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# Revisiting the Novelty Effect: When Familiarity, Not Novelty, Enhances Memory

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Reports of superior memory for novel relative to familiar material have figured prominently in recent theories of memory. However, such *novelty effects* are incongruous with long-standing observations that familiar items are remembered better. In 2 experiments, we explored whether this discrepancy was explained by differences in the type of familiarity under consideration or by differences in the difficulty of discriminating targets from lures, which may lead to source confusion for familiar but not novel targets. In Experiment 1, we directly tested whether previously observed novelty effects were the result of novelty, discrimination demands, or both. We used linguistic materials (proverbs) to replicate the novelty effect but found that it occurred only when familiar items were subject to source confusion. In Experiment 2, to examine better how novelty influences episodic memory, we used experimentally familiar, pre-experimentally familiar, and novel proverbs in a paradigm designed to overcome discrimination demand confounds. Memory was better for both types of familiar proverbs. These results indicate that familiarity, not novelty, leads to better episodic memory for studied items, regardless of whether familiarity is experimentally induced or based on prior semantic knowledge. We argue that proposals that state that information is encoded better if it is novel are based on over-generalizations of effects arising from the distinctiveness of novel materials.

*Keywords:* episodic memory, source information, novelty, familiarity, distinctiveness

Memory for one's first kiss and the first occurrence of other events can be far better than memory for events that occur repeatedly. This anecdotal observation is sometimes cited as evidence that novel experiences are remembered better than familiar ones, a notion that has been reinforced experimentally by evidence that memory can be superior for novel over previously repeated stimulus lists (Tulving & Kroll, 1995). Researchers have also reported increased activation in the medial temporal lobes, brain regions known to be important for long-term episodic memory (Moscovitch et al., 2005), in response to novel relative to repeated stimuli

(e.g., Danckert, Gati, Menon, & Köhler, 2007; Kirchoff, Wagner, Maril, & Stern, 2000; Poppenk et al., 2008). On the basis of such evidence, it has been suggested that information is encoded to the extent it is novel (Tulving, Markowitsch, Craik, Habib, & Houle, 1996). This proposal, however, is not easily reconciled with classical findings revealing mnemonic benefits of advance familiarization with to-be-remembered items, such as advantages of item repetition prior to study in list-learning experiments (Ebbinghaus, 1885/1913). In the current investigation, we directly address this discrepancy.

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## Cognitive Evidence for Benefits of Familiarity on Learning

Items may become familiar through repetition in an experimental session or through pre-experimental exposures in the course of ongoing experience. Classical and more recent experiments have linked both forms of familiarity with mnemonic advantages. Concerning the effects of familiarity established through repetition, Hermann Ebbinghaus (1885/1913) had participants study lists of nonsense syllables until errorless recitation was achieved and found that learning on any given trial was fastest when lists had been previously studied. Repetition benefits in list-learning experiments have been replicated hundreds of times (Hintzman, 1976). We refer to this form of familiarity—established during a single experimental session, prior to a study phase, and through in-

laboratory repetition of stimulus materials—as *experimentally induced familiarity*.

Concerning the effects of item familiarity established through pre-experimental exposures in the form of semantic memory, it has been argued that semantic knowledge is a prerequisite for episodic memory (Tulving & Markowitsch, 1998). Indeed, children’s episodic memory for pictures of objects appears to be limited by their semantic knowledge about the objects depicted (Robertson & Köhler, 2007). Other evidence from individuals with semantic dementia and Alzheimer’s disease suggests that intact semantic representations of items are not strictly required to form episodic memories of them, but semantic item representations enhance perceptual flexibility of memories, facilitating recognition of perceptually different but conceptually identical items (Graham, Simons, Pratt, Patterson, & Hodges, 2000). Because semantic knowledge is defined in these experiments with respect to the learner’s entire history, it could alternately be described as *pre-experimental familiarity*, a more theoretically neutral term we adopt to provide clear juxtaposition against experimentally induced familiarity. Materials with neither form of familiarity (i.e., those that are seen for the first time in the study phase) are described here as *novel*.

### Cognitive Evidence for Benefits of Novelty on Learning

The notion that there might be potential benefits of novelty over familiarity for new memory formation arises primarily from a line of cognitive research examining the detrimental effect of prestudy repetition of study materials on participants’ ability to later study the repeated materials and successfully identify them as studied in a memory test. This phenomenon was first observed by Kinsbourne and George (1974) and was later revisited by Tulving and Kroll (1995), who conceptualized it in terms of novelty (i.e., as a *novelty effect*) and linked it to priming effects in the neuroscience literature. Some have recently suggested that novelty effects may be linked to distinctiveness (e.g., Tulving & Rosenbaum, 2006), a possibility we consider in a later discussion.

