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On Serendip

Photographic Memory: A Look at Eidetic Imagery in the Brain

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"Everyone has a photographic memory. Some don't have film." As evidenced by this humorous quotation, the topic of photographic memory is quite prevalent in pop culture. Like much of the often talked about subjects in pop culture, however, the actual phenomenon is not very well understood by the general public. Photographic memory, or as it is technically called, eidetic memory, is not a well understood phenomenon in the world of neuroscience either. Much evidence points towards the concept being entirely fictional, as research has not been able to consistently verify the presence of such memory. The question, then, is not only whether photographic memory exists, but also whether it is neurologically feasible.

In theory, photographic memory involves the ability to remember things so vividly that an actual image is retained in the mind. (1) People with photographic memory can supposedly remember an unlimited amount of information with accuracy far superior to the average person. There have been a few well-documented cases of such remarkable recall, such as "S", the subject of Luria's The Mind of a Mnemonist, who could memorize anything from the books on Luria's office shelves to complex math formulas, and "Elizabeth", a woman who could mentally project images composed of thousands of tiny dots onto a blank canvas. (2) Both could also reproduce poetry in languages they could not understand years after seeing it written. (1) (2) Such recall seems as though it might be correlated to the phenomenon of flashbulb memory. In highly emotional situations, people tend to remember events so vividly that the memories take on a photographic quality. (3) Such memories were, until recently, believed to be permanent, never fading in quality. Recent studies, however, indicate that over time, people's memories of such events actually do fade. How accurately people remember such events appears to be directly proportional to how strong the emotional ties to the event were. (4) Photographic memory, which looks on the surface to be the same phenomenon, should not be long-lasting, since it does not generally have any emotional content.

If eidetic memory, which is so often referenced with respect to unemotional images or events, cannot be tied to the emotionally-linked phenomenon of flashbulb memory, then in what situations could it be observed? One frequently researched area is that of chess board configurations. It has been found that chess experts have much better recall for the location of pieces on a chess board than novices. The advantage in memory, however, is completely neutralized when the pieces are arranged in a way that could never occur in the course of an actual chess game. (5) This evidence seems to indicate that expert

chess players are not actually using any sort of photographic imagery to recall the location of the pieces on the board. They are instead relying on having seen many different board configurations in the past and using this experience to recreate the situation they were shown.

If not in experts, then perhaps eidetic memory can be found in children, who have little experience with the world, and thus may have no knowledge base to help them memorize things. According to Lev Vygotsky, one of the most influential theorists in the field of developmental psychology, young children do indeed rely on eidetic imagery to help them remember things. He references a child's closing his or her eyes and moving them around when asked to recall an image as evidence that children retain a mental picture of objects they have seen. In adulthood, he theorizes, these memory techniques are replaced by verbal techniques, such as mentally rehearsing a list of objects. (6) More recent studies have indicated that children's eidetic memory is not as universal as Vygotsky originally perceived. In a number of experiments, only 2-15% of elementary school children were able to project an image they had seen onto a blank easel and describe it afterwards. (7) Vygotsky's theory, then, that children use primarily eidetic imagery in memory until it is replaced by "higher mental functions" (6) involving verbal behavior in middle childhood, cannot be the complete answer.

Because only isolated examples of eidetikers (people who are capable of eidetic imagery) have been found, there doesn't seem to be any explanation for how such a phenomenon works neurologically. According to a well-accepted theory of memory, the first step in memory storage is sensory memory. Generally, information is stored here only very briefly, and is either lost entirely, or, if given proper attention, processed further. While still in the sensory memory, visual information is believed to be stored as an actual image. Any further processing is thought to change visual information into conceptual information. (8) The chess player, for example, no longer sees the actual chess board, but rather an internal, abstract concept of a chess board. Since photographic memory involves seeing visual images, it must be on the very basic sensory level that eidetic memory functions.

Is it possible then that something in the brains of these so-called eidetikers has been wired incorrectly, causing traces of memory that should only last mere seconds to remain in a person's memory for minutes, hours, or, in cases like S or Elizabeth, years? Absolutely. Memory is believed to be facilitated by changes at the neuronal level due to long-term potentiation. This phenomenon is essentially the strengthening of synaptic efficiency through repeated use over time, producing long-term memories. (9) Normally, this type of induction takes several rounds of stimulation in order to produce the increased proficiency of the neural circuit. It is conceivable that in a small portion of the population, genetic or environmental factors that have yet to be discovered lower the threshold for this potentiation, resulting in sensory memory that remains stored as a visual image instead of being lost or processed conceptually. Multiple stimulations would not be necessary to retain these images; one brief presentation of a stimulus would be sufficient.

Such a perspective on the neurological basis for eidetic memory would explain many of the unanswered questions on the topic. Photographic memory may be so rare that it appears to be fictional because it is the result of an uncommon genetic mutation or an unlikely combination of environmental and genetic factors. The greater prevalence of photographic memory in children can by explained by the re-appropriation of neurons from sensory memory circuits to verbal memory circuits as verbal behavior increases. That it is an event linked to sensory memory, and not episodic (autobiographical) memory explains why emotional or experiential ties to the object do not increase memory for it.

Advancing in the field of photographic memory would require scientists to find more subjects with unusual memory abilities. One recent case is that of "AJ", who seems to remember every detail about even the most trivial events during her lifetime. (10) Neurological testing may lead to a greater understanding of the location of memory in the brain, and more specifically, what causes such extraordinarily clear and detailed memories to form. With increasingly sophisticated technology and the hope that more people with exceptional memories will come forward, it is possible that the many unanswered questions about photographic memory will someday be less of a mystery.

Resources:

1)Eidetic Memory, from Wikipedia

2)An Adult Eidetiker, from the Sarah Lawrence College website

3)Flashbulb Memory, from Wikipedia

4)A study on flashbulb memory, from The Discovery Channel Canada Online

5)Photographic Memory, from the MadSci Network

6)Vygotsky, from the Massey University website

7)Children's Eidetic Memory, from the Magic Mnemonic Website

8)Memory, from the Memory Disorders Project of Rutgers University Online

9)Memory, from the University of Memphis Neuropsychology website

10)The Woman With Perfect Memory, from ABC News Onliine

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