

The Testing Effect

One of the most reliable findings in the science of memory is also one of the most counterintuitive: trying to retrieve information from memory strengthens that memory more than studying the information again does. This is the testing effect, also called retrieval practice, test-enhanced learning, or active recall. The act of pulling a fact back to mind is not a neutral readout that leaves the memory unchanged; it is a learning event in its own right, one that makes the retrieved information more durable and easier to recall in the future. The phenomenon was first documented nearly a century ago (Gates, 1917) and has since become one of the best-supported principles in cognitive psychology (Roediger & Butler, 2011). It is included in this series because it has a direct and constructive bearing on legal practice: it explains why an early, well-conducted interview can protect a witness's memory, a point developed at length in the companion paper [Remembering Changes Memory](#).

This paper explains what the testing effect is, why retrieval strengthens memory, a striking illusion that leads people to undervalue it, and how the principle translates from the classroom, where it has been most studied, to the interview room.

What the Effect Is

The decisive early experiment showed that retrieval does more than provide an extra exposure to the material. Carrier and Pashler (1992) compared learners who tested themselves on information with learners who spent the same amount of time studying the complete information, and those who retrieved remembered more later. Because the two groups had equal exposure, the advantage had to come from the act of retrieval itself, not from additional time on the material. The most cited demonstration extended this to meaningful prose: students who read a passage once and then took practice recall tests retained far more a week later than students who reread the passage the same number of times, even though the rereaders had performed better on an immediate test (Roediger & Karpicke, 2006). A meta-analysis of 159 studies confirmed the effect is robust, with retrieval practice outperforming restudy by a moderate and dependable margin (Rowland, 2014), and retrieval practice has been shown to produce more durable learning than even elaborate study techniques such as concept mapping (Karpicke & Blunt, 2011). A consistent feature is that the benefit grows over time: the gap between tested and restudied material widens as the delay to the final test lengthens.

Why Retrieval Strengthens Memory

Retrieval helps because it is effortful in a productive way. On the retrieval-effort account, a successful retrieval that requires more effort produces a larger memory benefit than an easy one, so the very difficulty of bringing something to mind is part of what consolidates it (Pyc & Rawson, 2009). This is one instance of a broader principle that conditions which make learning feel harder in the moment, so-called desirable difficulties, often produce better long-term retention (Karpicke & Roediger, 2008). A complementary account holds that testing changes the distribution of memory strengths, sharply boosting the items a learner can already retrieve while leaving unretrieved items behind, so that a test, in effect, sorts and strengthens what it touches (Kornell, Bjork, & Garcia, 2011). Two practical qualifications follow. The benefit depends on retrieval being largely successful, so tests that are too hard, attempted without any feedback, yield less; providing the correct answer as feedback restores and amplifies the gain. And the size of the effect varies with the material, tending to be smaller for very complex content than for the discrete facts on which much of the research has been done (Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013).

The Metacognitive Illusion

A remarkable and well-replicated finding is that people do not believe the testing effect even as they exhibit it. When learners are asked to predict how well they will remember material, they expect rereading to serve them better than self-testing, and they prefer to reread; yet on the later test the rereaders, who felt the most confident, perform the worst (Roediger & Karpicke, 2006). The illusion arises because rereading produces a comfortable sense of fluency, the material feels familiar and easy, and people mistake that present ease for durable learning. Retrieval practice, by contrast, feels effortful and error-prone in the moment, so it is undervalued despite producing better retention. Surveys of how students actually study confirm that most rely on rereading and few use self-testing as a learning tool (Dunlosky et al., 2013). The lesson reaches beyond education: the value of an early, effortful retrieval is easy to underestimate precisely because it does not feel as reassuring as passive review.

From the Classroom to the Courtroom

The same principle that improves student learning bears on the preservation of witness memory. An early, open-ended interview is, in effect, an exercise in retrieval practice: by drawing the witness to recall the event in their own words, it can strengthen the memory and slow its forgetting, not merely record it. This is part of why structured tools built on memory research, the Cognitive Interview and the written Self-Administered Interview, improve the completeness and durability of later recall when administered soon after an event (Gabbert, Hope, & Fisher, 2009; Hope, Gabbert, Fisher, & Jamieson, 2014). The metacognitive illusion adds a cautionary corollary for investigators and institutions: because the protective power of an early high-quality retrieval is easy to undervalue, its importance may be neglected in practice. One essential qualification keeps the principle balanced. Retrieval strengthens whatever is retrieved, which means that if the early interview is contaminated by leading or suggestive questioning, practice can entrench errors as readily as accurate detail; the protective benefit depends on the retrieval being open-ended and non-suggestive. The double-edged nature of remembering, that the same retrieval which preserves memory can also reshape it, is the subject of the companion paper [Remembering Changes Memory](#), and the two papers should be read together.

