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REPLY

When Does Intent Matter for Memory? Bridging Perspectives With Craik

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In his commentary, Craik (2023) argued that while intentional remembering might be effective for some populations and memory tasks, these are the exception, and that intent will not benefit memory if incidental encoding induces optimal processing. While we agree on many points, we maintain that in most situations the processes induced by the intention to remember are more effective than those induced by deep semantic processing alone. We show that effects of intent appear with a variety of tasks such as free recall, cued recall, source memory, item recognition, in both mixed and pure lists, and when studying individual words, word pairs, or word–image associations. Thus, the beneficial effects of intent generalize over tasks, list–compositions, and study materials. There are also little individual differences in the effect of intent in healthy young adults—most participants (86% out of 336 participants over six experiments) show a beneficial effect. We review evidence that the intent to remember strengthens item–context bindings in episodic memory, but that such effects could be masked and not measurable in subsequent memory tests, unless intrusions are taken into account. We agree that in principle incidental encoding could induce optimal processing, but we do not find the existing evidence convincing. We provide additional novel data that directly addresses Craik's (2023) concerns and we propose ways to further investigate how intention enhances memory. We conclude with a joint statement, coauthored by Craik and ourselves, that synthesizes our converging perspectives and current understanding of the impact of intent on memory.

Public Significance Statement

Prior to our initial article (Popov & Dames, 2023), it was widely believed that the intent to learn was irrelevant for episodic long-term memory; our research revealed that this assumption is false. In this reply, we show that effects of intent appear with a variety of tasks, and for the vast majority of healthy young adults, regardless of their strategy use. By doing so, we not only directly address concerns Craik (2023) raised in his comment to our work, but we conclude with a joint statement, coauthored by Craik and ourselves, that synthesizes our converging perspectives and current understanding of the impact of intent on memory.

Keywords: intent, memory, learning

When and how does the intention to learn benefit episodic long-term memory (LTM)? In our recent article (Popov & Dames, 2023), we claimed that intent always matters for episodic memory, even after deep semantic processing of items. This position challenged the long-accepted view in the field that if information is processed deeply, it does not matter whether people intend to remember it or not (Craik & Tulving, 1975; Hyde & Jenkins, 1969, 1973; Johnston & Jenkins, 1971; Mandler, 1967; Oberauer & Greve, 2022; Till et al., 1975).

In his commentary, Craik (2023) agreed that intent might sometimes be beneficial for memory, but he argued that "when incidental learning conditions induce encoding operations that are wholly compatible with retrieval operations, intentionality will confer no further benefits" (p. 21). He provided several examples in which intentionality does not boost memory, including list-wise manipulations of memory intent, recognition tasks, and in specific populations, such as older adults with deficits in cognitive control. Craik suggests that the mixed-list designs employed in our study may be an

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We are grateful to Klaus Oberauer for thoughtful comments on a previous version of this article. We would like to express our gratitude to Fergus I. M. Craik for his contributions to our joint statement and for engaging in such a stimulating exchange with us. A preprint version of our article is publicly available on the OSF framework at https://psyarxiv.com/gwd4s. The data and analysis script for the reported experiment are available at venpopov/intentional-incidental-ltm-paradox (github.com) under Experiment 15.

Hannah Dames served as lead for writing–original draft and served in a supporting role for methodology. Vencislav Popov served as lead for data curation, formal analysis, and visualization and contributed equally to methodology. Hannah Dames and Vencislav Popov contributed equally to conceptualization, project administration, writing–review and editing, and investigation.

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exception to the general rule—that while intentionality clearly induces more extensive item–context and interitem processing in our tasks, this is not beneficial to all types of retrieval. While we agree that intention alone does not magically improve memory but rather leads to further processing of the items, here, we argue that, nevertheless, intention-driven processes are more effective than those induced by deep semantic processing. Although Craik raises important points about when intentionality benefits learning, carefully examining the relevant data reveals that intent has a much more ubiquitous effect on memory than Craik suggested.

Our main goal is to show that rather than an exception to the rule, effects of intent appear in most memory tasks with most participants. Craik is correct that we cannot claim intent always matters—just like no amount of observations of white swans would allow us to conclude that only white swans exist. Be that as it may, we are yet to observe a single "black swan"—that is, a task which conclusively shows no effects of intent for the general population. Figure 1 illustrates a summary of results regarding the effect of intent on different types of memory tests in healthy, young populations (please note, that there is evidence suggesting that the effect of intent does not show for older adults; see Craik, 1977 and Troyer et al., 2006). In this reply, we critically review existing arguments and data for this position, as well as present new data and reanalysis of existing data addressing Craik's concerns regarding the generality of our findings.

