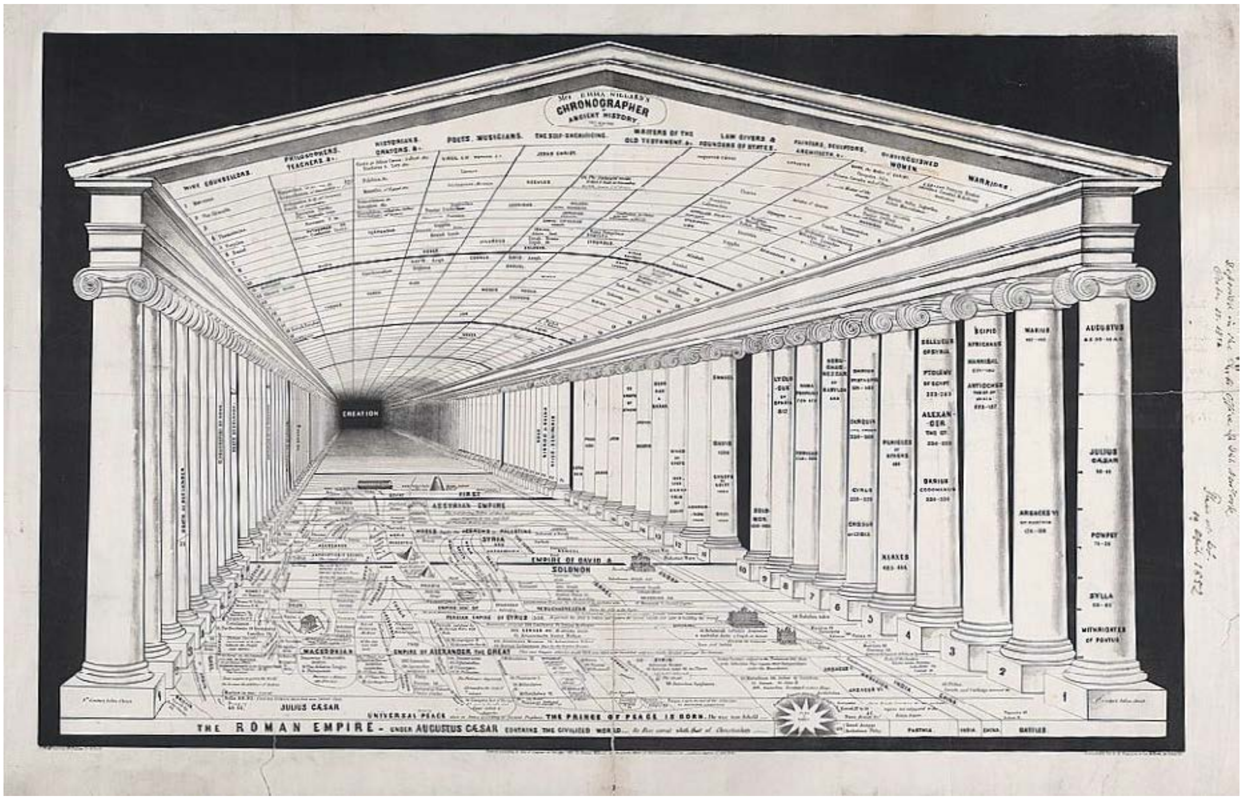

The *Temple of Time* (pictured), developed by Emma Willard in the mid-19th century to teach world history, is an example of the memory palace, a mnemonic device developed centuries ago. The author of this article received special permission from the Library of Congress to view an original *Temple of Time* wall hanging and workbook to aid in this research. (LOC photo)

Memory Techniques in the Intelligence Community

A Tool for Improving Analysis?

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This article presents the findings of an experiment to test the effect of memory training on intelligence analysis. The results indicate a significant relationship between memory training and a boost in recall of key details from intelligence reporting. This strongly suggests a link between memory optimization and analytic performance. Many organizations require memory testing and training. In contrast, the Intelligence Community places tremendous demand on intelligence analysts' memory, but it does not provide training or testing to improve this skill. Overall, this article recommends a modest IC investment in memory training to better support policymaking.

