ''Red Blood'' would not only impair ''Tomato,'' but also other red items like ''Radish,'' which are both studied and tested under an independent category cue, Food. As Figure 4 illustrates, ''Radish'' is a red thing, although we do not tell subjects this. Rather, we simply assume that they know this on the basis of general knowledge, as illustrated by the dotted line in Figure 4. The crucial question is whether practicing ''Red Blood'' would impair subjects' ability to recall ''Radish'' when cued with the category Food?

There is good reason to expect that it would. Because both ''Tomato'' and ''Radish'' are members of the Red category, both of these items should become activated when subjects try to recall ''Red Blood'' during the retrieval practice phase. Activation of ''Tomato'' and ''Radish'' should interfere with recalling the practiced item. If inhibitory processes suppress interfering representations, both ''Tomato'' and ''Radish'' should be suppressed, harming the ability to recall these items later on. The suppression of ''Radish'' should be measurable on recall tests that cue subjects with the category cue Food. In other words, ''Food Radish'' should be recalled less well when ''Red Blood'' is practiced than it should be in a control condition in which Red things are not studied, and an irrelevant category (e.g., Tools) is studied and practiced instead (bottom of Figure 4).

If practicing ''Red Blood'' impairs both ''Radish'' and ''Tomato,'' we have very specific evidence that suppression contributes to retrieval-induced forgetting. Whereas it is possible that the impaired recall of ''Tomato'' could be produced by blocking from items like ''Blood'' when subjects are cued with the category ''Red'' (i.e., subjects just can't think of anything other than blood because it is so strongly practiced), it is very difficult to imagine how ''Blood'' could block subjects' recall of ''Radish'' when they are recalling members of the Food category. ''Blood'' is simply not a food, and should not be elicited by that category cue. It seems that impaired recall of ''Radish'' on the final test would have to be the result of inhibitory processes acting directly on that item. Thus, final recall performance for ''Radish'' provides a window into the operation of suppression processes, uncontaminated by non-inhibitory influences, such as blocking.

Figure 4 displays the results of the experiment in which we first used this procedure. As in previous diagrams, the numbers in the circles reflect the percentage of items that subjects recalled on the final category cued recall test

at the end of the experiment. The first thing that stands out in these data is that the practiced items (e.g., ''Blood'' in this example) are recalled extremely well on the final test, about a 30% facilitation effect, relative to performance on baseline items (Baseline is 44%, see Crackers, bottom right of Figure 4), which is substantial, but not surprising, given that practice improves performance.

More important, however, is the finding that retrieval practice on ''Red Blood'' impaired subjects' later recall of both ''Tomato'' and ''Radish,'' and to a substantial degree, which you can see by comparing performance on those items to the baseline recall for ''Tomato'' when Red things were not studied or practiced (Tomato in bottom half of Figure 4), an effect of around 16%. Retrieval-induced impairment did not vary in size, whether recall was tested for ''Tomato,'' given the cue ''Red,'' or for ''Radish'' given the cue ''Food.'' These findings strongly suggest the operation of an inhibitory process that suppresses ''Tomato'' and ''Radish'' during the retrieval practice process. For a blocking process to explain the impaired recall of ''Radish,'' we would have to believe that when subjects are given the cue Food, they accidentally recall the item ''Blood'' and can't get it off their minds in order to recall ''Tomato.'' It is very difficult to see how such blocking could occur, given that ''Blood'' is not a food and is unlikely to ever be elicited by that cue. Thus, the impaired recall of ''Radish'' is likely to reflect the direct suppression of that item. It is important to note, for present purposes, that the impaired recall of these items was induced by a retrieval practice phase that occurred twenty minutes prior to the final retention test, so the effects of these inhibitory processes are not only substantial, but enduring.

What Function Does Inhibition Serve?

I have argued that competing items are suppressed because they interfere with the recall of to-be-practiced items during the retrieval practice phase of our procedure. However, although the preceding experiment supports the existence of inhibition, it does not provide specific evidence for a functional role of inhibition in overcoming interference. It is possible, for instance, that doing any kind of additional processing on the practiced items (e.g., Red Blood) would cause inhibition of related examples. It may not matter whether additional processing involved retrieval practice or simply involved studying the to-be-practiced items again, and it might not matter whether subjects had to overcome interference from related items (e.g., Tomato, Radish). If the amount of inhibition did not vary with the need to overcome interference during retrieval, it would suggest that suppression is not functioning to overcome distraction (interference), as we have argued. This would yield a very different conception of this phenomenon than would be suggested by the attentional perspective discussed thus far.