To obtain a novelty effect, Tulving and Kroll (1995) used a three-stage verbal memory procedure: in a *familiarity induction* stage, participants were exposed to two sets of 80 words with six repetitions. During one of the repetitions, recognition memory was evaluated with no lures, and a high rate of endorsement was observed. A subsequent encoding phase required participants to study words for a later memory test. Stimuli included one of the repeated sets of 80 words and a new set of 80 words. Finally, participants were asked to distinguish between the words that appeared in the study list (including one familiar and one novel set) and lures (including the unstudied familiar set and an unstudied novel set). Accuracy scores (hits minus false alarms) indicated substantially higher recognition performance for the novel words than for the repeated words, leading the researchers to conclude that novel stimuli are encoded better than familiar stimuli. This basic finding has been replicated many times (Aberg & Nilsson, 2001, 2003; Kormi-Nouri, Nilsson, & Ohta, 2005) and has had its most dramatic impact on neuropsychological and functional neuroimaging research aimed at understanding its neural mechanisms (e.g., Bunzeck & Düzel, 2006; Kirchoff et al., 2000; Kishiyama, Yonelinas, & Knight, 2009).

These findings, when considered alongside those showing mnemonic benefits of familiarity (i.e., *familiarity effects*), appear paradoxical. However, two factors may explain why both novelty and familiarity effects can be observed, albeit under different conditions. We refer to the information required of participants for successful memory discrimination as *discrimination demands*. Rather than being any special property of novel stimuli, the first factor concerns the possibility that novelty effects are explained by different discrimination demands for novel and familiar stimuli in paradigms where a novelty effect is obtained (Dobbins, Kroll, Yonelinas, & Liu, 1998; Kinsbourne & George, 1974). In such studies, better discrimination is typically required to reject familiar lures than to reject novel ones. To reject familiar lures, participants must use source information to determine whether the item was seen during familiarity induction only or was also seen in the encoding phase. In contrast, novel lures may be rejected by the absence of item familiarity alone, because these lures were not previously seen during the experiment. Because recognition accuracy scores are calculated with both the rate of hits and the rate of false alarms (either through direct subtraction or calculation of the discriminability index  $d'$ ) and because only familiar lures are subject to confusion arising from the presence of multiple possible sources (i.e., *source confusion*), it may not be appropriate to treat recognition accuracy scores for novel and familiar items in these experiments as comparable indices of episodic memory for the study phase. In support of this contention, Maddox and Estes (1997) found that separating the familiarity-induction and study phases by 24 hr led to fewer false alarms relative to no delay. This memory improvement, linked as it was with increased discriminability of sources, suggests that discrimination demands do play some role in memory for repeated materials. To circumvent this issue, some authors have focused on hits independent of lures, reporting novelty effects on the basis of hits alone (e.g., Aberg & Nilsson, 2003); however, high discrimination demands could easily produce lower accuracy by way of fewer hits, more false alarms, or both, depending on participants’ specific response bias.

A second possible explanation for why both novelty and familiarity effects are observed concerns the type of memory and familiarity under investigation. Studies of the kind reported by Robertson and Köhler (2007) involve manipulations of pre-experimental familiarity, whereas studies revealing novelty effects of the kind reported by Tulving and Kroll (1995) have manipulated experimentally induced familiarity. Although Ebbinghaus (1885/1913) reported mnemonic benefits of experimentally induced familiarity, his experiments assessed the number of repetitions required for list mastery, which could be considered a measure of implicit memory rather than of episodic memory. Therefore, it is possible that pre-experimental familiarity has beneficial effects on episodic memory, whereas experimentally induced familiarity has detrimental effects.

### Current Approach

What is needed to resolve the apparent paradox is a paradigm that (a) permits measurement of novelty and familiarity effects in a context where memory discrimination demands (distinguishing targets from lures) in novelty and familiarity conditions can be equated or controlled and (b) compares the impact of experimental versus pre-experimental forms of familiarity on memory. In Ex-

periment 1, we designed a novelty paradigm that contained a familiarity condition and a novelty condition, as is typical, but also included a second novelty condition in which repetitions of targets and lures occurred after the study phase and before the memory test. If stimulus novelty at initial presentation at study underlies the novelty effect, then performance should be reduced when repetition occurs before the study phase but not when it occurs afterward. On the other hand, if differences in discrimination demands are the determining factor in novelty experiments, performance should be equivalent in the two conditions. In Experiment 2, because familiarity effects in some classic studies are based on pre-experimental familiarity, whereas novelty effects are based on experimentally induced familiarity, we compared memory for stimuli that were novel, pre-experimentally familiar, or familiar because of experimental induction. In this experiment, we eliminated differences in discrimination demands by measuring memory for contextual features of encounters with familiar and novel information.

We conducted the two experiments with native English-speaking participants and used English and Asian proverbs as stimuli. These materials allowed us to introduce experimental familiarity by in-lab repetition of Asian proverbs and pre-experimental familiarity by real-world experience with English proverbs.

### Experiment 1

In Experiment 1, we directly evaluated whether novelty effects are related to stimulus novelty, to different discrimination demands in the familiarity and novelty conditions, or to both factors. We undertook this task by implementing a typical novelty experiment paradigm and adding a second novelty condition, which we named the *novel repeated* condition because stimulus repetitions occurred after study but before the memory test (Table 1). This condition differed from the familiarity induction condition in terms of the timing of stimulus repetitions, which took place after, rather than before, the study phase. As a result, novel repeated items were novel at the time of the study phase, whereas repeated items were not. In contrast, both novel and novel repeated items were novel at study but differed in terms of whether the stimuli were repeated following study along with new lures that were also repeated (Table 1). How accuracy fared in the novel repeated condition was central to the current experiment. If novelty effects arise from a stimulus novelty-based enhancement of memory encoding at study, then post-study repetition of targets and lures should have little effect. However, if novelty effects are a consequence of differences in discrimination demands between targets and lures,

then no memory advantage should be observed for the novel repeated condition over the familiarity induction condition, and memory for both conditions should be at a disadvantage relative to proverbs in the novel condition.