Memory is a core component of human cognition and an essential skill for intelligence analysis.[a] Analysts rely on memory for every facet of their job—from evaluating vast amounts of data to briefing and answering policymakers' questions. Recent studies in psychology and neuroscience show that memory training can improve cognitive performance. Top universities, tech companies, special operations units, and foreign intelligence services require memory testing and training. Yet, the US Intelligence Community does not provide its workforce with memory testing, education, or training.

The IC places tremendous demand on intelligence analysts' memory.[b] The measure of an analyst is determined in large part by their ability to recall details quickly and accurately. Thus, the IC's effectiveness is linked to the individual analyst's memory. The IC trains its analysts to mitigate cognitive biases but does not train them to improve cognition. Analysts develop expertise through education and experience but do not learn to optimize their memory to use that knowledge. The result is inconsistent performance across the IC workforce. This inefficient system lowers the quality of intelligence analysis provided to policymakers.

Intelligence analysts must contend with ever-increasing amounts of information. They risk cognitive overload even as they use artificial intelligence and machine learning. Improved human memory can reduce this burden by optimizing information organization and recall skills—freeing up mental resources for critical and creative thinking—tasks only humans can perform. As Sherman Kent noted, "Whatever the complexities of the puzzles we strive to solve, and whatever the sophisticated techniques we may use to collect the pieces and store them, there can never be a time when the thoughtful man can be supplanted as the intelligence device supreme."[1]

Improving the cognition of analysts formed an important part of the intelligence literature in the 1980s and 1990s. Richards Heuer devoted an entire chapter of *The Psychology of Intelligence Analysis* to memory improvement. He began this chapter claiming that "Differences between stronger and weaker analytical performance are attributable in large measure to differences in the organization of data and experience in analysts' long-term memory."[2] Similarly, in 1984, Robert Sinclair explored methods to harness heuristics and memory techniques to overcome memory's limitations in his groundbreaking Center for the Study of Intelligence monograph, "Thinking and Writing: Cognitive Science and Intelligence Analysis."[3]

This article seeks to modestly advance Heuer and Sinclair's work on the role of memory in intelligence analysis. It is the first academic work to test the memory tasks associated with intelligence analysis and the first memory study to involve IC members. It is also the first study to train memory strategies to improve analysts' performance and, thereby, the analysis provided to policymakers.

Theory

We theorize that intelligence analysts' performance is a function of three independent variables. The first independent variable is education, which involves Intelligence Community Directives (ICDs), analytic tradecraft, product creation, and briefing. The second independent variable is experience, which involves on-the-job practice and deployments. The third independent variable is memory, which involves encoding, organizing, and recalling the knowledge gained from education and experience. All three independent variables must be highly present for optimal analyst performance. Memory optimization is lacking in the IC, which results in inconsistent overall

a. This article is derived from the author's master's thesis, *Think Again: Intelligence Analysis and the Art of Memory*, submitted to the faculty of the National Intelligence University, June 2024.
b. See Dennis J. Gleeson Jr., "Artificial Intelligence for Analysis: The Road Ahead," *Studies in Intelligence* 67, No. 4 (December 2023).

performance. This inconsistent performance results in suboptimal intelligence analysis provided to policymakers.

Intelligence analysts receive education in IC doctrine and tradecraft as part of their professional development. They gain experience in the office and in the field. However, the IC does not train its analysts on how to encode and recall what they have learned. Intelligence analysts are not trained to optimize their memory to gain a return on investment in education and experience. Simply put, analysts do not learn how to learn. This is a gap in analyst professional development. Therefore, we assume the variables of education and experience are present and adequate causal mechanisms of the dependent variable of recall performance. Thus, we focused solely on the independent variable of memory. Specifically, we focused on memory's impact on recall performance, which is the dependent variable of the experiment.

