these positions. Park et al. (2004) replicated the Chun and Phelps (1999) study using college students as subjects with midazolam-induced amnesia. A within-subject, double blind, cross-over design involved the administration of midazolam in one session and saline in the other. The same T/L visual search task was used in one session and a similar 2/5 search task in the other session, counterbalanced on order and drug condition assignment. Immediately after injection, subjects studied a list of paired associates that were tested at the end of the day's session as a manipulation check on the amnestic effects of the drug. Immediately after studying the list of paired associates, the visual search test consisting of 24 blocks of 24 trials commenced.

Following these 24 blocks of trials, subjects were given a quadrant guessing task in which they were shown the repeated displays and novel displays, with the target replaced with another distractor. Subjects were asked to guess which quadrant should contain the target. In both the drug and saline conditions, subjects were at chance guessing the target quadrant, replicating previous results that the knowledge of target location is implicit.

Figure 14.3 plots the response time (RT) to locate the target in a display of distractors as a function of practice at the task, whether the display was repeated across blocks of trials and drug condition. Each epoch is the average of four blocks of 24 trials. In both the saline and midazolam conditions, subjects showed a general speed-up effect with practice. However, the faster RTs for target identification in repeated configurations were only seen in the saline condition, and not under the administration of midazolam. In other words, when subjects were injected with midazolam, they did not demonstrate

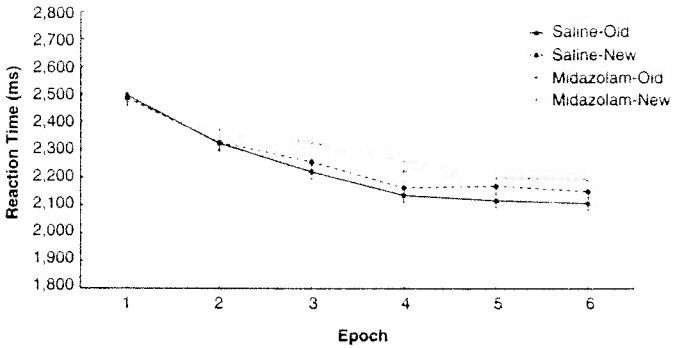

Figure 14.3 Reaction times on visual search task as a function of drug condition and visual field repetition. Reproduced from H. Park et al., The effect of midazolam on the visual search: Implications for understanding amnesia. *Proceedings of the National Academy of Sciences, USA*, 2004, *101*(51), 17879–17883.

the implicit contextual cuing effect, instead demonstrating an implicit memory impairment.

In summary, our findings supported the conclusions of Chun and Phelps (1999) that amnesia can lead to impairment on implicit tasks, in addition to the established impairment of explicit memory tasks.

Example 2: Not all stimuli can be bound to context

Drug-induced amnesia hurts recognition, but only for memories that can be unitized (Reder et al., 2006)

The previous example illustrated that amnesia can affect learning that is implicit in nature. The present example illustrates that amnesia does not always impair explicit memories. The goal of this study was to test the thesis that explicit recognition can be affected by the ease of generating a unique label. We assume that there are two ways to recognize a stimulus seen earlier in an experiment, one based on recollection (retrieval of details of encoding context) and the other based on the familiarity of the stimulus (see Diana, Reder, Arndt, & Park, 2006; Yonelinas, 2002, for reviews). According to the SAC model of memory (e.g., Reder et al., 2000), recollection requires the formation of an association of the stimulus concept with the encoding context; however, when recollection fails, recognition can sometimes occur based on the familiarity of the stimulus concept.

Our working hypothesis is that midazolam affects memory performance by blocking the formation of new associations or binding (Park et al., 2004). We propose that subjects administered midazolam will be unable to use associations to make recollections, and they will have to rely exclusively on familiarity judgments in an experimental setting. The use of midazolam affects explicit memory for new information when those judgments require recollection of context. On the other hand, when explicit memory judgments can be based on familiarity (i.e., binding to context is not a requirement), midazolam should not affect memory performance.

Reder et al. (2006) used midazolam to test two hypotheses. The first hypothesis was that stimuli that are not sufficiently familiar to be *unitized* (formed into a "chunk") cannot be bound to context and therefore cannot be recollected later. Therefore, any stimulus that cannot be bound to context in normal conditions will suffer less when studied under midazolam. The other hypothesis we examined was whether recollection would show less impairment from midazolam relative to the saline control when the stimuli could not be labeled with unique descriptors. In other words, even if the label representing a stimulus could be bound to context, there would be no advantage of binding for those stimuli that do not evoke a unique label (one that distinguishes the stimulus from foils). Therefore those stimuli that evoke a generic label will be relatively unimpaired in the midazolam condition because the ability to bind to context does not help with recollection.