### Methods

**Participants.** Twenty-nine students of the University of Toronto, all native English speakers with normal or corrected-to-normal vision and hearing, participated in the experiment (15 female, 14 male; mean age = 19.8). Two additional participants were excluded because they did not engage in the experimental tasks. Participants were screened for the absence of neurological and psychiatric conditions and received academic credit or financial compensation for their participation. The protocol for this experiment was approved by the Ethics Review Board at the University of Toronto.

**Stimulus materials.** A list was created containing 150 Chinese and Japanese (Asian) proverbs translated into English (see the Appendix). Each proverb consisted of a complete sentence at least five words in length that included no archaic or vernacular language. Some of the Asian proverbs were modified from their literal translations to ensure smooth, concise reading in English and to minimize the use of culturally specific terms or concepts. Proverbs from this list were randomly allocated to the familiarity induction, novel repeated, and novelty conditions for each participant, thereby creating three sublists containing 50 items each. Each sublist was then split evenly between targets and lures, resulting in 25 targets and 25 lures for each condition (Table 1).

**Experimental tasks.** Participants were informed that the experiment consisted of several phases that together would take 1 hr to complete. Prior to each task, they were reminded that accuracy was the most important aspect of their response but that the speed of their response was also important.

The procedure consisted of four main phases: Phase 1 involved familiarity induction through in-lab repetition of proverbs. Phase 2 was an encoding phase in which proverbs were familiar or novel. Phase 3 involved repetition of a set of novel proverbs in the novel repeated condition. Phase 4 was a test phase, in which a recognition memory test was administered for the proverbs encountered in Phase 2 (Table 1). The pre- and post-study repetition phases allowed us to distinguish the effects on memory of familiarity induction (repetition before study) from the effect of repetition in general.

In a familiarity-induction session (Phase 1), participants were presented with 50 Asian proverbs that had been randomly allocated to the repetition condition (Table 1). Each proverb was

Table 1  
*Schematic of Experimental Protocol and Stimulus Exposure in Experiment 1*

| Phase and purpose  | Lists presented   | Task instructions           |
|--|---|-----------------------------|
| Phase 1: Three repetitions for familiarity induction       | Familiar <sub>targ</sub> and Familiar <sub>lure</sub>                                 | South American or Japanese? |
| Phase 2: Incidental encoding of proverbs in a valence task | Familiar <sub>targ</sub> , Novel repeated <sub>targ</sub> , and Novel <sub>targ</sub> | Rate valence (1–5)          |
| Phase 3: Three repetitions for familiarity induction       | Novel repeated <sub>targ</sub> and Novel repeated <sub>lure</sub>                     | South American or Japanese? |
| Phase 4: Test of memory for Phase 2 presentations          | All previous items plus Novel <sub>lure</sub>   | Rated valence earlier?      |

*Note.* Stimuli consisted of three lists of 25 Asian target proverbs (Familiar<sub>targ</sub>, Novel repeated<sub>targ</sub>, and Novel<sub>targ</sub>) and three lists of 25 Asian lure proverbs (Familiar<sub>lure</sub>, Novel repeated<sub>lure</sub>, and Novel<sub>lure</sub>).

visually presented for 3.5 s and was followed by presentation of a fixation cross for 0.8 s. During the time that each proverb was visible, participants were asked to indicate with a button press whether each proverb was South American or Asian in origin (although in fact all proverbs were Asian) to encourage deep encoding of the proverbs. Response key mappings were presented at the bottom of the screen. The full list was presented in random order three times; participants were told they had three tries and were asked to give each proverb fresh consideration each time.

During an incidental encoding phase (Phase 2), participants saw the 25 target familiar proverbs and 50 target novel ones (25 novel repeated and 25 novel proverbs; see Table 1). The materials were presented at the same rate and in the same format as in Phase 1. Participants rated the subjective valence of each proverb on a scale from 1 (*very negative*) to 5 (*very positive*), a task selected to help distinguish the study phase from other phases.

Post-study repetition (Phase 3) of the 25 novel repeated targets and 25 novel repeated lures took place following the encoding phase (Table 1). Aside from the use of different materials, Phase 3 was identical to Phase 1. Participant responses from Phases 1 through 3 were used only to ensure that participants engaged in the experimental tasks.

At the end of the experiment, a surprise recognition memory test was administered for the items presented in Phase 2. In this test, participants were asked to indicate with a button press whether each proverb was present in the Phase 2 study list and to disregard whether they had seen the proverbs in the familiarity induction phase. In other words, participants decided whether they had rated proverbs in terms of valence (the Phase 2 incidental encoding task) while ignoring any memories related to rating the cultural origin of proverbs (the Phase 1 and 3 repetition tasks). Target items in the test included all 75 proverbs from Phase 2, namely the 25 familiar, 25 novel repeated, and 25 novel proverbs (Table 1). Lures included 25 familiar proverbs that were seen in Phase 1 (familiarity induction) but not Phase 2 (study), 25 novel repeated proverbs that were seen in Phase 3 but not in Phase 2, and 25 previously unseen (novel) proverbs. The targets and lures were presented in random order, again at the same rate as in earlier phases.