Data Collection

We used a posttest-only control group experiment to test the hypothesis that memory training increases intelligence analysts' ability to recall key details, thereby improving their performance. The experiment subjects were randomly divided into two study groups: a memory training group and a control group. The memory training group received training on mnemonic devices that use mental imagery and spatial contextualization—specifically elaborative encoding, the major system, and the memory palace. The control group received no training. Both groups were tested with the same instrument. The testing involved both groups reviewing notional unclassified intelligence reporting containing 15 sequential pairings of actors with actions. After five minutes, participants were tested on their ability to match the actors and actions in the correct sequence. One week later, both groups were retested with the same instrument to gauge long-term memory retention of the material. All participants completed a demographic survey to identify moderating variables that could impact the results.

Data collected from the tests and surveys was used to determine if memory training increased analysts' ability to recall key details from reporting. Differences between the memory training group and control group were analyzed statistically via the t-test and Analysis of Variance (ANOVA) methods to interpret the results. The threshold for statistical significance was a p-value below 0.05. In other words, for the differences in mean values to be considered significant, there is at least a 95-percent confidence that they are not due to random chance.

Participants

All 30 participants in this study were National Intelligence University (NIU) graduate students, US federal employees, and active members of the IC. Every participant self-identified as an intelligence analyst or an intelligence officer with experience performing intelligence analysis.[a] All participants completed a 10-week refresher course on intelligence analysis at NIU approximately two weeks before the experiment. Participants ranged in age between 26 and 43, with a mean age of 33. Fourteen participants self-identified as female (46.6 percent), which is in line with the 2022 federal workforce and civilian labor force female ratios of 45.0 percent and 46.7 percent, respectively.[4] Military members of the IC comprised 56.6 percent of participants. Approximately one-third of participants (30 percent) claimed prior exposure to memory techniques in their personal experience. This ratio provided suitable variance to test the impact of prior exposure to memory techniques on recall performance and durability in this study. The study's sample size and variance were sufficient to perform analysis of variance (ANOVA) and t-tests.

a. In this article, intelligence officer denotes a civilian or service member in the IC who is not a career analyst. It does not denote rank.

Test Procedure

Data collection occurred in person at NIU in a distraction-free classroom environment. Consent forms, tests, and surveys were hand-distributed and administered on paper copies. No digital media was used in data collection. The author of this article and at least one NIU faculty member were present for all data collection events.

Data collection proceeded in three steps. First, participants were asked to memorize 45 items of information in five minutes. The information consisted of one sheet of paper with 15 pairs of actors with associated actions in sequential order. After the five minutes, the information sheets were collected, and participants were given a five-minute break. Participants could socialize in place but were not permitted to discuss the test or write anything down. Second, after the five-minute break, participants were provided a blank information sheet and asked to recall and record as much of the previous information as possible from memory. Third, one week later, participants were again provided the blank information sheet and asked to recall and record the information from memory. Participants were asked not to write down any test information and had no prior knowledge of the one-week retest prior to its execution as a "pop quiz."

Experiment design

- Participants (N= 30) were randomly assigned to a memory training group or control group.
- Participants were given five minutes to memorize test material.
- Participants' recall was tested at five minutes and one week.

Finally, a demographic survey collected information on three moderating variables that could impact participant's performance in the study. These moderating variables were 1) prior exposure to memory techniques; 2) intelligence community experience; and 3) education level. A separate descriptive survey collected participants' overall views of the experiment and their opinions on the potential for the IC to provide memory training to its analysts.