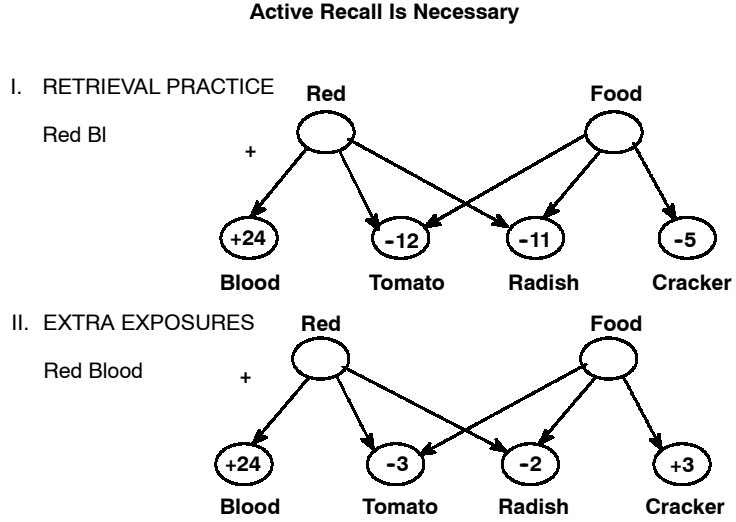
Recently, this issue has been examined (Anderson & Shivde, 1998, 1999). Anderson and Spellman's (1995) procedure was replicated exactly, except for one crucial variation. One group of subjects performed retrieval practice on the to-be-practiced items (e.g., Red Blood), just as in the Anderson and Spellman experiment. The new aspect of this study came with the addition of a second condition, which we call the Extra Presentations group. Instead of retrieval-practice, subjects in this new condition were given additional exposures to the to-be-practiced pairs (e.g., they would see Red Blood instead of Red Bl___) for exactly the same number of repetitions. We reasoned that if inhibition depended on the need to overcome interference during the recall process, retrieval-practice subjects should be impaired, but extra presentations subjects should not, because in the latter group there is no need to overcome interference during the extra exposures.

The results of this study are displayed in Figure 5. Unlike in previous figures, each number displayed in a circle reflects the difference in recall performance between that condition and its baseline, with positive and negative scores indicating facilitation above and impairment below baseline, respectively. As can be seen in the upper portion of this figure, subjects in the retrieval practice condition showed the pattern observed by Anderson and Spellman (1995): practiced items (Red Blood) were significantly facilitated, and both the within-category (Red Tomato) and cross-category items (Food Radish) were significantly impaired. However, in the extra exposures condition (the lower portion of this figure), practiced items were also facilitated, but neither the within-category nor the cross-category items showed impairment. These findings thus show that extra processing on ''Red Blood'' by itself does not cause inhibition; rather, inhibition arises specifically from the need to suppress interference caused by competing items during the retrieval practice process, exactly as would be predicted by the attentional suppression perspective.

Does Remembering Always Cause Forgetting?

What the findings of Anderson and Shivde (1998) show is that active recall of the to-be-practiced items during the practice phase is necessary for related items to be suppressed. What is less clear, however, is whether active recall is sufficient to induce inhibition. Might it be possible to do retrieval practice without suppressing related items? According to the attentional suppression approach, it should be possible to perform retrieval practice on a set of target items without impairing related memories, to the extent that related items do not interfere with retrieval-practice. If related items don't interfere, there should be no need for suppression, and so retrieval practice should cause no impairment.

FIGURE 5. A Study by Anderson and Shivde (Under Review) Showing the Active Recall (from Incomplete Cues–e.g., Red Bl___) During the Retrieval Practice Phase Is Necessary to Cause Cross-Category Inhibition. This Figure Simplifies the Presentation of Results by Presenting Difference Scores for Each Item, Relative to its Baseline. A Positive Score Means That an Item Was Facilitated Above Its Baseline; a Negative Score Means an Item Was Inhibited Below Its Baseline. Note: That Retrieval Practice of "Red Blood" (Top Half of Figure) Caused 11% Cross Category Inhibition of "Radish." However, Another Group of Subjects Who Simply Got Extra Exposures of the Same Items Suffered Virtually No Inhibition (2%).



Source: Anderson & Shivde (under review)

One way to make related items non-interfering is to have subjects integrate them with the to-be-practiced target items. Classical research indicates that when items are linked with one another, the competition that one ordinarily sees during retrieval can be eliminated (Horton & Kjeldergaard, 1961; Jenkins, 1963; Kjeldergaard, 1968; see also Radvansky & Zacks, 1991; Smith, Adams, & Schoor, 1978). For instance, although the examples Orange and Banana might normally interfere with each other when the retrieval cue Fruit is presented, this competition will be greatly reduced or eliminated if subjects form direct connections between Orange and Banana (e.g., "they are both fruits that you peel") while studying them. If integrating competing memories reduces competition, it should then be possible to do retrieval practice on these items (e.g., Fruit Orange) without suppressing competitors (e.g., Fruit Banana).

This implication was recently explored using the materials of Anderson, Bjork, and Bjork (1994), in which subjects studied simple categories like fruits and drinks (with no cross-categorizable items) (Anderson & McCulloch, 1999). In this experiment, two groups of subjects were treated identically except for one crucial variation during the initial study phase of the experiment. In the no-integration condition, subjects were given the standard study-phase instructions to study each category exemplar pair for a later test. In the integration condition, however, subjects were given those same instructions, but were also told to form inter-relationships (integrate) between the exemplar themselves. No specific instructions about how to integrate items were given. Following this, subjects did retrieval practice, and ultimately were tested on their memory for all items.