## Results and Discussion

As a preliminary manipulation check, we first determined whether the previously reported novelty effect was replicated. We computed a  $d'$  measure of accuracy for the novelty condition, using the rate of hits to novel targets and the rate of false alarms to novel lures, and for the familiarity condition, using the rate of hits to familiar targets and rate of false alarms to familiar lures. As is typical in novelty studies,  $d'$  was higher in the novel condition than in the familiar condition,  $t(28) = 7.06$ ,  $p < .001$  (Figure 1). To limit the number of  $t$  tests performed in our analysis, we did not assess statistical differences in hits and false alarms. Numerically, there was a higher rate of hits for familiar items than for novel ones but also a higher rate of false alarms to familiar lures than to novel ones.

Having successfully replicated a novelty effect in our paradigm (with a characteristically large effect size, Cohen's  $d = 1.20$ ), we next explored the relationship between the familiar and novel repeated conditions: To the extent that stimulus novelty enhances memory for materials, memory for novel repeated items should be

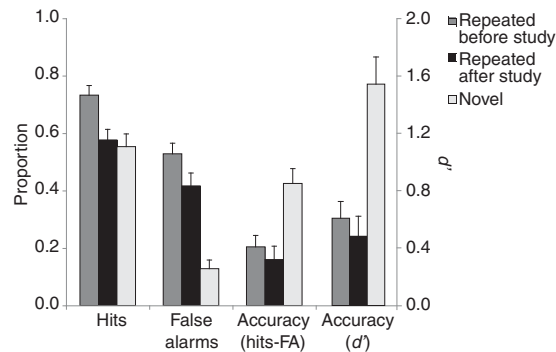


Figure 1. Hits, false alarms (FAs), and corrected accuracy scores for prestudy repetition items, novel repeated items, and novel items in the Experiment 1 memory test. In all figures, error bars denote +1 standard error of the mean.

superior. However, no novelty effect was observed in our  $d'$  measure of accuracy,  $t(28) = -1.19$ ,  $p = ns$ . As we observed in the comparison between familiar and novel items, there was a numerically higher rate of hits for familiar target items than for novel repeated targets and a higher rate of false alarms to familiar lures than to novel repeated lures (Figure 1).

We also compared memory between the novel repeated and novel conditions. Comparisons between these conditions can be interpreted as a direct test of the influence of discrimination demands. Accuracy scores were higher in the novel condition,  $t(28) = 5.36$ ,  $p < .001$ , indicating that the repetition of stimuli outside of the study phase did introduce significant levels of source confusion. Numerically, there was little difference in the rate of hits between the conditions—possibly reflecting the equivalence of the conditions during the study phase—although there was a higher rate of false alarms to novel repeated lures than to novel lures (Figure 1).

The current experiment strongly suggests that novelty effects, as typically measured, arise from different discrimination demands in novelty and familiarity conditions. Our findings indicate clearly that source confusion, rather than stimulus novelty, produces the novelty effect. The introduction of post-study repetitions of targets and lures reduced the memory advantage for items that appeared in the study phase for the first time (novel), just as prestudy repetition (familiarity induction) did for items that were familiar at study.

What is still needed to understand the impact of novelty and familiarity on memory is a comparison of their impact in a context where discrimination demands are equivalent across all conditions. We addressed this need in a second experiment. In addition, to examine potentially different memory consequences related to the form of familiarity investigated in classic studies and recent novelty studies, we compared the impact on memory of experimentally induced and pre-experimental forms of familiarity.

## Experiment 2

We used a three-phase design, with the phases corresponding to familiarity induction, study of novel and familiar materials, and memory testing (Table 2). To the extent that episodic memory incorporates critical information about the time and place of previous experiences, source information is a central attribute of

Table 2  
Schematic of Experimental Protocol and Stimulus Exposure in Experiment 2

| Phase and purpose   | Lists presented   | Task instructions                           |
|---|---|---|
| Phase 1: Three repetitions for familiarity induction              | Asian familiar <sub>1</sub> and Asian familiar <sub>2</sub>                       | South American or Japanese?                 |
| Phase 2: Incidental encoding of proverbs in two tasks             | English <sub>1</sub> , Asian familiar <sub>1</sub> , and Asian novel <sub>1</sub> | Rate vividness (1–5)                        |
| Phase 3: Test of memory for Phase 2 source information            | English <sub>2</sub> , Asian familiar <sub>2</sub> , and Asian novel <sub>2</sub> | Rate valence (1–5)                          |
| Phase 4: Identification of proverbs known prior to the experiment | All items   | Rated vividness or valence?                 |
|   | All items   | Learned today or know from prior knowledge? |

*Note.* Stimuli consisted of two lists of 20 English proverbs (English<sub>1</sub> and English<sub>2</sub>) and four lists of 20 Asian proverbs (Asian familiar<sub>1</sub>, Asian familiar<sub>2</sub>, Asian novel<sub>1</sub>, and Asian novel<sub>2</sub>).

episodic memory (Johnson, 2005; Tulving, 1983). Accordingly, to circumvent the discrimination demand confound observed in Experiment 1, we altered the memory test such that successful selection of targets required contextual information that was specific to individual encoding events. To provide distinguishing contextual information, participants rated half of each type of material on one scale (vividness) and the other half on another scale (valence); in the test phase, participants decided on which scale they had rated each proverb. Using this design, we compared the effects of pre-experimental familiarity, experimentally induced familiarity, and novelty on memory.