Scoring

Incorrect responses were assessed with respect to the sequence of items in the original list. This involved counting the number of responses that were out of sequence and assigning a numerical value to the number of places out of sequence the item occurred. For example, if the sixth items on the list were written in the eighth place, a sequence value of 2 was assigned to that incorrect response. This is based on the concept of positional distance developed by Alec Solway, et al.[5] In this study, the Sequence Index was introduced to correct for the phenomenon that an item recalled out of order necessarily introduces a second error in the place where the item would have appeared, whether or not the other item was recalled correctly.[6] For example, recall of the sequence 1,2,3,4,5 as 1,3,2,4,5 contains two positional errors of distance 1 resulting from the single reversal of (2,3).[7] The Sequence Index corrects for this and allows for straightforward computation of the magnitude of overall sequence accuracy. This allows for a more accurate and nuanced comparison of results across an entire item list using a single index for each participant and test.[8] The total sequence value (sum of positional distance errors) for each response sheet at each time point was converted to the sequence index (SeqI) using the formula SeqI = (Σ position errors ÷ 2) ÷ (# correct responses).

Memory Training Group

Intelligence analysts struggle to recall details from reporting because the human mind is poorly suited to encode abstract information such as numbers, dates, and timelines. Evolutionary psychologists claim that modern humans and primitive hunter-gatherers share the same basic brain physiology.[9] Thus, modern humans are the inheritors of thousands of years of selective adaptation, which fashioned the ideal hunter-gatherer mind. Therefore, our minds are calibrated to remember predators, potatoes, and potential mates—not passwords, pin codes, or Pyongyang's military order of battle. To do that, memory techniques known as mnemonic devices act as software to run on our hunter-gatherer hardware. Mnemonic devices work by converting arbitrary information into vivid and emotionally charged images and scenes that stick in the mind.

Heuer put it this way:

> *Specifically, information that is vivid, concrete, and personal has a greater impact on our thinking than pallid, abstract information … Mnemonic devices are useful for remembering information that does not fit any appropriate conceptual structure or schema already in memory. They work by providing a simple, artificial structure to which the information to be learned is then linked. The mnemonic device supplies the mental "file categories" that ensure retrievability of information. To remember, first recall the mnemonic device, then access the desired information."*[10]

Mnemonic Devices

The following paragraphs describe the three mnemonic devices used in the experiment: mental imagery and elaborative encoding; the major system; and the memory palace.

Mental Imagery and Elaborative Encoding

Mental imagery optimizes memory by engaging parts of the brain involved in creativity and imagination. Indeed, the word imagination derives from the Latin word imago or image. Aristotle claimed that "to think is to speculate with images."[11] Albert Einstein and Marcel Proust claimed that mental imagery played a central role in their creative processes.[12] Simply put, the mind is optimized to remember what it engages with creatively, such as mental imagery.

Elaborative encoding is a mnemonic device that imbues mental imagery with emotional cues to convert abstract information into vivid, emotionally charged images and scenes. Elaborative encoding is a way to hack the hunter-gatherer mind's natural proclivity for threat avoidance, jovial social interaction, and mate-seeking. All the world's memory champions use elaborative encoding, often in conjunction with the other mnemonic devices used in the experiment.[13] In psychology, this phenomenon is known as the emotional arousal theoretical framework.[14]

Elaborative encoding also operates according to the Von Restorff effect, named for pioneering German female psychiatrist and pediatrician Hedwig von Restorff (1906–62). The Von Restorff effect states that people are more likely to notice and remember things that stand out from the norm, such as vivid, emotionally charged images or scenes.[15] Several neuroscience experiments using brain scans show that areas associated with emotion and memory are activated during elaborative encoding. This suggests that emotion serves as a kind of turbo booster, strengthening the imprint of the memory.[16] Other laboratory experiments demonstrate that "emotional arousal, even from an unrelated source, is capable of modulating memory consolidation."[17]