Craik's (2023) Arguments

It is difficult to disagree with Craik's main position, stated on page 302:

> Intentionality will improve learning and memory only when the learner carries out operations that are appropriate for the subsequent retrieval test, and were not induced incidentally by the environment or by an orienting task. If the intention to learn results in no further relevant encoding operations beyond those induced incidentally, intentionality will have no further effect on memory performance.

The crux of the matter is whether there is any evidence that incidental learning ever results in optimal encoding that cannot be improved by further processing.

Argument 1: Traditional Pure-List Experiments Show No Benefit of Intent

The main difference between our and previously reported studies is the experimental design—we used a mixed-list within-subject design where all items are processed deeply, but only some of them must be remembered. In contrast, most prior studies used a pure-list between-subject design in which only one group of participants were told about the memory test in advance (intentional learning condition), while for another group the memory test comes as a surprise (incidental learning condition). In mixed-list studies, intent has a significant effect on free recall, while pure-list studies show no effect of intent on correct recalls.

Craik argues that the effects of intent in our mixed-list experiments are an exception to the general rule, that if information is elaborated deeply, there is no additional benefit of intent. We disagree. Although Craik provides examples of several experiments (p. 302) that found no added benefit of intent compared to an incidental semantic processing task (e.g., Hyde & Jenkins, 1969, 1973; Johnston & Jenkins, 1971; Oberauer & Greve, 2022; Postman & Adams, 1956), all these studies relied solely on pure-list designs. The studies he cites found no benefit of intent, but they only used pure-list designs. Our primary argument in Popov and Dames (2023) is that incidental learning groups have weaker memory traces but can lower their retrieval threshold during testing at the cost of more intrusion errors. The experiments reported in Popov and Dames, and our reanalysis of extant pure-list data (Oberauer & Greve, 2022) support this notion. Our work thus explains why previous studies that relied on pure-list designs failed to observe any beneficial effect of intent.

Regardless of whether one is convinced by our theoretical explanation, on its own, the observed increase in intrusion rates in the incidental versus the intentional learning group demonstrates an effect of intent in pure-list designs and it contradicts the idea that the level of processing carried out on items in the incidental and intentional learning groups is equivalent.

Since none of the previous pure-list studies reported intrusion rates or made the relevant data available, it is unclear whether they support the idea that both incidental and intentional learning lead to optimal encoding in pure-lists. However, both our own (Popov & Dames, 2023) and Oberauer and Greve's (2022) pure-list experiments were similar to previous ones, and since they show higher intrusion levels in the incidental learning group, it is likely that older studies would show the same.

To summarize, if there is a "general rule" (as Craik suggests), current evidence is pointing toward the conclusion that intent strengthens item-context bindings and that the benefits of intent are measurable in most memory tasks (free recall, cued recall, item recognition, source memory), study designs (mixed- and pure-lists) and materials (individual words, word pairs, and word–image associations). Craik admits that "intentionality will be beneficial, however, when the learner initiates further operations that are relevant to the retrieval test but were not induced by the incidental task" (p. 5). We agree with that point but so far, there is very little evidence for the idea that deep semantic processing ever results in a similar level of encoding strength as reached by intentionality. The magnitude of the intent effect varies across test types, but it seems to be omnipresent. Thus, the relevant question becomes not whether intent helps memory, but what determines its varying effectiveness in different memory tests.

Argument 2: Insufficient Depth of Processing in Our Experiments

Craik suggests that our experiments may be a "special case" where an effect of intent can be observed. This argument is partly based on the concern that our incidental processing task "may provide inadequate processing operations" (p. 302) despite the semantic judgment.

Specifically, Craik argues that the semantic categorization task in our experiments may have resulted in weaker encoded representations than other categorization tasks. This is supposedly reflected in the low recall performance for process-only items in our experiments (∼2%–10% in different experiments). In comparison, in Craik and Tulving's (1975) Experiment 3, recall performance for incidentally encoded items was 28%. Craik provides an example of a semantic orienting task that leads to insufficient processing: questions that elicit a "no" response are recalled and recognized

Figure 1

Summary of Findings for Healthy, Young Adults (Discussed in Craik, 2023, and Our Work) Regarding the Effect of Intent on Different Types of Memory Tests

	Mixed-lists	Pure-lists
Free recall	✓ Popov & Dames (2022); Troyer et al., (2006)	✓ * Popov & Dames (2022); Reanalysis of Oberauer & Greve (2022)
Cued recall	✓ Popov & Dames (2022)	? **
Recognition	✓ Craik (1977); Dames & Popov (this reply); Popov & Dames (2022)	?
Source memory	✓ Popov & Dames (2022)	✓ Popov & Dames (2022)

Note. Single asterisk "*" denotes as measured by differences in intrusion rates; also found in reanalysis of prior pure-lists experiments. Double asterisk "**" denotes Popov and Dames (2023) source memory findings suggest that there would be an effect of intent on cued recall in pure-list designs—source memory tasks are associative memory tasks in which a contextual element of the experience is cued to be retrieved by the item presented in that context. This is analogous to a cued-recall task in which one item is cued by another. See the online article for the color version of this figure.

less often than questions that elicit a "yes" response (Craik & Kester, 2000). Craik seems to suggest that our processing task may suffer from similar issues. However, our categorization task did not require a yes/no response, but rather asked participants to respond whether items are larger or smaller than a soccer ball. Memory performance did not differ between "larger" and "smaller" responses.

