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Conceptual implicit memory and environmental context

Neil W. Mulligan*

Department of Psychology, University of North Carolina, Chapel Hill, NC 27599-3270, United States

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ABSTRACT

Changes in environmental context between encoding and retrieval often affect explicit memory but research on implicit memory is equivocal. One proposal is that conceptual but not perceptual priming is influenced by context manipulations. However, findings with conceptual priming may be compromised by explicit contamination. The present study examined the effects of environmental context on conceptual explicit (category-cued recall) and implicit memory (category production). Explicit recall was reduced by context change. The implicit test results depended on test awareness (assessed with a post-test questionnaire). Among test-unaware participants, priming was equivalent for same-context and different-context groups, whereas for the test-aware, the same-context group produced more priming. Thus, when explicit contamination is controlled, changes in environmental context do not impair conceptual priming. Context dependency appears to be a general difference between implicit and explicit memory rather than a difference between conceptual and perceptual implicit memory. Finally, measures of mood indicated no changes in affect across contexts, arguing against mood mediation for the context effects in explicit recall.

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1. Introduction

Research on memory often reveals a sensitivity to contextual change. One important aspect of context is environmental context, referring to the physical surroundings in which learning or retrieval takes place. Reinstating the learning context often has a beneficial effect on retrieval. One oft-cited study featured a rather extreme manipulation of environmental context in which scuba divers learned words either on dry land or underwater (Godden & Baddeley, 1975). Divers later tested in the same context recalled more words than those tested in the opposite environment. More typically, researchers have examined such “place effects” on memory with less extreme manipulations of context such as different experimental rooms or indoor vs. outdoor locations. These studies have often demonstrated context-matching effects on memory tests such as recall and recognition (see Smith & Vela, 2001, for a review).

The vast majority of the research on environmental context and memory has used explicit memory tests, in which participants intentionally and consciously recollect past events. In contrast, implicit memory refers to unconscious or unintentional retrieval of past experience and is typically assessed with tests of repetition priming. Dissociations between implicit and explicit memory demonstrate that these forms of memory differ in important ways. For example, patients with organic amnesia exhibit reduced explicit memory (the primary symptom of their disorder) but largely intact priming on tests of implicit memory (e.g., Levy, Stark, & Squire, 2004; Shimamura, 1986).¹ A variety of encoding variables also dissociate these

* Fax: +1 919 962 2537.

E-mail address: nmulligan@unc.edu

¹ This generalization is based on traditional implicit tests measuring priming for individual stimuli. Emerging research indicates that associative priming may be disrupted in amnesia (e.g., Keane & Verfaellie, 2006).

forms of memory, and neuroimaging analyses indicate different neural substrates (for reviews, see Horner & Henson, 2008; Mulligan, 2004; Roediger & McDermott, 1993; Schacter, 1987). In addition, researchers also differentiate among different forms of implicit memory, most notably between perceptual and conceptual implicit memory. Tests of perceptual implicit memory feature fragmentary or rapidly-presented cues which participant attempts to complete or identify. The word-fragment completion and perceptual identification tasks are examples. Priming on these tests is generally sensitive to manipulations of perceptual form (e.g., study modality) but not manipulations of semantic elaboration (e.g., the levels-of-processing manipulation). In contrast, conceptual implicit tests present participants with cues that are meaningfully related to the to-be-retrieved material. An example is the category production task in which category names are used to elicit examples. Conceptual priming is typically affected by semantic encoding manipulations but unaffected by manipulations of surface form (such as modality) (see Mulligan, 2004; Roediger & McDermott, 1993, for reviews).

Because context-dependency is a defining characteristic of explicit memory, it is important to determine whether context-dependency as reflected, for instance, by environmental-context effects also characterizes implicit memory (McKone & French, 2001). A few such studies have been conducted and have produced conflicting results. Several studies using perceptual priming tests have shown no effect of context change. Jacoby (1983) manipulated context across two experimental rooms and found no effect of match between study and test on the perceptual identification test. Similarly, McKone and French (2001) manipulated context by using one indoor and one outdoor location, and found that context match produced no effect on priming in the word-stem completion test but reduced recall on the matched explicit test of word-stem cued recall. Parker, Gellatly, and Waterman (1999) manipulated context match in a similar way and found no effect on the perceptual implicit tests of word-fragment completion and anagram solution, coupled with an effect of context match on free recall. These studies imply that the effects of environmental context dissociate implicit and explicit memory.