Major System

The major system is a mnemonic device for encoding and recalling long numbers. French scholar Aimé Paris (1798–1866) developed the system to aid in mathematics.[18] The major system translates numbers into basic phonetic sounds and uses elaborative encoding to transform these sounds into vivid mental images. These images are easier for the mind to remember than arbitrary numbers. The major system involves four steps. First, memorize the translation of numbers 0-9 into simple phonetic sounds. Second, separate the long number into manageable chunks of two to four numbers per chunk. (George Miller's famous article "Magical Number Seven, Plus or Minus Two," describes the "chunking" process and is why US telephone numbers are separated into groups of three and four numbers.)[19] Third, translate the chunks into words by adding vowels between the chunks. Last, create a memorable mental image of the word combinations. To recall the original number, reverse the process to translate the mental image back into numerical form using the memorized translation code. Memory champions use the major system to perform incredible memory feats like memorizing the mathematical constant pi out to thousands of digits.[20] The major system provides intelligence analysts a tool for encoding and recalling details from intelligence reporting such as timelines, actor/action associations, military order of battle charts, equipment specifications, and mapping coordinates.

Memory Palace

The memory palace is the world's oldest and arguably most powerful mnemonic device, particularly when combined with elaborative encoding and the major system. It uses mental navigation along well-known spatial routes stored in memory, such as a college campus, place of worship, or childhood home. To-be-remembered information is mentally placed at landmarks along the imagined route. The information is then recalled by mentally retracing the route, "picking up" the "placed" information along the journey.[21]

Heuer recommended the memory palace in *The Psychology of Intelligence Analysis*:

> *Try to memorize the following items from a shopping list: bread, eggs, butter, salami, corn, lettuce, soap, jelly, chicken, and coffee; the list is difficult to memorize because it does not correspond with any schema already in memory. The words are familiar, but you do not have available in memory a schema that connects the words in this group to each other. If the list were changed to juice, cereal, milk, sugar, bacon, eggs, toast, butter, jelly, and coffee, the task would be much easier because the data would then correspond with an existing schema—items commonly eaten for breakfast. Such a list can be assimilated to your existing store of knowledge with little difficulty, just as the chess master rapidly assimilates the positions of many chessmen.*
>
> *To learn the grocery list of disconnected words, you would create some structure for linking the words to each other and/or to information already in long-term memory. You might imagine yourself shopping or putting the items away and mentally picture where they are located on the shelves at the market or in the kitchen. Or you might imagine a story concerning one or more meals that include all these items. Any form of processing information in this manner is a more effective aid to retention than rote repetition.*[22]

Heuers' views were informed by the pioneering work of Francis Bellezza, an Ohio State professor emeritus of psychology and noted scholar of mnemonic devices.[23]

The memory palace was taught in the Western educational system from ancient Greece until the late 19th century, including in US schools. One example of the memory palace in American classrooms is Emma Willard's 1846 *The Temple of Time*.[24] This system taught world history through an imaginary walk through a large, printed representation of an ancient Greek temple (depicted in the cover image of this article). Students followed along with the lessons by creating mental images of important historical events and persons, mentally "placing" the images along the temple's numbered columns.[25,26]

Findings

The results of the experiment revealed four key findings. First, memory-training-group participants scored 45 percent higher overall than controls. Second, memory-training-group participants recalled 57 percent more information after one week than controls. Third, memory-training-group participants were five times more likely to achieve a perfect score on long-term and short-term memory tests than controls. Last, participants of both groups with prior exposure to memory techniques scored 18 percent higher than participants with no prior exposure. These findings meet or exceed the standard of statistical significance and support the hypothesis that memory training increases intelligence analysts' ability to recall key details, thereby improving their performance.

Statistical Significance

The threshold for statistical significance used throughout the experiment was p-value below 0.05. In other words, for the differences in mean values to be considered significant, there is at least a 95-percent confidence that they are not due to random chance. The t-test for the overall mean score comparison between the study groups revealed a p-value of 0.00000001, meaning that the results were almost certainly not due to random chance. Statistical analysis and graphing were performed with Stata 18.0 Basic Edition.

Impact of Moderating Variables

A demographic survey collected information on three moderating variables that could impact participant's performance in the study. These moderating variables were prior exposure to memory techniques, intelligence community experience, and education level.