The more critical point is Craik's suggestion that people could complete the size-judgment task using minimal processing, explaining a beneficial effect of intent benefits performance. He points out that people spend more time making the size-judgments for intentionally encoded items relative to incidentally encoded items. However, in our between-subject pure-list experiments using the same task, increased judgment times for the intentional learning group did not lead to higher levels of recall. If Craik's argument were correct, intentional learning would predict more correct recalls even in our between-subject experiments, but this was not observed.

In principle, one could replicate the effect of Intent using different processing tasks. However, without theoretical reasons to predict which judgments could be performed with minimal processing, one could always raise the same objection if there is a difference between the intentional and incidental learning conditions. Thus, no potential data would put this concern to rest. Nevertheless, during the reviewing process of our original paper, we decided to replicate our results using a different processing task. In Experiment 11, each word was presented with a real-world scene, and participants had to judge how often they might encounter the object in that scene on a scale from 1 (*never or rarely*), 2 (*sometimes*), or 3 (*often or always*). The task likely induced overall deeper processing than the size-judgment task, as it increased recall by ∼8% relative to the otherwise identical Experiment 10. Still, the large recall difference between remember and process-only items in mixed lists remained demonstrating that similar results can be observed even using a deeper processing task.

To summarize, it seems unlikely that low recall values found for our process-only words in our mixed-list experiments are attributable to insufficient processing in our encoding task.

Argument 3: Differences Between Mixed and Pure-List Designs Are Frequently Observed in Directed Forgetting Studies

According to Craik, there is more differential processing of items in mixed lists compared to pure lists, which could explain why the effects of intent differ in both designs. Craik bases this assumption on directed forgetting studies that also obtain varying results depending on the type of test and study design. The directed forgetting effect refers to the finding that memory for to-be-remembered (TBR) items is typically better than for items instructed to-be-forgotten (TBF). There are directed forgetting effects in recognition for the item–method but not consistently for the list–method of directed forgetting (e.g., Basden et al., 1993; Geiselman et al., 1983).

However, comparing the present pure-list designs and the ones employed in directed forgetting studies is not ideal, as intent is induced differently in the two paradigms. In list–method-directed forgetting, all participants learn the first list intending to remember all its items. Only after studying List 1, they are instructed to forget that list. Thus, initial encoding of List 1 items is identical between the remember and forget groups because both groups originally think they will have to remember all items. In contrast, when we manipulate intent to remember in pure-list (e.g., Craik & Tulving, 1975; Oberauer & Greve, 2022; Popov & Dames, 2023), incidental learning participants never intend to remember the items of the list.

Thus, the mechanisms and effects in the list-method and item-method directed forgetting studies are qualitatively different (see Golding & MacLeod, 1998 and Sahakyan et al., 2013, for reviews). Theories of list–method directed forgetting assume that participants deliberately change their internal context (e.g., Sahakyan & Kelley, 2002), or inhibit List 1 items upon the forget instruction, which impairs access to List 1 memories. In contrast, in item-method directed forgetting, memory instructions appear immediately after the offset of a word and participants immediately know whether to remember or forget each word. Due to the different cognitive mechanisms involved, differences between list-wise and item-wise directed forgetting are to be expected.

Whereas item–method-directed forgetting is similar to our mixed-list design, list–method directed forgetting is quite different from the pure-list manipulations of intent. While parsimony would be nice, we cannot explain the differences between pure and mixed-list designs in directed forgetting and in intentional learning with the same mechanisms. What participants expect at different times during the study procedure differs too much between the two paradigms.

Argument 4: Mixed Lists Result in More List-Wide Interitem Processing for Remember Items Than for Process-Only Items

Despite the differences between list-method directed forgetting and pure-list designs discussed here, there are strong similarities between item-method directed forgetting and our mixed-list designs. Therefore, comparing differential processing of TBR items in item-method directed forgetting and in our mixed-list experiments might be useful. Specifically, Craik argues that mixed lists in either paradigm may "provide more opportunity for selective rehearsal" (p. 305), explaining the substantial benefit of intentionally over incidentally learned words. Craik asks if such further selective processing of remember items could entirely explain the observed benefits of intent (p. 305). Likewise, elsewhere in his commentary, Craik suggests that, in our experiment, participants are probably less motivated to "carry out list-wide organizational processing" (p. 10) of the process-only items but did so for remember items.