In contrast, studies examining conceptual implicit memory have reported effects of environmental context. The Parker et al. (1999) study, mentioned above, also assessed context effects with the conceptual implicit tests of category production and general knowledge questions, and found that conceptual priming on both tests was reduced with a change in context between study and test. In a similar vein, Smith, Heath, and Vela (1990) reported an effect of context match on priming in the homophone spelling test, a test often characterized as conceptual (e.g., McKone & French, 2001; see Roediger & McDermott, 1993, for discussion). These studies imply that insensitivity to context manipulations is not a general characteristic of implicit memory. Rather, Parker et al. argue, dissociations produced by context change may be better accounted for by the distinction between conceptual and perceptual processing rather than the implicit–explicit distinction (see McKone & French, 2001, for a similar suggestion).

However, there are reasons to hesitate before accepting this conclusion (Parker, Dagnall, & Coyle, 2007). An important issue in implicit memory research is the potential for explicit contamination to undermine results from implicit memory experiments. When given an implicit memory test, participants may become aware of the relationship between the test and the study episode (and may engage in intentional retrieval). Furthermore, this possibility is more likely with conceptual than perceptual implicit tests (e.g., Butler & Berry, 2001; Mace, 2003; Mulligan, Guyer, & Beland, 1999). If conditions or groups differ on explicit memory then explicit contamination is especially problematic as it might produce the appearance of a difference in implicit performance. For example, Mitchell and Bruss (2003), motivated by prior research implying reduced conceptual priming in old age, showed that when steps were taken to limit the likelihood of explicit contamination, older and younger adults produced equivalent priming on conceptual tests. Mitchell and Bruss concluded that the appearance of age differences in conceptual priming was due to explicit contamination in the nominally implicit test which differentially benefited the younger adults, the group with superior explicit memory ability (see Schmitter-Edgecombe & Woo, 2007, for a similar conclusion). In a similar vein, if explicit contamination occurred in a context study, the matching condition, expected to produce superior explicit memory, could produce greater priming, producing the appearance of a context-match effect on the implicit measure.

A common technique for assessing explicit contamination is the post-test questionnaire (Bowers & Schacter, 1990). Following the implicit test, the participant is asked a series of increasingly specific questions to determine if the participant was aware of the connection between the study and test phases of the experiment (and also to determine if the participant engaged in intentional retrieval). These questionnaires have demonstrated reliability and validity (e.g., Barnhardt & Geraci, 2008; Mulligan et al., 1999). Furthermore, the categorization of participants based on the questionnaire (e.g., as test-aware vs. test-unaware) is often related to the amount of priming and its pattern across other variables (e.g., Bowers & Schacter, 1990; Kinoshita, 2001; Mace, 2003; McKone & Slee, 1997; Mulligan et al., 1999).

The present study examined the effects of environmental context on conceptual implicit and explicit tests matched in terms of memory cues and response requirements. The implicit test is the category production task, the most commonly-used measure of conceptual implicit memory. Its explicit counterpart is category-cued recall, in which the same category cues are paired with explicit retrieval instructions. Different groups of participants were given the implicit or explicit test to eliminate the possibility that the effects of one test might influence performance on subsequent tests (cf. Parker et al., 1999; Smith et al., 1990). Environmental context was manipulated across different experimental rooms designed to be quite distinct from one another. Participants received their test in either the same or different context than their study session. The implicit test was followed with a post-test questionnaire to assess the extent of explicit contamination. In particular, participants were classified as test-aware or test-unaware based on their answers. If changing context generally reduces conceptual priming (Parker et al., 1999), then an effect should be found regardless of test awareness. In contrast, if explicit contamination produced the appearance of disrupted conceptual priming in prior research, the test-unaware participants

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