Analysis of the demographic survey and experiment results revealed:

- Participants with prior exposure to memory techniques scored 18 percent higher than participants with no prior exposure (p-value = 0.026). This result is considered statistically significant.
- There was no statistical significance in the difference in recall scores between participants with greater IC experience.
- There was no statistical significance in the difference in recall scores between participants with advanced degrees versus undergraduate degrees.

Experiment Results

The experiment provided the following results:

- Memory training group participants scored 45 percent higher overall than controls.
- Memory training group participants recalled 57 percent more information after one week than controls.
- Memory training group participants were five times more likely to achieve a perfect score on long-term and short-term memory tests than controls.
- Participants of both groups with prior exposure to memory techniques scored 18 percent higher than participants with no prior exposure.

Unexpected Findings

The experiment revealed an unexpected correlation between increased age and lower recall performance. Participants aged 34 and older scored 21 percent lower than those aged 33 and younger on both the short-term and long-term memory tests, regardless of study group. This result is statistically significant. A body of medical literature and common experience correlate increased age with memory loss. However, this study assumed that greater IC experience and higher education levels would compensate for age-related memory degradation. Of note, no other demographic but age on the participant survey yielded significant score variance. These demographics included sex, occupation (analyst vs. officer), and military experience.

We predicted that participants with greater IC experience and more formal education would score higher on memory recall tests. Surprisingly, the findings indicated no statistical significance in the difference in scores between participants with 1–20 years of IC experience. There was also no significance in the difference in recall scores between participants with advanced degrees versus undergraduate degrees. This finding is likely due to the negative impact of age on memory performance addressed in the previous paragraph.

Despite the memory training group's superior overall performance, the group made significantly more "near miss" errors than controls. These errors involve minor semantic mistakes, such as recalling the verb "jump" or "leap" instead of the correct verb "hop." These errors likely occurred while the memory training group mentally "decoded" remembered mental images back into the original test information. This result exposes a weakness in mnemonic devices that would require additional training to overcome.

Limitations and Future Research

The experiment had three limitations. First, all 30 participants were IC members and intelligence analysts or officers, but not all served as full-time analysts. Although there was no significance in score variance between analysts and officers, the study was designed to test analysts. A larger sample of solely analysts would better gauge the impact of memory training on analysts' recall performance. Second, this study used notional unclassified intelligence reporting that did not contain violent or disturbing material. Future studies should use actual classified reporting to better replicate conditions in the field. Last, participants ranged in age between 26 and 43. Future studies should use a broader age distribution to better represent IC demographics and more accurately gauge the impact of age on memory.

The memory training group received training on the three best-known mnemonic devices that use mental imagery and spatial contextualization—elaborative encoding, the major system, and the memory palace. A future direction for research is to study the impact of individual mnemonic devices on specific intelligence analysis tasks, such as critical thinking, creative thinking, product creation, and briefing. Those findings would help analysts employ the best mnemonic device for the analytic task at hand.

Recommendations

Intelligence analysts over the age of 34 would benefit most from memory training, based on the results of this study. Memory training is cost-effective and does not require special technology. For example, the results in this study were achieved in a one-hour block of instruction using only a short video, briefing slides, whiteboards, and paper handouts. Of note, according to a descriptive survey, all participants of the memory training group found the instruction valuable, and 96 percent of all participants thought the IC should provide memory improvement training to its workforce.

Conclusion

This article presented the findings of an experiment to test the effect of memory training on intelligence analysis. The results indicate a significant relationship between memory training and a boost in recall of key details from intelligence reporting. This strongly suggests a link between memory optimization and analytic performance. Memory techniques that use mental imagery to convert abstract information into vivid, emotionally charged scenes are the most effective for intelligence analysis. As a result, we can proclaim with confidence that mnemonic devices have a place in the analyst's toolkit—just as Heuer and Sinclair theorized in the 1980s and 1990s. Overall, this article recommends a modest IC investment in memory training to better support policymaking and improve the overall skill of the workforce.■

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