We agree that selective rehearsal or other forms of list-wise organizational processing may contribute in part to the effect of intent—as we argued, intent motivates additional processing of remember items. Yet, in contrast to Craik, we do not think that the effect of intent is a specific, special case of mixed-lists: Participants engage in selective rehearsal or list-wide organizational processing of TBR (but not TBF) items when they intend to remember the information, and this occurs not only in mixed-list design but also in pure-list designs.

In pure-list designs, because participants in the Incidental learning condition only make semantic judgments to individual items, they have no reason to engage in list-wise organization processes. For instance, because participants in the Incidental learning condition never intend to remember the items, they do not rehearse that information, while people in the Intentional learning condition do. Thus, in both pure- and mixed-lists, there is more list-wide and interitem processing for intentionally learned items. As a result, memory is better in the intentional learning condition in both types of designs. That is, there is no fundamental difference in the effect of intent between pure- and mixed-lists. In pure-list designs, the resulting beneficial effect of intent is not measurable in recall performance because participants can shift their retrieval threshold, but it is measurable in the proportion of intrusions.

Argument 5: Intent Matters Only for Specific (e.g., Recall) but Not All (e.g., Recognition) Memory Tests

While Craik agrees with our conclusion that intent often enhances learning (p. 304), he suggests that intent will be helpful only when the test specifics demand it. For instance, a previous study by Challis et al. (1996, Experiment 1) observed a beneficial effect of intent in free recall but not word-fragment completion or recognition tests (see p. 13). The argument is that the effect of intent does not show in all types of memory tests—even in mixed-list designs.

Although these experiments used a within-subject manipulation, they still used a pure-list design, and it is possible that participants also shifted their retrieval threshold for each memory test, explaining the lack of effect in recognition or word-completion tests. Additionally, it is difficult to interpret the results of these experiments in the context of our paper, because, as pointed out by Craik himself, in the Intentional learning condition participants did not have to make a semantic judgment of the items. Thus, the level of semantic processing was not equated between the Incidental and Intentional learning conditions.[1] As with free recall, this question is best resolved with mixed-list designs; in support of his argument, Craik points out that the difference in recognition memory between Process-only and intentional items was only 5% in the recognition task we reported in the original paper. Yet, in that experiment, memory performance was at ceiling, potentially underestimating the effect of Intent.

We followed Craik's suggestion and ran another recognition memory experiment to reduce overall performance and evaluate the effects of intent without ceiling effects. We collected data on Prolific ($N =$ 102 participants), and we increased the number of items on the list from 30 to 60 to get performance off ceiling. As before, participants judged the size of all items relative to a football, but they were asked only to remember half of them. After the size-judgment, a random half of the items on the list were followed by a "remember" instruction; the other half of the items only needed to be processed ("process-only" items). Following our original experiment, participants expected a free recall test, but as a surprise, they were given a recognition test. Instead of a two-forced choice recognition task, we asked participants to perform a single-item recognition task where 60 old words were interspersed with 60 new words at test, and participants had to provide confidence judgments on a scale from 1 (*sure new*) to 6 (*sure old*). All other procedural details of the experiment were identical to Experiment 8 in Popov and Dames (2023).

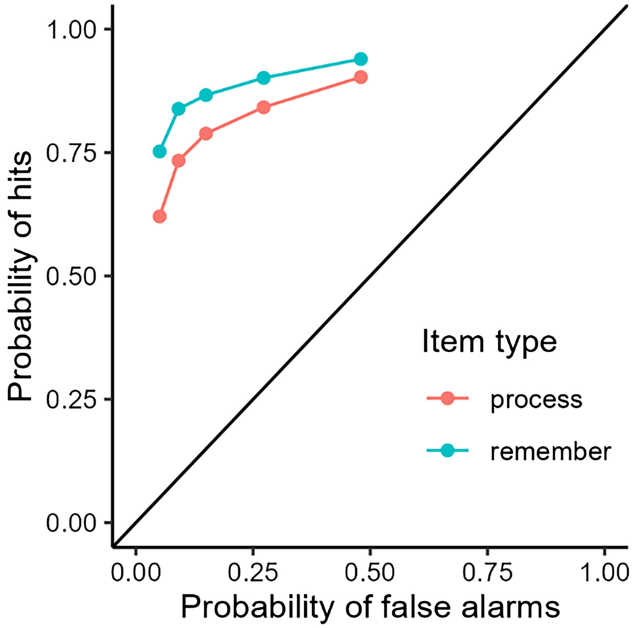
Figure 2 shows the ROC (receiver operating characteristic curve) constructed from the confidence judgments for old and lure items. As can be seen, recognition memory was far from ceiling, and performance was better for remember relative to process-only items.[2]

What can we conclude from this experiment? Craik proposed that "additional processing associated with intentional learning is likely to enhance organizational and interitem processes that are particularly beneficial to free recall tests" and not for recognition tests

[1] Furthermore, even in the data presented by Craik later in his commentary (Craik, 1977, Table 2) young adults demonstrate a clear effect of intent in the recognition test, speaking against the assumption that intent does not improve recognition memory. Surprisingly, the pattern is reversed for the Troyer et al. (2006) data which show an effect of intent for younger adults in the recall but not the recognition condition.