## Methods

**Participants.** Twenty-eight students at the University of Toronto, all native English speakers with normal or corrected-to-normal vision and hearing, participated in the experiment (15 female, 13 male; mean age = 19.8). All participants had less than 1 year of experience with Asian languages or culture, and all but one had at least one parent or guardian who was also a native English speaker. One additional participant was excluded for not engaging in the experimental tasks. Participants were screened for the absence of neurological and psychiatric conditions and received academic credit as compensation for their participation. The protocol for this experiment was approved by the Ethics Review Board at the University of Toronto.

**Stimulus materials.** Two base lists of proverbs were prepared, one containing 40 common English proverbs and the other 80 Asian proverbs (see the Appendix). Each of the Asian proverbs was unfamiliar to at least eight of 12 undergraduate students polled in a preliminary norming investigation, whereas each of the English proverbs was familiar to at least eight students from the same group. The Asian proverb list was randomly divided evenly between the repetition condition and the novelty condition to create two lists of 40 Asian proverbs.

**Experimental tasks.** The procedure consisted of three main phases: Phase 1 involved familiarity induction of Asian proverbs. Phase 2 was an encoding phase in which proverbs were novel, pre-experimentally familiar, or familiar through experimental induction. Phase 3 was a test phase in which a source memory test was administered for the proverbs encountered in Phase 2 (Table 2).

Familiarity induction (Phase 1) was the same as in Experiment 1. All participants decided three times whether 40 Asian proverbs were South American or Japanese in origin (Table 2).

During the study phase (Phase 2), participants saw the 40 pre-experimentally familiar English proverbs, 40 experimentally familiarized Asian proverbs, and 40 previously unseen (novel) Asian proverbs (Table 2). One randomly allocated half of each list (20 proverbs) was presented as part of a vividness-rating task: Participants were asked to rate, using a keyboard, the intensity of the mental imagery evoked by each proverb on a scale from 1 (*not vivid*) to 5 (*highly vivid*). The other half of each list was presented as part of a valence-rating task: Participants rated how positive each proverb was on a scale from 1 (*negative*) to 5 (*positive*). Participants completed each rating task in eight short blocks of six items (two from each list). The rate and manner of presentation were the same as in Phase 1, and responses from these first two phases were used only to ensure that participants engaged in the experimental tasks.

In a subsequent memory test (Phase 3), participants were shown the full set of 40 pre-experimentally familiar English proverbs, 40 experimentally familiarized Asian proverbs, and 40 novel Asian proverbs that were presented during Phase 2 (Table 2). Participants were asked to indicate, using a button press, whether they had rated each proverb for its vividness or its valence. The rate and manner of presentation were the same as in Phase 1, although the interstimulus interval began as soon as a response was detected.

At the end of the experiment, to confirm our assumption that participants would have better prior knowledge of English proverbs than Asian ones, we asked participants to complete a proverb identification task (Phase 4). In this task, they indicated with a button press which proverbs they knew prior to the experiment (Table 2). All materials used in the experiment were presented.

## Results and Discussion

In the Phase 4 proverb identification task, participants' categorization of English and Asian proverbs was generally consistent with our expectation that participants would know the English but not the Asian proverbs prior to the experiment (known English proverbs:  $M = 80.0\%$ ,  $SD = 14.0\%$ ; known Asian proverbs:  $M = 15.5\%$ ,  $SD = 12.1\%$ ). Accordingly, we proceeded to explore the effect of experimentally induced and pre-experimental familiarity on source memory measured in Phase 3. Source memory accuracy for novel proverbs was lower than that for pre-experimentally familiar proverbs,  $t(27) = 2.20$ ,  $p < .05$ , and experimentally familiarized proverbs,  $t(27) = 3.02$ ,  $p < .01$  (Figure 2). There was no difference in memory between the two types of familiar proverbs,  $t(27) = 0.41$ ,  $p = ns$ .

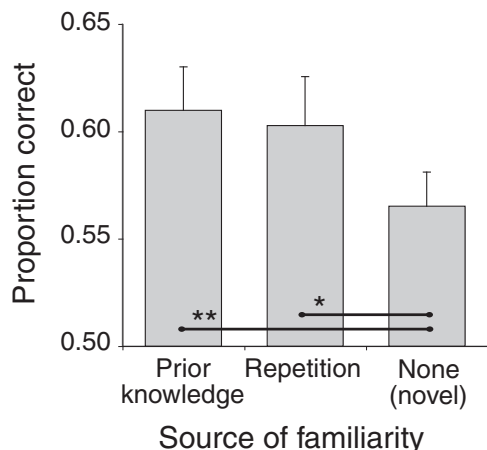


Figure 2. Source memory accuracy in Experiment 2 for pre-experimentally familiar proverbs, proverbs with experimentally induced familiarity, and novel proverbs. A significant difference is designated by \*  $p < .05$  and \*\*  $p < .01$ .