Special Issues in Legal Practice

The principles described above apply with equal force to every party in a legal proceeding. Memory operates the same way regardless of who is asking the questions, and the science summarized here favors no side. What differs between the parties is not the science but the vantage point — the particular places where memory issues tend to surface, and the particular errors each party is best positioned to guard against. The two summaries below identify those recurring issues. They are offered for orientation, not as litigation strategy; in every case the controlling question is what the evidence in that case will, and will not, support, and the expert's role is to inform the trier of fact rather than to advocate for either side.

Special Issues for Prosecutors

For the State, the testing effect supports the value of obtaining an early, high-quality, open-ended account from a witness, because that initial retrieval can strengthen the memory and reduce later forgetting, and the prosecution is well positioned to show that memory preserved through the witness's own early recall reflects sound practice rather than rehearsal or coaching (Gabbert et al., 2009; Hope et al., 2014). The error to guard against follows from the same science. Retrieval strengthens whatever is retrieved, so an early interview conducted with leading or suggestive questions can consolidate error as durably as truth, and the metacognitive illusion may lead investigators to undervalue the care that the first retrieval requires. The safeguard is to ensure that early interviews are open-ended and non-suggestive, to record how the account was first elicited, and to corroborate its content rather than relying on the mere fact that the witness has consistently repeated it.

Special Issues for Defense

For the defense, the testing effect is relevant to how a witness's account was first elicited and what early retrieval may have done to it. Because retrieval consolidates whatever is recalled, a suggestive or leading initial interview can entrench inaccurate details and make them more confidently held and more resistant to correction at later interviews and at trial, and the defense is well positioned to examine the form of the first retrieval rather than assuming that a consistent, fluent account is therefore accurate (Roediger & Karpicke, 2006). The corresponding error to guard against is overclaiming. The testing effect does not show that an early-interviewed account is unreliable; on the contrary, an open-ended early retrieval generally protects accurate memory, and consistency is not by itself a defect. Responsible cross-examination and expert testimony should focus on whether the initial retrieval was open-ended or suggestive, and on what was consolidated by it, rather than treating the strengthening of memory through early recall as inherently suspect.

References

- Carrier, M., & Pashler, H. (1992). The influence of retrieval on retention. *Memory & Cognition*, 20(6), 633–642. <https://doi.org/10.3758/BF03202713>
- Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J., & Willingham, D. T. (2013). Improving students' learning with effective learning techniques: Promising directions from cognitive and educational psychology. *Psychological Science in the Public Interest*, 14(1), 4–58. <https://doi.org/10.1177/1529100612453266>
- Gabbert, F., Hope, L., & Fisher, R. P. (2009). Protecting eyewitness evidence: Examining the efficacy of a self-administered interview tool. *Law and Human Behavior*, 33(4), 298–307. <https://doi.org/10.1007/s10979-008-9146-8>
- Gates, A. I. (1917). Recitation as a factor in memorizing. *Archives of Psychology*, 6(40).
- Hope, L., Gabbert, F., Fisher, R. P., & Jamieson, K. (2014). Protecting and enhancing eyewitness memory: The impact of an initial recall attempt on performance in an investigative interview. *Applied Cognitive Psychology*, 28(3), 304–313. <https://doi.org/10.1002/acp.2984>
- Karpicke, J. D., & Blunt, J. R. (2011). Retrieval practice produces more learning than elaborative studying with concept mapping. *Science*, 331(6018), 772–775. <https://doi.org/10.1126/science.1199327>
- Karpicke, J. D., & Roediger, H. L., III. (2008). The critical importance of retrieval for learning. *Science*, 319(5865), 966–968. <https://doi.org/10.1126/science.1152408>
- Kornell, N., Bjork, R. A., & Garcia, M. A. (2011). Why tests appear to prevent forgetting: A distribution-based bifurcation model. *Journal of Memory and Language*, 65(2), 85–97. <https://doi.org/10.1016/j.jml.2011.04.002>
- Pyc, M. A., & Rawson, K. A. (2009). Testing the retrieval effort hypothesis: Does greater difficulty correctly recalling information lead to higher levels of memory? *Journal of Memory and Language*, 60(4), 437–447. <https://doi.org/10.1016/j.jml.2009.01.004>
- Roediger, H. L., III, & Butler, A. C. (2011). The critical role of retrieval practice in long-term retention. *Trends in Cognitive Sciences*, 15(1), 20–27. <https://doi.org/10.1016/j.tics.2010.09.003>
- Roediger, H. L., III, & Karpicke, J. D. (2006). Test-enhanced learning: Taking memory tests improves long-term retention. *Psychological Science*, 17(3), 249–255. <https://doi.org/10.1111/j.1467-9280.2006.01693.x>
- Rowland, C. A. (2014). The effect of testing versus restudy on retention: A meta-analytic review of the testing effect. *Psychological Bulletin*, 140(6), 1432–1463. <https://doi.org/10.1037/a0037559>

Legal Authorities

- Daubert v. Merrell Dow Pharmaceuticals, Inc., 509 U.S. 579 (1993).
- Frye v. United States, 293 F. 1013 (D.C. Cir. 1923).
- Kumho Tire Co. v. Carmichael, 526 U.S. 137 (1999).

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