[2] Transparency and openness: The data and analysis script for this experiment are available at venpopov/intentional-incidental-ltm-paradox (github .com) under Experiment 15.

Figure 2
ROC Curves for Process-Only and Remember Items in Experiment 1



Note. ROC = receiver operating characteristic curve. See the online article for the color version of this figure.

that do not depend on organizational processes. These data do not support this idea. In summary, the extant data, combined with our previous report, demonstrates that effects of intent can be found in free recall (on levels of correct recall in mixed lists and on intrusion levels in pure lists); cued-recall/ source memory (in both pure and mixed lists); and recognition (on recollection levels in mixed-lists; unclear whether the effects appear in pure lists). These tasks encompass the most explicit episodic list-memory paradigms. As it stands, the effect of intent on episodic memory seems to be ubiquitous and robust, rather than a special case for mixed-list free recall conditions, as Craik suggested in his commentary.

Argument 6: Individual Differences in Strategies and Cognitive Control Levels Qualify the Role of Intentionality in Learning

We fully agree with Craik that "the processing operations carried out under intentional conditions likely vary considerably depending on the learner's" strategies (p. 304). Since we claimed that intent improves memory by inducing additional processing, the effect of intent would depend on whether this additional processing itself is beneficial for memory. As a result, people who do not or cannot engage in successful additional processing would not benefit from the intent to remember. Craik presents data from two studies (Craik, 1977; Troyer et al., 2006) where items were processed either incidentally or intentionally in a mixed list.[3] Whereas the data reveals a strong intent effect for young adults in some but not all memory tests, the effect is not consistent for older adults. This is a compelling exception to the general rule we argued for that intent almost always benefits memory.

Be that as it may, older adults show a myriad of cognitive deficits, and it is not clear what underlies their inability to effectively encode intentionally learned information. If it is true that the effectiveness of intentional learning will depend on the strategies that people use, it might be useful to examine individual differences in strategy use and whether they can predict individual differences in the effectiveness of intentional learning. Fortunately, in Experiment 10 of Popov and Dames, we collected self-reports on strategy use in the mixed-list free recall condition. The details of the strategy analysis are reported in the Appendix, but to summarize the results: although we observed differences in self-reported strategy use (e.g., imagery, sentence-generation, rehearsal, grouping, etc.), the type of self-reported strategy did not affect the magnitude of the intent effect. Hence, intent matters despite interindividual differences in strategy use. Please note that these are self-reported strategies, and it is unclear whether participants followed them exclusively. Ideally, future studies would experimentally manipulate different types of strategies instead of relying on self-reports (see Future Directions and Lessons Learned section).

Another way to look at the generality question is to ask how many of our healthy young participants show an effect of intent in free recall, as measured by the difference in recall probability for remember versus process-only items. To answer this question, we combined data from all 336 participants who took part in six mixed-list free recall experiments in our original study. Of those, 86% had better recall for remember relative to process-only items; Figure 3 shows the distribution of individual differences for the effect of intent.

In summary, we found no evidence that strategy use determines the effectiveness of intentional encoding instructions in healthy young adults, and that the vast majority of our participants show an effect of intent, bolstering our original claim that intent matters, if not always, at least most of the time for most people.