On the basis of these findings, we conclude that familiarity, rather than novelty, provides an episodic memory advantage when discrimination demands are made equivalent, whether familiarity is pre-experimental or experimental in nature. This pattern is consistent with the established view that prior memory representations facilitate the episodic encoding of information (e.g., Hintzman, 1988; Moscovitch et al., 2005; Tulving & Markowitsch, 1998; Wickelgren, 1979).

### General Discussion

In the current study, we attempted to resolve conflicting findings concerning beneficial or detrimental effects of novelty on memory by exploring two critical factors in experiments measuring novelty: (a) type of familiarity (experimentally induced vs. pre-experimental) and (b) discrimination demands (equal vs. unequal). In Experiment 1, we found that the novelty effect, as observed in the paradigm originally used to isolate it, is driven by differences in discrimination demands across conditions rather than by the influence of stimulus novelty. In Experiment 2, we found that type of familiarity did not account for the divergent findings of classical studies and novelty studies. We also found that context memory for familiar proverbs was consistently better than context memory for novel ones when discrimination demands were equated across conditions.

Although our results cast doubt on the hypothesis that novel information enhances episodic memory encoding (Tulving & Kroll, 1995), they do support the idea of a link between novelty and distinctiveness. Numerous serial list-learning experiments have shown that materials that are distinctive with respect to some intralist contextual pattern, such as a common font or semantic category, are better remembered than other items (Hunt & Lamb, 2001; von Restorff, 1933). In novelty experiments of the kind designed by Tulving and Kroll (1995), differences in discrimination demands may be considered a direct reflection of differences in distinctiveness. When events are based on entirely novel materials or even on materials that are novel within a particular laboratory visit, they are distinctive because they may be identified on the basis of item information alone (recognition memory). In contrast, events based on materials repeated during a partic-

ular session must be distinguished from similar past events involving the same materials on the basis of specific contextual information (source memory). Viewed in this way, the novelty effect may be appreciated as a distinctiveness phenomenon, with different levels of discrimination demands for novel and familiar items acting as a mechanism driving superior memory for novel items (rather than a confound clouding memory comparisons of novelty and familiarity conditions; see Talmi, Luk, McGarry, & Moscovitch, 2007, for similar arguments concerning the effect of emotion on memory). The case for novel items exerting beneficial effects on memory through increases in distinctiveness has been made by a number of authors (e.g., Hunt & Lamb, 2001; Kishiyama & Yonelenas, 2006; Tulving & Rosenbaum, 2006). However, and returning to one of the goals of the current study, our objective was to test whether retention of source or other contextual information from the study phase (i.e., episodic memory) differed for novel and familiar stimuli. Working toward this goal, differing discrimination demands for novelty and familiarity conditions (i.e., item memory for novel items vs. source memory for familiar ones) were indeed a confound. Once these were controlled, a familiarity advantage was observed in episodic memory. A controlled comparison of this type has been needed as a critical test of the novelty-encoding hypothesis, which concerns episodic memory (Tulving & Kroll, 1995). Drawing on our results, we argue that previous claims of beneficial effects of novelty on memory, including the proposal that information is encoded only to the extent of its novelty (Tulving et al., 1996), appear to be based on over-generalizations of effects arising from the distinctiveness of novel materials.

Questions are raised by our findings concerning the neuropsychological novelty effect. Hippocampal activation is often observed at the time of encoding in response to stimulus novelty (e.g., Poppenk et al., 2008; Tulving et al., 1996), which, in light of the known importance of the hippocampus for memory, has been interpreted as evidence that novelty and memory are linked (e.g., Lisman & Grace, 2005). However, direct evidence linking novelty and memory at the level of the hippocampus has been largely absent, with the exception of one study revealing overlapping novelty and subsequent memory responses in the hippocampus (Kirchhoff et al., 2000). Even this study did not evaluate how encoding of previously familiarized items occurs, leaving open the possibility that familiar items are encoded in other parts of the hippocampus. Indeed, a recent functional neuroimaging study revealed hippocampal memory-encoding regions that specifically predicted novelty-encoding success but also revealed other, more posterior hippocampal regions that specifically predicted familiarity-encoding success (Poppenk, McIntosh, Craik, & Moscovitch, 2010). Together with our current results, this evidence casts doubt on the existence of a specific, privileged link among novelty, the hippocampus, and subsequent memory.

It is important to note that we did not aim to identify the mechanisms that underlie the observed familiarity effects in episodic memory in the current set of experiments. It is possible that the effects arise because different types of information are encoded on initial and subsequent exposures to materials: Representations of a novel item may be established during a first exposure and may contain little information other than a specification of the stimulus itself. In contrast, contextual information, which is crucial for episodic memory as typically defined (Johnson, 2005; Tulving, 1983), may be the focus of encoding during subsequent exposures.

Alternately, item memory may be more likely to fail for novel items than for familiar ones, leading to related source memory failures. Because the current study was not designed to measure item and source memory simultaneously, our results do not allow us to state whether either of these possible processes underlie the observed phenomena; however, an assessment of these and other possible processes will be a fine objective for future research. We believe that, irrespective of the mechanisms that may underlie the observed familiarity effects, the phenomenon is of intrinsic interest in light of its implications for the novelty-encoding hypothesis and notions of familiarity enhancing episodic memory formation.