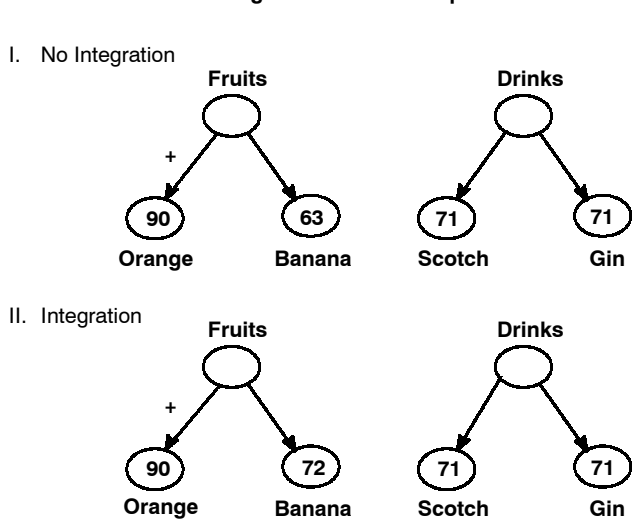
The results of our study are depicted in Figure 6. As can be seen, retrieval practice facilitated performance on practiced items (e.g., Fruit Orange) to exactly the same degree across the no-integration and integration conditions (compare performance on Orange to baseline on right side of figure). Retrieval-induced forgetting was only observed, however, in the no-integration condition. Thus, when subjects integrated the category exemplars with each other, it eliminated inhibition altogether. This result shows that there are clear limits on when suppression will impair related memories and when it will not. This finding regarding integration may prove especially important in understanding the implications of these findings for traumatic amnesia.

Properties of Retrieval-Induced Forgetting: A Summary

Figure 7 summarizes the properties of retrieval-induced forgetting. The first property (point I) is simply the observation that the act of remembering can itself impair later recall of related memories through inhibition. Second, the inhibition caused by retrieval generalizes to a variety of cues with which one might test that inhibited item (point II), as suggested by cross-category inhibition (Anderson & Spellman, 1995). This result strongly favors an inhibitory interpretation of retrieval-induced forgetting over other plausible non-inhibitory ones, such as blocking. Third, whether related items are inhibited depends on whether they interfere during the retrieval-practice of to-be-practiced items (Anderson, Bjork, & Bjork, 1999; Anderson & Shivde, 1998, 1999) suggesting that related items get inhibited for a good functional reason (point III). Finally, inhibition appears to be restricted to those items that are not well integrated with the retrieval target, and that impede selective retrieval of that item (Anderson & McCulloch, 1999) (point IV).

In the context of this summary, two additional properties of retrieval-induced forgetting bear mentioning without going into a lot of detail on the studies that support them, because these properties are also quite important. First, to our great surprise, the inhibitory processes at work in this phenomenon

FIGURE 6. Results of a Study by Anderson and McCulloch Studying the Effects of Integration on Retrieval-Induced Forgetting. The Upper Portion of the Figure Is the Data from a Group of Subjects Who Participated in the Standard Retrieval Practice Procedure. Numbers in the Circles Are the Percentages of Items Recalled on the Final Recall Test. Note that the Earlier Retrieval Practice of Fruit-Orange Facilitated Final Recall of Orange on the Final Test, Relative to the Baseline (Drinks), and Impaired Recall of Banana. Subjects in the Bottom Portion of the Figure Were Instructed to Link the Category Exemplars to Each Other (Represented by the Lines Linking the Examples) During the Study Phase. As Can Be Seen, Integration in the Study Phase Insulated Subjects from Later Retrieval-Induced Forgetting on Banana.



Source: Anderson & McCulloch (1999)

impair the ability to recognize study items as well as the ability to recall them. That is, if subjects are shown studied items on the final test, and are simply asked to decide if they have seen the items before, they will be less likely to recognize the items than if they hadn't been inhibited. Even when they do recognize the study items, they are less confident that they do (Anderson, De Kok, & Child, 1997).

Second, retrieval-induced forgetting has been generalized to non-verbal stimuli. For example, it has been found with arbitrary multidimensional geometric stimuli. People have been induced to forget the location, shape, and color of an object by retrieving information about similar objects (Ciranni & Shimamura, 1999). This work has also shown that impairment is specifically caused by retrieval-practice and not mere presentation of similar objects.

FIGURE 7. A Summary of the Important Properties of Retrieval-Induced Forgetting and the Studies that Support Each Property

Properties of RIF

I. Retrieval Impairs Related Memories
II. Cue-Independence
III. Interference Dependence
  A. Recall Specific
  B. Taxonomic Frequency Effects
IV. Non-Integrated Events Suffer Most
V. Recognition Memory Impaired
VI. Generalized to Non-Verbal Stimuli

Furthermore, retrieval-induced forgetting has been found in an eyewitness memory paradigm, with rather more complex stimuli than used here (Shaw, Bjork, & Handel, 1995). By "interrogating" subjects about a mock crime that they witnessed during a slide presentation, subjects can be induced to forget other similar information not included in the initial interrogation. These findings argue that this effect is not restricted to memory for previously studied words, but generalizes to memories varying widely in content and complexity.

INHIBITORY PROCESSES AND TRAUMATIC AMNESIA

In the first portion of the article, the phenomenon of retrieval-induced forgetting, and the evidence suggesting that this form of memory impairment is caused by active inhibitory processes was reviewed. These inhibitory processes are thought to suppress competing mental representations in the interest of attentional control during memory search. If cognitive control employs such mechanisms in these more mundane (though necessary) circumstances, it seems reasonable to wonder whether these mechanisms might be applied strategically under more extreme circumstances–as would occur in efforts to forget a traumatic experience (Bjork, Bjork, & Anderson, 1997).