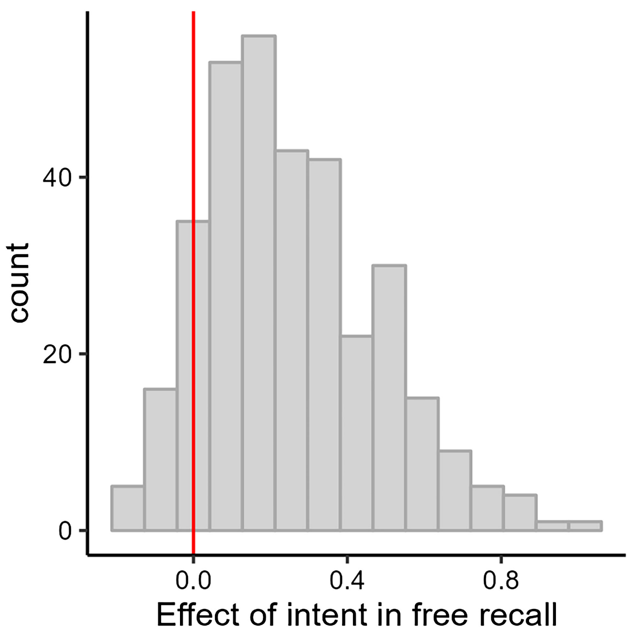
Future Directions and Lessons Learned

We agree with Craik (2023) that the nature of processing carried out on an item determines performance in subsequent memory tests. Our view is that intention strengthens item-context bindings through some form of extended processing–but we do not currently know the nature of these processes. While intent may have a general positive effect on memory performance because it strengthens item-context bindings, we agree that it is necessary to consider its limitations and potential interactions with other cognitive factors. Further research is needed to elucidate the precise mechanisms underlying the effect of intent on memory, and to determine its applicability to real-world learning. Here are some potential future directions that may help to uncover such processes:

1. It is crucial to uncover conditions under which the difference in memory performance between incidental (i.e., process-only) and intentional (i.e., remember) learning conditions can be reduced to a minimum. For instance, experimentally manipulating strategy use of participants (as done in a recent study by Bartsch et al., 2022) and analyzing their impact on the magnitude of the intent effect could help to

[3] Again, intentionally learned items were not additionally given a semantic processing task. Hence, the findings are not directly comparable to our results.

Figure 3
Distribution of Individual Differences in the Effectiveness of Intent in Six Mixed-List Free Recall Experiments Reported by Popov and Dames (2023)



Note. See the online article for the color version of this figure.

uncover whether (and if so, which) specific encoding strategies strengthen item–context bindings. Because our study suggests that an effect of intent is often masked in pure-list designs, future studies investigating such boundary conditions of the beneficial effect of intent should opt for mixed-list designs or (at least) consider intrusion errors when employing pure-list manipulations.

2. Although intent might induce additional processing (such as selective rehearsal or list-wide organization, as suggested by Craik), it is also plausible that intent directly affects the strength of learning (determining how strongly or rapidly item-context bindings are encoded into memory) without the need to assume the engagement of a specific encoding strategy. For instance, the mechanism by which intent improves encoding could involve directing memory resources toward the Remember items, facilitating the formation of strong and distinctive memory traces (e.g., as suggested in the source of activation confusion, short SAC, model by Popov & Reder, 2020). The interesting question here is whether it would be possible to experimentally "force" participants to boost learning of an item in such a way without the need for forming the intent to remember that information. In other words, assuming that the allocation of (e.g., encoding) resources is under an individual's control (Popov et al., 2019), are there ways individuals can allocate different amounts of resources to certain items without asking them to remember that information? Testing whether the effect of intent can still be observed under different study material (e.g., use of emotional or infrequent words) could be one way to study that question.
3. An intriguing avenue for further investigation would involve directly manipulating participants' strength of motivation (akin to intent by providing memory instructions) to determine its significant impact on subsequent performance in a memory test. For instance, by demotivating participants to remember information, even when they are aware of an upcoming memory test, and observing a subsequent decrease in memory performance, we could underscore the critical role of intent/motivation on memory strength. Such a finding would align with our present research, where we compared memory performance between individuals who engaged in semantic processing without expectations of a memory test (thus not fully motivated to memorize the material) and those who were additionally informed about the memory test (thus fully motivated to engage in semantic processing). Our study highlights that semantic processing is not an all-or-none process but varies based on an individual's motivation level. Thus, moving forward, we encourage researchers to include motivation as a factor when exploring memory performance, as it can significantly influence subsequent memory strength.
4. Last, future research should determine the applicability of our findings to real-world learning scenarios. In everyday life, the information we intend to remember is much different from the learning of word lists. Potentially, in everyday life, we remember information without the explicit intent to remember it because incoming information is always embedded in a context that contains self-referential cues (e.g., because we typically select the environment we interact with). That is, Oberauer and Greve (2022) may have been correct in assuming that, in everyday life, most information we encounter could potentially be relevant to oneself and is thus stored in episodic LTM regardless of intent. To test this possibility, future studies could test whether the difference between remember and process-only items is measurable for meaningful study content. This could be achieved by asking participants to read sentences instead of single words. Participants in the incidental learning condition could judge whether a target word fits into a given sentence or not.

Constraints on Generality

Craik (2023) criticized our original claim that intent always matters for memory, and he was right to do so. Are we committing the same error of overstatement with saying that intent matters for memory, most of the time for most people? Although we have shown that the effects of intent appear in all explicit list-memory tasks, perhaps these tasks do not sufficiently represent the claim "most of the time?" After all, as we described in the Future Directions and Lessons Learned section, further research on that topic is needed.