In summary, our findings indicate that novelty effects arise specifically when source confusion resulting from increases in discrimination demands reduces accuracy for familiar items. Differences in discrimination demands, rather than differences between pre-experimental, compared with experimentally induced, forms of familiarity, appear to explain the long-standing inconsistency between the results from novelty-encoding experiments and those from classical experiments. Thus, our findings call into question the core notion of the novelty-encoding hypothesis that information is encoded into long-term memory networks to the extent that it is novel (Tulving & Kroll, 1995) and support the traditional perspective that memory formation is facilitated by familiarity.

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(Appendix follows)



## Appendix

### Proverb Stimuli Used in Experiments 1 and 2

#### Asian Proverbs

1. You can't wrap fire with paper.
2. When you bow, bow low.
3. When a rat wants to die, it bites a cat's tail.
4. A single hair can hide mountains.
5. Govern a family as you would cook a small fish.
6. A good man in an evil society seems the greatest villain of all.
7. Below the navel is neither religion nor truth.
8. A fallen lighthouse is more dangerous than a reef.
9. What you cannot avoid, welcome.
10. Visiting friends is easier than living with them.
11. Fortune seldom repeats, but troubles do.
12. Dead songbirds make a sad meal.
13. Pain is only weakness leaving the body.
14. Not every day can be a feast of lanterns.
15. One grows most tired when standing still.
16. Careful feet can tread anywhere.
17. Too much enthusiasm betrays a lack of it.
18. If you want a thing long enough, you don't.
19. A tree grown in the wind has strong roots.
20. It's better to be a live beggar than a dead king.
21. Pain is easier to endure than an itch.
22. Ragged hats hide many good faces.
23. Those arriving in darkness depart at nightfall.
24. Those who hide their faults plan to make more.
25. The older the ginger, the more it bites.
26. If you chase two rabbits, you'll catch neither.
27. He who hurries cannot walk with dignity.
28. Crisis is opportunity in a dangerous wind.
29. Far waters cannot quench near fires.
30. Defeat isn't bitter if not swallowed.
31. Doctors are careless about their own health.
32. One murder makes a villain, millions a hero.
33. Clumsy birds seek early flight.
34. Don't hit a dog with a sausage.
35. Don't insult the crocodile until you've crossed the river.
36. Toast bread but don't toast your hand.
37. Talk does not cook rice.
38. There are no secrets in the world.
39. Use power to curb power.
40. Arrogance always loses the battle.
41. Better to be quarreling than lonesome.
42. Dream different dreams on the same bed.
43. Treat thoughts as guests and wishes as children.
44. If a child is uneducated, blame his parents.
45. Three glasses of wine end a thousand quarrels.
46. Desperate men will leap a wall.
47. Courtesy never offended anybody.
48. He that will steal an egg will steal an ox.
49. Don't walk in the sun if your head is made of wax.
50. Those with one leg never stumble.
51. If you pay peanuts, you get monkeys.
52. When you hear hoofbeats, think horses, not zebras.
53. More than polite is rude.
54. The rich fight with the poor's might.
55. A hasty man drinks his tea with a fork.
56. Enough is as good as a feast.
57. Appear like a god and disappear like a phantom.
58. Where a chest lies open, a righteous man may sin.
59. An ant may destroy a dam.
60. Never dine in a restaurant with a thin chef.
61. If you have something to say, say it tomorrow.
62. If you want an audience, start a fight.
63. The first time's a favour, the second a rule.
64. Falling into the ditch makes you wiser.
65. Be polite with one who can help you.
66. Beautiful flowers grow from mud.
67. A just cause seen but not pursued is cowardice.
68. A bad spouse is one hundred years of bad harvest.
69. Quiet rivers have flowery banks.
70. Those who cannot boast cannot succeed.
71. Don't open a shop unless you like to smile.
72. He who dies with the most toys is still dead.
73. All the world's crows are black.
74. For every wise man, there are ten thousand idiots.
75. Be just before you're generous.
76. Faded ink is truer than the best memory.
77. Politeness wins the confidence of princes.
78. After victory, tighten your helmet.
79. The door to charity is heavy.
80. None know a son like his father.
81. Gold is tested by fire and man by gold.
82. Poverty and ugliness are difficult to hide.
83. A bucket shop profits when the wind blows.
84. A heart in love with beauty never grows old.
85. Water bears and sinks ships.
86. Nuts come to those with no teeth.
87. In shallow holes, moles make fools of dragons.
88. Keep your broken arm inside your sleeve.
89. Even a rabbit will bite when cornered.
90. Mockery is a work of slander.
91. He who builds by the road has many surveyors.
92. You can't hide an elephant with a lotus leaf.
93. Pouring water on hot stones changes little.
94. When a tree falls, monkeys scatter.
95. A blind cat catches only dead rats.
96. Wealthy are those with nothing to lose.
97. Dig the well before you're thirsty.
98. A courageous foe is better than a cowardly friend.
99. If you look good, watch your breath.