The next portion of the article develops a proposal for how such mechanisms might explain at least a part of the findings on traumatic amnesia. While far from being a finished theory, my hope is that this proposal, if nothing else, will generate the discussion necessary for such a theory to evolve.

Focus of the Proposal

There are several limits on the scope of the current proposal that should be described at the outset. First, this proposal is not meant to address all instances in which a traumatic experience is forgotten. There are many reasons why trauma could be forgotten, having to do with disruption at virtually any stage of processing in the memory system, either with encoding or elaboration, as argued by van der Kolk and Fisler (1995), or with retrieval. This proposal will address the latter variety of forgetting, in which an experience has been adequately encoded, and for which the difficulty lies primarily with retrieval.

Second, this proposal is limited to forgetting of the declarative representation of the experience, and does not address other forms of knowledge such as conditioned responses or procedural knowledge. By declarative representation, I do not mean to restrict the account to verbal representation, rather to propositional representations (linguistic or not) that may be consciously experienced by the rememberer (Squire, 1992; Cohen & Eichenbaum, 1993). The present account is focused on declarative representations because, to date, all studies of retrieval-induced forgetting have studied declarative knowledge, and because it is entirely possible that nondeclarative representations are not affected in the same way by the processes discussed thus far. For instance, it may be possible to suppress the declarative representation of trauma without altering a person's conditioned emotional responses to trauma-related stimuli (see Bechara, Tranel, Damasio, & Adolphs, 1995, for evidence on the potential independence of declarative representations and fear conditioning).

Finally, the proposal focuses on trauma for interpersonal experiences, specifically childhood sexual abuse. Of particular interest is the striking finding that people reporting childhood sexual abuse are much more likely to report a period of forgetting if the abuse was perpetrated by a family member than if by a non-family member. I first encountered this finding in Jennifer Freyd's book, *Betrayal Trauma: The Logic of Forgetting Childhood Abuse*, in which she develops a compelling argument about why traumatic amnesia may come about (Freyd, 1996). Freyd argues that many instances of amnesia for sexual abuse reflect adaptive responses of a child who has been abused by a trusted caregiver. A child who has been abused by a parent or relative often has very few options about how to respond. Freyd (1996) argues that it is in the child's best interests to not know about or to forget the abuse if remembering it would disrupt their ability to maintain significant attachment relationships with the caregiver. If this view is correct, one would expect to see a greater incidence of amnesia for abuse perpetrated by family members than by strangers, for whom no significant attachment relationships exist. This is exactly the pattern that has been observed empirically. In a reanalysis of

several existing data sets on traumatic amnesia (Cameron, 1993; Feldman-Summers & Pope, 1994; Williams, 1994), Freyd (1996) found much greater rates of forgetting when the perpetrator was a family member.

Figure 8, adapted from Freyd (1996), gives several examples of this finding, only one of which I will discuss for the sake of illustration. In a study reported by Feldman-Summers and Pope (1994), over 300 psychologists filled out a survey regarding sexual abuse. Of these psychologists, 25% reported having been abused themselves as children. Freyd categorized these individuals by whether or not they reported having had a period during which they could not recall the experiences, and by whether or not the abuse was perpetrated by a family member.

One can see from these data that when people were abused by a family member, they were more likely to have had a period of forgetting of the experience than to have had continuous memory for it. However, respondents who reported having been abused by strangers were more likely to have had continuous memory for the abuse. These findings are mirrored in the reanalyses of other studies by Williams (1994) and Cameron (1993), that used different methodologies and different subject populations. Although caution

FIGURE 8. Three Studies That Have Found Evidence for Heightened Incidence of Forgetting for Betrayal Traumas as Compared to Stranger Abuse. Subjects Are Classified According to Whether They Were Abused by a Family Member or Not, and by Whether They Ever Had a Period During Which They Had Forgotten the Abuse. The Numbers in the Table Are the Percentages of Subjects Who Fell into the Relevant Classifications.

Heightened Incidence of Forgetting for Betrayal Trauma

Feldman-Summers & Pope (1994)

	Abuse Ever Forgotten?	
Family Member	Yes	No
Yes	53%	47%
No	30%	70%

Williams (1994)

	Abuse Reported	
Family Member	Yes	No
Yes	53%	48%
No	69%	31%

Cameron (1993)

	Abuse Ever Forgotten?	
Family Member	Yes	No
Parent	72%	28%
Non-Parent	19%	81%

needs to be exercised in interpreting people's self assessments of prior retrievability (see Schooler, 1996), taken at face value these findings lend support to betrayal trauma theory. The current proposal attempts to explain how the circumstances of a betrayal trauma ultimately cause these incidents of forgetting through the normal operation of memory inhibition mechanisms.

The Selective Retrieval Hypothesis

What mechanisms might underlie greater forgetting for betrayal traumas? The proposal offered here is that betrayal traumas are much more likely to create circumstances conducive to retrieval-induced forgetting, and thus suppression, than are cases of stranger abuse. This will be referred to this as the selective retrieval-hypothesis. The suggestion will be posed that betrayal traumas and stranger abuse will tend to be forgotten by somewhat different memory mechanisms.