We disagree that these tasks are not representative: In our work, we are making a theoretical claim about the basic functioning of the episodic memory system, and virtually all computational models of episodic memory are concerned with explaining the effects of only list-based memory tasks, all of which show an effect of intent. With regards to the claim "for most people," one could also argue whether our Western, educated, industrialized, rich, and democratic (WEIRD) sample (Heinrich et al., 2010) is representative of the general population—it is clearly not. But in the absence of theoretically grounded reasons why such a fundamental property of the memory system would vary by culture, we must base our conclusions on the available evidence—namely that 86% of people in our sample showed an effect of intent and that this effect did not depend on individual differences in strategy use. We are open to revising our conclusion in light of future data, but the currently available evidence clearly points to a ubiquitous effect of intent on episodic memory.

Conclusion

While there are points of both agreement and disagreement with Craik's commentary, the former outnumber the latter. We agree with Craik's overall sentiment that intent on its own does not magically strengthen memory. As we already stated on page 69 in our paper: "Although we agree with Craik and Tulving (1975) that intention, just by existing, does not boost learning, it is clear from our results that intention causes additional processing on top of the deep processing orienting task, and that this processing can be unmasked in mixed-list free recall designs or in source memory forced-choice tasks in which thresholds play no role in performance."

Our point of disagreement is that the observed effects of intent in our experiments *are not* an exception to a general rule. Instead, in this response, we argue that intent to remember motivates additional processing on top of the semantic analysis, leading to better memory regardless of the research design. Previously reported null effects of intent in pure-lists designs can be fully explained by assuming that participants in the Incidental learning condition lower their retrieval threshold to compensate for weak memory traces. Doing so allows them to retrieve as many Process-only items as in the Remember condition, however, at the expense of higher false alarm rates. In agreement with Craik (p. 18), we consider it likely that this idea of a shifting retrieval threshold is relevant for many previous studies that showed no effect of intentionality when a pure-list design was used (see our reanalysis of Oberauer & Greve, 2022).

Given that an effect of intent is observed in both mixed-lists and pure-list designs when accounting for increased intrusion error for the incidental learning condition, and in several types of memory tests (see newly reported studies here), there seems to be overwhelming evidence for our conclusion that intent strengthens memory for item-context bindings over and above the level reached by deep-sematic processing. Consequently, we disagree with Craik that "optimal encoding operations for a subsequent retrieval condition may be induced incidentally by a semantic orienting task, or induced intentionally by operations initiated by the learner" (Craik, 2023, p. 302).

In summary, if we adopt the notion of a shifting retrieval threshold and acknowledge that prior studies may have overlooked the effects of intent due to their reliance on pure-list designs, then there is little support for the original claim that intent does not result in qualitatively different processing than deep semantic processing. We therefore conclude that intent matters above and beyond deep processing of items. In contrast to what Craik (2023) suggests, we argue that this is the general rule and not an exception.

Converging Perspectives: Key Insights From Discussions With Fergus Craik Around This Reply

Even before submitting his commentary, Craik had reached out to us, and this led to a fruitful exchange that continued over the following months. After drafting this reply, we met with the goal of finding common ground. We found that generally, our perspectives on learning and intentionality share more commonalities than differences. With this paragraph, it is our goal to inform interested readers, who have been following the published exchanges on this matter, about how we resolved any discrepancies between our views during these discussions. Ultimately, we reached a consensus that, for most people, intent matters for episodic memory most of the time, which is also the title of this reply. Specifically, the current view on the effects of intentionality can be summarized as follows:

> People can store information in episodic memory without intending to remember it, and their subsequent memory performance will depend on the quality of the processing during encoding and the degree to which these processes match the nature of the memory test. However, people can also strengthen these representations by explicitly intending to remember them for the future. In such cases, intent will lead to additional processing which can strengthen item-context associations over and above the encoding strength reached by deep semantic processing alone. The nature of the additional processing that intent induces will result in a variety of encoding operations depending on the individual's understanding of memory processes, their consequent encoding strategies, and their ability to carry out the required operations. The beneficial effect of such further processing will depend on retrieval conditions, the person's response threshold, and the extent to which relevant operations were not induced by the incidental task.

We drafted this statement together with Craik. He confirmed it is in line with his current perspective on intentionality and learning and agreed to its publication in the current form. We all agree there is a clear need for further work on the question of which process(es) or mechanism(s) strengthen item–context bindings based on intent to remember. In that regard, we can make a number of suggestions: It would be useful to attempt to find boundary conditions under which the effect of intent in a mixed-list design disappears. This would allow us to narrow down a potential set of candidate processes underlying the observed intent effect. Combined, our review of the literature in favor for the ubiquitous effect of intent on memory, the consensus statement, and the directions for future research provide a valuable resource for the memory community about the current view on the role of intentionality in episodic memory and about what remains to be learned.