(Appendix continues)

100. Losing comes of winning money.
101. Indulgences have more victims than swords.
102. Kill one soldier to warn a hundred.
103. A clear conscience never fears midnight knocking.
104. Those sleeping with dogs will rise with fleas.
105. An old horse may die in someone's keeping.
106. Patience is a bitter plant with sweet fruit.
107. No famous food is delicious.
108. An unseeded plant won't bud.
109. Flies don't visit eggs without cracks.
110. Don't cover your ears if you're stealing a bell.
111. There's no shame in asking those of lower status.
112. To know the road ahead, ask those coming back.
113. All towers stand on the same ground.
114. One happiness scatters a thousand sorrows.
115. Watching men work takes little effort.
116. Talented hawks hide their nails.
117. Catch fish with two hands.
118. Two barrels of tears will not heal a bruise.
119. When you throw dirt, you lose ground.
120. Urge people to work, not to eat.
121. You have to walk before you can run.
122. Don't insult the cook if you're hungry.
123. Don't kindle a fire you can't put out.
124. Act as if none were beside you.
125. If you want respect, respect yourself.
126. A rumour goes in one ear and out many mouths.
127. Knowing is easier than doing.
128. Hawks will not pick out hawks' eyes.
129. Diseases come on horseback, but steal away on foot.
130. The weak can never forgive.
131. Those who are thirsty dream of drinking.
132. Don't ride an elephant to catch a grasshopper.
133. Better a flawed diamond than a flawless pebble.
134. Doing may be a mistake, but not doing is a worse mistake.
135. If a string has one end, it has another.
136. Fear not going slowly, only standing still.
137. Knowledge is treasure no thief can touch.
138. Falling hurts least for low fliers.
139. If your words are worthless, don't give advice.
140. Measure your throat before you swallow a bone.
141. Rotten wood cannot be carved.
142. A bird can only roost on one branch.
143. Don't cut off your nose to spite your face.
144. Don't let the falcon loose until you see the hare.
145. Some prefer carrots and some prefer cabbage.
146. A tiger-rider can never dismount.
147. Solving one problem keeps a hundred at bay.
148. The best soldiers are not warlike.
149. Two leaps per chasm is fatal.
150. When you trip, don't blame your foot.

### English Proverbs

1. A little knowledge is a dangerous thing.
2. There's no such thing as a free lunch.
3. Don't put all your eggs in one basket.
4. Time flies when you're having fun.
5. Home is where the heart is.
6. All work and no play makes Jack a dull boy.
7. Beauty is only skin deep.
8. If you scratch my back, I'll scratch yours.
9. A penny saved is a penny earned.
10. Rome wasn't built in a day.
11. Actions speak louder than words.
12. An ounce of prevention is worth a pound of cure.
13. All is fair in love and war.
14. Necessity is the mother of invention.
15. It's better to have loved and lost than never to have loved at all.
16. When the going gets tough, the tough get going.
17. Strike while the iron is hot.
18. Good things come to those who wait.
19. All that glitters is not gold.
20. One man's trash is another man's treasure.
21. Laughter is the best medicine.
22. You win some and you lose some.
23. A picture is worth a thousand words.
24. Ask and you will receive.
25. He who laughs last, laughs best.
26. It takes two to tango.
27. You can't teach an old dog new tricks.
28. The more things change, the more they stay the same.
29. If you can't say something nice, don't say anything at all.
30. You can't make an omelette without breaking eggs.
31. Absence makes the heart grow fonder.
32. Money makes the world go around.
33. Variety is the spice of life.
34. A watched pot never boils.
35. Too many cooks spoil the broth.
36. Desperate times call for desperate measures.
37. The road to hell is paved with good intentions.
38. If you can't beat them, join them.
39. No news is good news.
40. Two heads are better than one.
41. There's more than one way to skin a cat.
42. You can lead a horse to water but you can't make it drink.
43. Give the devil his due.
44. A friend in need is a friend indeed.
45. The spirit is willing, but the flesh is weak.
46. A rolling stone gathers no moss.
47. All good things must come to an end.
48. A jack of all trades is master of none.
49. Behind every successful man is a woman.
50. Beauty lies in the eye of the beholder.

(Appendix continues)

51. When it rains, it pours.
52. An apple a day keeps the doctor away.
53. A fool and his money are soon parted.
54. Don't bite the hand that feeds you.
55. Every cloud has a silver lining.
56. Revenge is a dish best served cold.
57. What goes up must come down.
58. The ends justify the means.
59. He who hesitates is lost.
60. Great minds think alike but fools seldom differ.
61. It's no use crying over spilt milk.
62. A dog's bark is worse than its bite.
63. Be careful what you wish for.
64. Many hands make light work.
65. The early bird gets the worm.
66. Birds of a feather flock together.
67. Lightning never strikes twice in the same place.
68. Where there's a will there's a way.
69. If you can't take the heat, get out of the kitchen.
70. Don't count your chickens before they hatch.
71. The pen is mightier than the sword.
72. Home is where the heart is.
73. You can't have your cake and eat it too.
74. All's well that ends well.
75. The best things come in small packages.
76. A bird in the hand is worth two in the bush.
77. Honesty is the best policy.
78. A coward dies a thousand times before his death.
79. Two wrongs don't make a right.
80. You can't judge a book by its cover.

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