Human Cognition and Figure Design

Human (Visual) Memory: A Brief Introduction

There are several types of human memory. The most important for understanding how visual representations are processed and retained are:

- **Sensory Memory**: Sensory memory is the brain's retention of signals from sensory organs. This memory lasts for a very short period of time (~500 ms or less). Processing sensory signals, commonly called "pre-attentive processing,"[1] is highly parallelized (Treisman and Gelade 1980, Pylyshyn1988–il) and requires little cognitive load (Treisman and Gelade 1980).
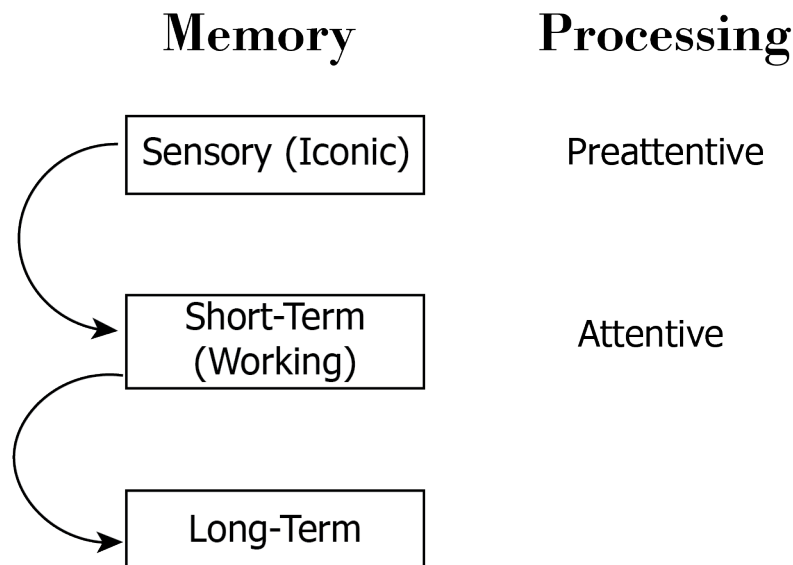- **Short-Term Memory**: Short-term memory is more complex;

Figure 1: Rough overview of the levels of human memory and associated processing types. Despite the simplified representation, this is not a one-way street, as the brain can switch from attentive processing to pre-attentive processing after selecting a subset of input for additional search (Hochstein and Ahissar 2002; Di Lollo et al. 2001).

References

Di Lollo, Vincent, Jun-Ichiro Kawahara, Samantha M Zuvic, and Troy A W Visser. 2001. "The Preattentive Emperor Has No Clothes: A Dynamic Redressing." *J. Exp. Psychol. Gen.* 130 (3): 479. https://doi.org/10.1037/0096-3445.130.3.479.

Hochstein, Shaul, and Merav Ahissar. 2002. "View from the Top: Hierarchies and Reverse Hierarchies in the Visual System." *Neuron* 36 (5): 791–804. https://doi.org/10.1016/s0896-6273(02)01091-7.

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[1]There is some controversy about the use of "pre-attentive processing" and its relationship to "attentive processing" (Wolfe 2003). A perhaps better terminology is "vision at a glance" and "vision with scrutiny," which more explicitly suggests the potential for feedbacks between higher- and lower-level vision and cognitive processes (Hochstein and Ahissar 2002). However, we use "pre-attentive" and "attentive" here, as they are common in the data visualization literature.

Treisman, A M, and G Gelade. 1980. "A Feature-Integration Theory of Attention." *Cogn. Psychol.* 12 (1): 97–136. https://doi.org/10.1016/0010-0285(80)90005-5.

Wolfe, Jeremy M. 2003. "Moving Towards Solutions to Some Enduring Controversies in Visual Search." *Trends Cogn. Sci.* 7 (2): 70–76. https://doi.org/10.1016/s1364-6613(02)00024-4.