

inability to generate a unique label for photographs of unknown faces or places made accurate recollection difficult. First, to the extent that the label was generic (e.g., "blond female" or "mountain stream"), the fan from the label might be high, making it more difficult to access the episode node (see Reder, Donavos, & Erickson, 2002; Reder et al., 2000); second, a generic label could apply to foils as well as targets and lead to spurious recollection as well as spurious familiarity based responding.

In Example 1, we demonstrated that midazolam-induced amnesia had a detrimental effect on some forms of implicit memory performance (contextual cuing) that requires binding of spatial relations, but not others (task speed up) with practice at the skill. In the present example, we provided support for the flip side: midazolam impaired only those explicit memories that were based on association-specific recollections, while subjects had the same memory performance for familiarity-based judgments (see Reder et al., 2009). The present results demonstrate the importance of binding and association for accurate memory recall and indicate that midazolam negatively affects memory by preventing the creation of associations and preventing the recollection of contextual information.

Example 3: The link between consolidation and forgetting

Retrograde facilitation under midazolam (Reder et al., 2007)

Recent memory research has considered the role of consolidation in forgetting previously processed information. Wixted (2004) posited that memory theorists have failed to appreciate the role of consolidation in explaining whether or not information is forgotten. Consolidation requires effort, and when mental exertion interferes with consolidation, this exertion can lead to forgetting. On a neurological level, Wixted (2004) suggested that the limited capacity of the hippocampal system may also contribute to the impact of interference on memory formation. He proposed that a major source of forgetting is the disruption of consolidation that occurs when new incoming information competes with the older information for limited hippocampal resources. An example of support he offered for his position came from a benzodiazepine study that was purported to show *retrograde facilitation* for information acquired prior to the injection. This facilitation was a comparison of recall performance of items from the list studied prior to injection for the saline (control) compared with the benzodiazepine group. Those subjects who received saline recalled more of the second list items than those who received the benzodiazepine, but they recalled fewer items from the first list. Reder et al. (2007) tested an alternative explanation for the difference in performance on the first list that did not postulate a role for differential consolidation: Better performance on the pre-injection list was the result of less interference from the second list that was very poorly recalled in the amnesia group.

To test our explanation, we used a modified version of the experiment

described by Wixted (2004). We used a cued recall paradigm involving three lists of word pairs, one list presented prior to injection, two lists studied post injection. Each list (of 45 word pairs) consisted of three types of word pairs (15 of each type): one third of the pairs were repeated across all three lists (practice pairs); one third of the pairs (control pairs) were only shown on one of the lists; the final third of the word pairs (interference pairs) were shuffled from list to list such that the left-hand word of a pair (stimulus word) was reassigned to a different right-hand word (response term) across lists. If the effect of midazolam was to enhance consolidation of material learned prior to the injection, then all types of pairs should benefit equally. On the other hand, if the effect of midazolam is to block the formation of new associations, then the benefit of the drug condition should be greatest for those word pairs that would otherwise experience the most interference from the formation of competing associations (the interference pairs).

For each subject, words were randomly paired with other words, as well as randomly assigned to pair condition and list. The 45 word pairs on a list were presented first for two seconds each and were tested individually by asking the subject to type the response term to the stimulus word. After the attempted recall, the word pair was re-studied for three seconds and another pair was tested. Each pair was tested twice in this manner for each list.

After completing the study-test cycle for List 1, subjects received an injection of either saline or midazolam. They then studied a new list of paired associates followed by two study-test cycles for List 2, followed by the same procedure for List 3. After studying all three word lists, subjects were given a snack, and their monitoring devices were removed. After the snack and rest, subjects were given a final cued-recall test consisting of all word-pairs from the three lists in a random order. In this case, cued recall included both the stimulus word and the list number in which the pair had been studied. For practice pairs, any of the three lists could be mentioned, but one was randomly selected with the constraint that all three lists were tested equally often for the practice pairs.

Figure 14.6 shows the acquisition data for the three lists of words. Understandably, there were no differences for drug condition for List 1, which was studied pre-injection. Likewise, there were no differences among pair types, since the differences among types of pairs was defined in relation to all three lists. However, the data for List 2 and List 3 do show differential effects of drug condition and stimulus type. When administered midazolam, subjects had difficulty learning word pairs. Notably, this difficulty was only seen for interference and control pairs. Since the practice pairs were studied before the injection, they were less affected by midazolam. Figure 14.7 presents the final recall data. Subjects were reliably better at recall in the saline than the midazolam condition. Recall was also best for practice pairs and worst for interference pairs.

Of particular interest is the comparison of recall for List 1 items in the midazolam versus the saline condition. Specifically, would we replicate the