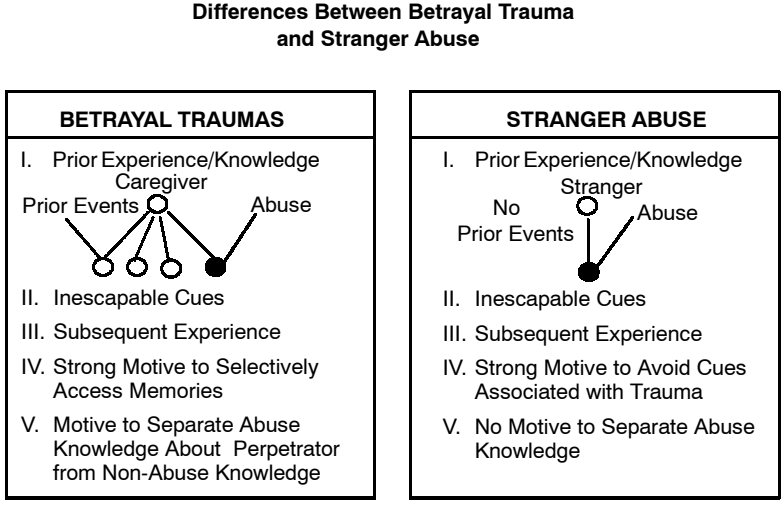
Cognitive Differences Between Betrayal-Trauma and Stranger Abuse. To appreciate how betrayal traumas may be more likely to create conditions conducive to retrieval-induced forgetting, it is important to consider the many systematic differences between these situations that are likely to create differences in representation and processing in the child. Several significant differences are illustrated in Figure 9, which describes the situation of betrayal trauma on the left, and that of stranger abuse on the right.

First, as is obvious, in betrayal trauma, the abuse is committed by a trusted caregiver about whom the child already knows much, there is extensive knowledge and prior experience that has already been encoded about the caregiver prior to the encoding of the abuse. This situation contrasts with stranger abuse, in which (by definition) little is known about the stranger. Indeed, the abuse may be the only thing that is known about the person, making it highly retrievable. This contrast is depicted in Figure 9 as a greater number of associated memories linked to the central cues for the abuse in betrayal traumas (i.e., the caregiver, left side) than in stranger abuse (i.e., the stranger, right side).

Second, in betrayal trauma, the cues that would remind the child about the abuse are not escapable, the child must live with the parent, and in the location of the abuse despite the fact that these stimuli will tend to cue the memory powerfully. In stranger abuse, however, cues are at least potentially avoidable and escapable, the child need not encounter the stranger again, and may be able to avoid the location in which the abuse occurred.

Third, as a result of the prior difference, children suffering betrayal traumas will encode more subsequent experiences with the caregiver because the child is forced to live and interact with them. These new experiences only add to the knowledge available in memory to compete with the abuse memory (imagine more associated memories in the diagram on the left of Figure 9). In

FIGURE 9. Systematic Differences in Representation and Processing Across Betrayal Traumas and Stranger Abuse. Diagrams Represent Simplified Versions of the Memory Structures Assumed to Be Represented in the Case of Betrayal Trauma and Stranger Abuse.



the case of stranger abuse, there will be less subsequent experience concerning the abuser (for the reasons cited above), which will only preserve the unique and thus highly accessible status of the memory as an association to the most potent cues, the perpetrator or the location of the abuse.

Fourth, as argued by Freyd (1996), the child suffering a betrayal trauma has a powerful motive for selectively accessing some of the knowledge about the caregiver. Because the child cannot escape the retrieval cue, the caregiver, they must develop a way to selectively retrieve knowledge about the caregiver that will ensure their survival and that will be relevant to supporting essential attachment relationships with the parents. If retrieving abuse-related knowledge undermines these objectives, retrieval of that knowledge should be avoided. In the case of stranger abuse, however, there is no such motive because there is no attachment relationship with the stranger. Furthermore, because no other knowledge has been stored about the stranger and because the cue itself (the stranger) is avoidable, selective retrieval is both impossible and, in any event, unnecessary. Rather, the main tool for forgetting abuse perpetrated by a stranger will likely be to avoid the cues altogether.

Finally, in betrayal traumas, the child has a motive to separate out knowledge associated with the abuse from other knowledge about the perpetrator.

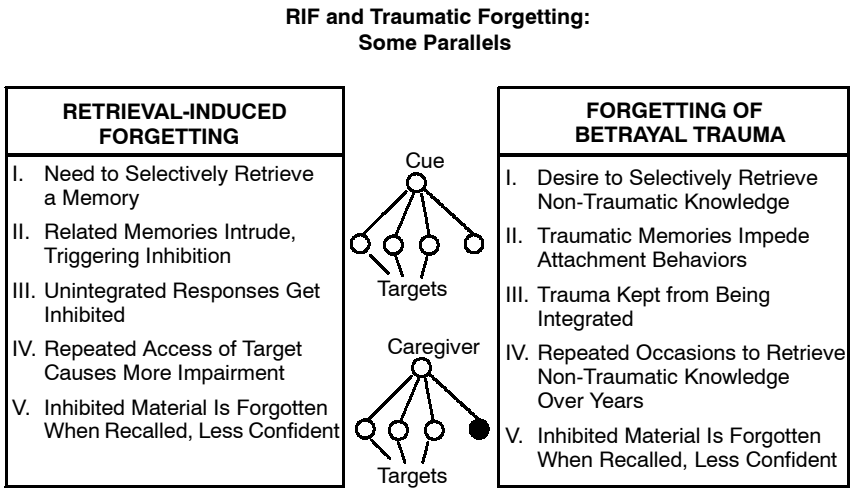
In everyday interactions with the caregiver, it may be difficult for a child to behave normally if memories, thoughts, and feelings about the abuse were not set aside in some fashion. Indeed, conclusions and feelings compelled by thoughts of the abuse may be in a fundamental conflict with basic assumptions concerning the caregiver, assumptions which underlie much of the child's physical and emotional responses to that person (Horowitz, 1986). The ability to separate out abuse from nonabuse knowledge may thus allow the preservation of a necessary image or model of the parent. In the case of stranger abuse, there is no such motive; it is not disadvantageous to integrate abuse knowledge with whatever nonabuse information was known about the perpetrator.

