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Analyzing Mental Image Generation Data through Imputation: Evidence of a Visual and an Episodic Buffer for Image-Size Scaling

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We reanalyzed data reported in previous mental imagery experiments (D'Angiulli, 2001; D'Angiulli & Reeves, 2002). The data consisted of self-reported image vividness ratings (1 = no image; 7 = perfectly vivid) and image latencies (image completion RTs) for "small" (i.e., subtending < 16^o) and "large" (i.e., > 16^o) images, in two image generation conditions: *trial-unique* and *repeated*. In the original experiments, the seven vividness levels were not used equally frequently. This produced "planned" missing values. Consequently, we investigated whether filling-in the missing data through regression modeling (*imputation*) would allow us to frame current and previous findings into a new conception of mental imagery and its architecture.

Methods

We applied an imputation procedure based on an expectation-maximization algorithm for maximum likelihood estimation (Schafer & Graham, 2002) to obtain two datasets which mixed real data with a substantial percentage of replaced missing data. Namely, the planned missing observations were replaced with interpolated means estimated from all available repeated measurement on an individual, assuming that values were missing-at-random. We then used ANOVA contrasts for statistical comparisons.

Results & Discussion

Typically, it took about 4 s to generate trial-unique small images of common objects, whereas it could take up to 10 s to generate trial-unique large images. In contrast, repeated images were generated at the same rate irrespective of size. Repeated images were generated more slowly (~ 1.5 s) than trial-unique small images. Trial-unique small images were considerably more vivid, as compared to large trial-unique images and to repeated images of any size. Large repeated images tended to be slightly more vivid than large trial-unique images.

Latency and vividness were inversely related, for both trial-unique and repeated images, but such vividness-latency inverse relation flattened out for repeated images. Namely, it took a similar amount of time (~5 s) to generate a rather vivid image whether in one or repeated attempts. However, generating a non-vivid image took only 1 additional second for repeated images, while it could take more than 5 additional seconds for trial-unique images (twice the time required by a vivid image).

The present findings suggest that generation time of mental images of common objects visualized at ordinarily perceived sizes is a function of how vivid images are, or how 'active' the underlying representations are in our LTM (D'Angiulli & Reeves, 2002). But, if we generate images at relatively or unusually large sizes, then image latency will reflect the compound influence of processes that transform, edit or alter these images (as shown by Kosslyn, 1994).

The present findings also suggest that recently-formed images can be temporarily maintained and refreshed for several seconds (see Kroll et al., 1970). Images that are evoked repeatedly are not generated all over again but depending on their initial vividness level they are either stored as vivid copies or refreshed until reasonably vivid (and handy for near-future tasks).

Overall, our results imply a *direct route* and an *indirect route* through which images may reach conscious awareness. Images at usual sizes can be accessed directly through an *episodic buffer* (Baddeley, 2000) which also serves as a 'back-up' store, retaining carbon-copies of the images at a certain decay rate. If however these images need to be edited or manipulated they will be transferred to a *visual buffer* (Kosslyn, 1994) and, after undergoing transformation there, they will return to the episodic buffer.

References

Baddeley, A. (2000). The episodic buffer: a new component of working memory? *Trends in Cognitive Sciences*, 4, 417-124.

D'Angiulli, A., & Reeves, A. (2002). Generating mental images: Latency and vividness are inversely related. *Memory & Cognition*, *30*, 1179-88.

D'Angiulli, A. (2001). Phenomenal and temporal aspects of visual mental image generation: validating verbal report on vividness through latency analysis. *Dissertation Abstracts International,61 (9-B)*, 5015.

Kosslyn, S. M. (1994). *Image and brain*. Cambridge, MA: MIT Press.

Kroll, N.E.A., Parks, T., Parkinson, S.R., Bieber, S.L., & Johnson, A.L. (1970). Short-term memory while shadowing: recall of visually and aurally presented letters. *Journal of Experimental Psychology, 85*, 220-224.

Schafer, J.L. & Graham, J.W. (2002). Missing data: Our view of the state of the art. *Psychological Methods*, *7*, 147-177.