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(*Appendix follows*)

Appendix

Additional Analysis of Strategy Use

In this additional experiment, we wanted to test the possibility that in Popov and Dames (2023), participants engaged in elaborative encoding strategies, for example, by using visual imagery or story generation to link Remember items together. In the context of this reply, we were particularly interested to explore to what extent the strength of the intent effect on memory is modulated by the use of specific strategies. If we could identify a strategy or a set thereof where the strength of intent was the largest, this would bring us one step closer to pinpointing the processes that may underly the beneficial effect of intent (i.e., which cognitive process boosts memory for an item when we intent to remember it). To examine whether the effect of intent on memory can be explained by the use of elaborative encoding strategies, at the end of Experiment 10 in Popov and Dames (2023), we asked participants to describe in their own words (in as much detail as possible) the strategy they used to remember the words. Each of us then independently coded each strategy description as an instance of one of the categories reported in Table A1.

For each strategy, we coded both a main category and a subcategory. For example, we considered sentence generation, story generation, song generation, and grouping by semantic similarity to all be instances of a broader category which we called Schema, because they all reflect elaborative encoding into a schematic structure. Since some of the individual subcategories were reported by only a few participants, we report analyses based on the broader categories only. If participants indicated that they used two strategies, we coded both reported strategies. Because we coded both strategies for participants who reported two strategies, the total N in Table A1 is larger than the number of participants in that experiment. If participants reported more than two strategies, we coded the overall strategy as "Other." The two independent coders agreed in 84% of the cases. For the remaining cases, we discussed each in turn until we agreed on a common categorization.

Figure A1 shows the effect of item-wise memory instructions in the within-subject condition as a function of the reported encoding strategies (the effect of strategy use in the between-subject design

Table A1

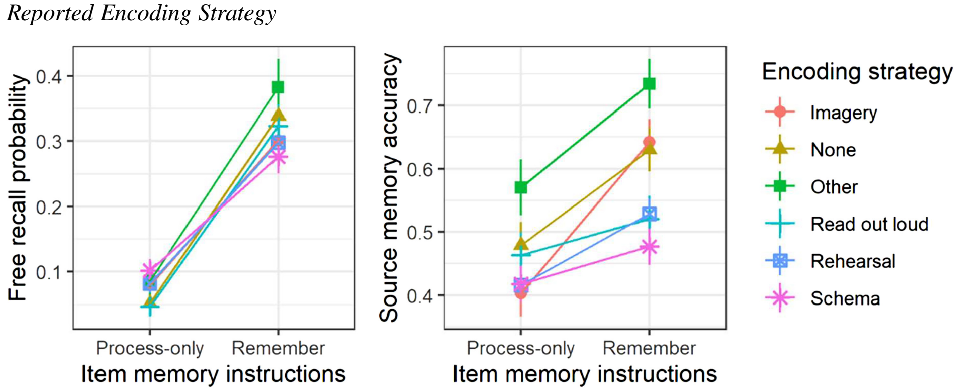
Categories Used to Code the Encoding Strategies Reported by Participants in the study of Popov and Dames (2023, Experiment 10)

Main category	Subcategory	Comment	N
Imagery		Used visual imagery	13
Rehearsal	Cumulative	Rehearsed all words in order when a new word appeared	26
	Individual	Rehearsed repeatedly the current word until a new word appeared	2
	Unclear	When it is unclear if they did cumulative or individual rehearsal	2
Schema	Sentences	Linked words together in a sentence	2
	Story	Linked words together into a coherent story	9
	Song	Linked words together in a song	1
	Grouping by similarity	Grouped semantically similar words	9
Read out loud		Spoke each word out loud after it appeared	14
None		Either explicitly said passive reading, or reported that they did not use any strategy	14
Wrote		Wrote down words on paper	6
Other		Unique strategy, unclear strategy, or ≥3 strategies reported	9

Note. N refers to the number of participants that reported each strategy.

Figure A1

Free Recall (Left) and Source Memory (Right) Performance in the Final List of the Within-Subject Condition of Experiment 10 in Popov and Dames (2023) as a Function of Memory Instruction and Reported Encoding Strategy



Note. See the online article for the color version of this figure.

condition could not be evaluated since naturally we did not ask the Incidental learning group what their learning strategy was). For free recall, there was no main effect of strategy use on overall memory performance (BFnull = 1.4 × 108); more importantly, strategy use did not interact with the intentionality instructions (BFnull = 1.1 × 107), suggesting that the effect of intent was independent of the encoding strategies used by participants. For source memory accuracy, we again found no evidence for a main effect of strategy use (BFnull = 2.04 × 107); nor an interaction with intentionality instructions (BFnull = 2.8 × 107). Taken together, these results indicate that strategy use did not mediate the effect of intent in Experiment 10 (Popov & Dames, 2023).

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