All of these situational differences will create substantial differences in representation and processing that make betrayal traumas extremely conducive to retrieval-based inhibitory processes.

Parallels with Laboratory Phenomena. A central claim of this proposal is that the foregoing differences are relevant to the likelihood of experiencing amnesia for betrayal traumas. They are relevant because they directly pertain to the conditions necessary to observe retrieval-induced forgetting. Figure 10 highlights several of the most important parallels between retrieval-induced forgetting (left side) and betrayal-trauma (right side). In the retrieval practice paradigm, the subject's aim is to selectively recall a particular target item (e.g., Orange) in response to a retrieval-practice cue (e.g., Fruit or___), and to not retrieve other intrusive items (e.g., Banana). In the case of betrayal trauma, the child needs to selectively retrieve nontraumatic information about the caregiver, to the exclusion of the traumatic knowledge. The similarities between these two situations are depicted graphically in the center of Figure 10, in which it can be seen that both situations require the progression from a retrieval cue to a particular memory, despite the presence of many competing memories. Thus, both situations demand selective retrieval.

Consider several other significant parallels. First, in the retrieval practice paradigm, alternative memories intrude and interfere with access to the retrieval practice target, triggering their suppression. In the case of betrayal trauma, traumatic memories intrude and must be suppressed to sustain behaviors and thoughts consistent with the goal of maintaining the current attachment relationships with the caregiver. Second, as highlighted earlier, unintegrated memories are hardest hit by retrieval-induced forgetting; integrated information is often unimpaired by the selective retrieval of related knowledge. In betrayal trauma situations, the victim often keeps traumatic information from being integrated with nonabuse knowledge. This segregation of abuse knowledge has two effects: it keeps the information out of awareness while attachment behavior proceeds, but it also renders the abuse knowledge more vulnerable to the suppression.[1,2,3]

FIGURE 10. Parallels Between the Representation and Processing Demands Typical of Retrieval-Induced Forgetting and Those Likely to Be True in Cases of Betrayal Trauma. Diagrams in the Center Represent Simplified Versions of the Memory Structures Presumed to Be Formed in Each Case. In the Retrieval Practice Paradigm, There Is a Cue (a Category Typically) Associated to Many Exemplars. In Betrayal Trauma, the Memory Retrieval Cue Is the Caregiver, and the Associated Memories Are of Personal Experiences with or Knowledge About the Caregiver.



Fourth, in the retrieval-practice paradigm, practiced memories are repeatedly retrieved throughout the practice phase, causing greater inhibition of related items. Recently, the degree of retrieval induced forgetting has been shown to increase with the number of retrievals of practiced items (Anderson & Shivde, 1999). If inhibition increases with the number of times that a related item is retrieved, this would make betrayal traumas powerfully conducive to suppression. Even if a child fails to suppress memories of the trauma initially, many years of experience with the caregiver following the incident will provide more than enough opportunities to master the task of selective retrieval. As the child becomes more skilled at ''thinking the right thoughts'' about the caregiver, suppression of the trauma seems a natural consequence. Indeed, studies of abused children indicate that abusers may encourage this process by grooming the child to have a particular (positive) understanding of the abuser (Veldhuis & Freyd, 1999).

Perhaps the most important parallels between these situations lie in the qualitative characteristics of the phenomena themselves. In laboratory studies, inhibition causes the interfering information to be forgotten. Importantly, even when the inhibited item is remembered, subjects are much less confident about having experienced it (Anderson et al., 1997). In betrayal traumas, as in retrieval-induced forgetting, the result of suppression is long lasting amnesia for the abuse event, followed by a period of uncertain memory for the experience, if it is ever recalled at all.

Research on retrieval-induced forgetting also suggests new explanations for observations in traumatic amnesia that might otherwise seem paradoxical. For instance, Terr (1991) has observed that, contrary to what one might expect, victims of repeated abuse have a higher incidence of amnesia than do victims who have been abused a single time. Freyd (1996) speculated that this pattern may arise because multiple-abuse cases tend to be betrayal traumas. If Freyd is correct, victims of multiple instances of abuse may suffer more amnesia because betrayal traumas foster retrieval-induced forgetting. In addition, if victims encode multiple abuse-related memories that are highly similar to one another, as might be the case if the abuse took place in the same location and at the same time of day, betrayal traumas may foster memories that are particularly sensitive to suppression. First, as a rule, the memories that are most likely to be suppressed are those that interfere with attempts to selectively retrieve target items during retrieval practice (Anderson et al., 1994; Anderson et al., 1999; Anderson & Shivde, 1998; 1999; Anderson and Spellman, 1995). Factors that increase the accessibility of a memory (e.g., repetition) should also make it highly interfering, and potentially more susceptible to suppression. Second, recent work has shown that more suppression occurs when to-be-suppressed memories are highly similar to one another (Anderson, McCulloch, & Green, 2000). Thus, to the extent that betrayal traumas foster highly intrusive abuse memories that are similar to each another, people suffering from them might be particularly susceptible to retrieval-induced forgetting.

Although there are clearly many differences between the this simple laboratory procedure and betrayal traumas, the preceding parallels make it clear that the conditions of betrayal trauma encourage the sorts of inhibitory processes studied in the retrieval-practice paradigm, indeed, much more so than cases of stranger abuse. This may provide a useful starting point for understanding the mechanisms underlying the greater incidences of amnesia for betrayal traumas (Freyd, 1996).

Differences in Mechanisms Underlying Forgetting of Stranger Abuse and Betrayal Trauma. The foregoing analysis does not imply that traumatic amnesia will be restricted to cases of betrayal trauma. It merely argues that the conditions of betrayal trauma are particularly conducive to retrieval-based

inhibitory processes. The present analysis does suggest, however, that different mechanisms may underlie forgetting of betrayal traumas and stranger abuse. Unlike in betrayal trauma, the retrieval cues that are most likely to reinstate memory for the abuse event, the location of the abuse and the abuse, are typically more avoidable in the case of stranger abuse. By deliberately avoiding situations in which these cues would arise, a person who was abused by a stranger can learn to forget by the mechanisms of context dependent memory rather than by direct suppression. Although it is difficult to know what implications this mechanistic difference may have for the ability to recover those prior experiences, it seems plausible that forgetting by this mechanism may be more reversible than it is for betrayal traumas, given reinstatement of the cues. This seems likely because the avoidance of cues ensures that those cues remain uniquely associated to the abuse event, and thus effective at eliciting the abuse event.

It remains possible, however, that some instances of traumatic amnesia from stranger abuse may be caused by memory inhibition processes. Although victims may be able to avoid the abuser and the location of the abuse, sexual experiences later in life may also serve as cues to the abuse event. One response to such remindings would be to avoid sexual encounters altogether, in much the same way as the location of the abuse is avoided. Alternatively, if a person chooses not to avoid sexual experiences, the potency of such experiences as cues to the recalling the abuse event (or at least its declarative representation) may diminish as more sexual experiences are stored in memory. By learning to focus on more recent experiences, a person may initiate the suppression processes described previously.

CONCLUDING REMARKS

Although forgetting is often an undesirable outcome, there are many cases in which it is desirable. It is equally clear that people often make deliberate efforts to forget things (at least temporarily), even in relatively simple nontraumatic circumstances. To the extent that such forgetting is possible, we must explain the mechanisms that underlie it. In this article, a program of research in theoretical memory that shows that people use inhibitory control processes to ''push aside'' interfering representations in memory has been reviewed. These mechanisms are adaptive because they help to focus cognition in the face of internal distraction from the abundance of representations that may become active as we perform a cognitive act. These inhibitory processes render the inhibited representations less accessible in the long run.

If inhibitory processes cause forgetting in these more mundane circumstances, it is reasonable to ask to what extent they may underlie the forgetting of concern to those studying traumatic amnesia. Although there is no direct

evidence linking this simple phenomenon to traumatic amnesia, I have argued that retrieval-induced forgetting provides a highly plausible laboratory model of the processes that may lead to traumatic amnesia, particularly so in the case of betrayal trauma. Retrieval-induced forgetting arises whenever a person must learn to selectively retrieve some memories associated to a cue and not others. A child suffering from a betrayal-trauma is often confronted with precisely the same problem: To learn to recollect some memories (positive, attachment related memories) about an abuser and not others (the abuse event/s), if he or she is to maintain attachment relationships with the caregiver. Although matters are clearly more complex than this simple analogy suggests, the selective retrieval hypothesis is consistent with reports of the greater incidence of forgetting for betrayal trauma than for stranger abuse. If correct, the selective retrieval hypothesis suggests that different mechanisms may underlie the forgetting of betrayal traumas and stranger abuse. If so, it becomes important to separate these two situations in research aimed at understanding the characteristics of memory for childhood sexual abuse.

NOTES

1. The preparation of this article was supported by startup funds from the University of Oregon. The author would like to thank Jennifer Freyd and Anne DePrince for useful comments on an early version of this paper.

2. In laboratory studies, the particular pattern of integration between the exemplars of a category plays a crucial role in whether integration will prevent retrieval induced forgetting. For integration to prevent impairment, the information that receives retrieval practice should be directly integrated with the related material that would otherwise be suppressed. Integration *between the practiced exemplars themselves*, or between the *related items* will not prevent the retrieval of those practiced items from suppressing the related exemplars. Similarly, neither integration of nonabuse memories with each other, nor abuse memories with each other should be sufficient to prevent traumatic amnesia.

3. It is unclear whether the segregation of abuse knowledge from nonabuse knowledge is a conscious, goal directed activity. Although the present account does not require any commitment on this point, we suspect that knowledge segregation may be an indirect consequence of attempts to keep abuse knowledge out of awareness during attachment related activities. Because integration requires *simultaneous processing* of the items of knowledge being integrated, such a practice would prevent integration.

4. It should be emphasized that the current assumptions about the situation of betrayal trauma represent the author's analysis of that situation and does not necessarily reflect the assumptions of betrayal trauma theory (Freyd, 1996).

REFERENCES

Anderson, M. C., & Bjork, R. A. (1994). Mechanisms of inhibition in long-term memory: A new taxonomy. In D. Dagenbach & T. Carr (Eds.), *Inhibitory processes in attention, memory, and language* (pp. 265-325). San Diego, CA: Academic Press.

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*, 1063-1087.

Anderson, M. C., Bjork, E. L., & Bjork, R. A. (in press). Retrieval-induced forgetting: Evidence for a recall-specific mechanism. *Psychonomic Bulletin and Review.*

Anderson, M. C., De Kok, D., & Child, C. (1997, November). Retrieval-induced forgetting on a test of recognition memory. *Abstracts of the Psychonomic Society*, *2*, Volume 2.

Anderson, M. C., & McCulloch, K. C. (1999). Integration as a general boundary condition on retrieval-induced forgetting. *Journal of Experimental Psychology*: *Learning*, *Memory*, *and Cognition*, *25*, 608-629.

Anderson, M. C., McCulloch, K.C., & Green, C. (submitted). What doesn't inhibit "banana" makes it stronger: Why similarity can both increase and decrease retrieval-induced forgetting.

Anderson, M. C., & Neely, J. H. (1996). Interference and inhibition in memory retrieval. In E. L. Bjork & R. A. Bjork (Eds.), *Memory. Handbook of perception and cognition* (2nd ed.) (pp. 237-313). San Diego, CA: Academic Press

Anderson, M. C., & Shivde, G. (May, 1998). Inhibition in episodic memory: Evidence for a retrieval-specific mechanism. *Poster presented at the 10th Annual Conference of the American Psychological Society*, Washington DC, May, 1998.

Anderson, M. C., & Shivde, G. (November, 1999). The functional role of inhibitory processes in retrieval: Evidence from a parametric study of retrieval-induced forgetting. *Abstracts of the Psychonomic Society*, Volume 4.

Anderson, M. C., & Spellman, B. A. (1995). On the status of inhibitory mechanisms in cognition: Memory retrieval as a model case. *Psychological Review*, *102*, 68-100.

Bechara, A., Tranel, D., Damasio, H., & Adolphs, R., Rockland, C., & Damasio, A.R. (1995). Double dissociation of conditioning and declarative knowledge relative to the amygdala and hippocampus in humans. *Science*, *269*(5227), pp. 1115-1118.

Bjork, E. L., Bjork, R. A., & Anderson, M. C. (1997). Varieties of goal directed forgetting. To appear in J.M. Golding & C.M. McCleod (Eds.), *Directed Forgetting*: *Interdisciplinary Approaches*. (pp. 103-138). Lawrence Erlbaum Associates.

Cameron, C. (1993). *Recovering memories of childhood sexual abuse*: *A longitudinal report*. Paper read at the Western Psychological Association convention, Phoenix, Arizona, April.

Ciranni, M. A., & Shimamura, A. P. (in press). Retrieval-induced forgetting in episodic memory. *Journal of Experimental Psychology*: *Learning*, *Memory*, *and Cognition*.

Cohen, N. J., & Eichenbaum, H. (1993). *Memory, amnesia, and the hippocampal system*. MIT Press, Cambridge, MA.

Feldman-Summers, S., & Pope, K. S. (1994). The experience of forgetting childhood abuse: A national survey of psychologists. *Journal of Consulting and Clinical Psychology, 62*, 636-639.

Freyd, J. J. (1996). *Betrayal trauma: The logic of forgetting childhood abuse*. Cambridge, MA: Harvard University Press.

Godden, D., & Baddeley, A. D. (1975). Context dependent memory in two natural environments: On land and under water. *British Journal of Psychology, 66*, 325-331.

Horowitz, M. J. (1986). *Stress response syndromes* (2nd ed.). New York: Jason Aronson.

Schooler, J. W. (1996). Seeking the core: The issues and evidence surrounding recovered accounts of sexual trauma. In K. Pezdek & W.P. Banks (Eds.), *The recovered memory/False memory debate*. (pp. 279-296). Academic Press.

Shaw, J. S., Bjork, R. A., & Handal, A. (1995). Retrieval-induced forgetting in an eyewitness-memory paradigm. *Psychonomic Bulletin & Review, 2*, 249-253.

Squire, L. R. (1992). Memory and the hippocampus: A synthesis from findings with rats, monkeys, and humans. *Psychological Review, 99*, 195-231.

Terr, L. C. (1991). Childhood trauma: An outline and overview. *American Journal of Psychiatry, 148*, 10-20.

van der Kolk, & Fisler (1995). Dissociation and the fragmentary nature of traumatic memories: Overview and exploratory study. *Journal of Traumatic Stress, 8*, 505-525.

Veldhuis, C. B., & Freyd, J. J. (1999). Groomed for silence, groomed for betrayal. In M. Rivera (Ed.), *Fragment by fragment: Feminist perspectives on memory and child sexual abuse* (pp. 253-282). Charlottetown, PEI Canada: Gynergy Books.

Williams, L.M. (1994). Recall of childhood trauma: A prospective study of women's memories of child sexual abuse. *Journal of Consulting and Clinical Psychology, 62*, 1167-1176.