**TITLE**

**Working Memory**

Human society has used working memory since the beginning of existence. Robinson-Riegler, G. and Robinson-Riegler, B. describe working memory as a process in which you intake stimuli and examine it. Working memory plays its biggest role as part of your short-term memory (STM), as it works in a close interacting system that serve higher level mental processes. This could be as simple as responding to a question or remembering a phone number. Robinson-Riegler, G. and Robinson-Riegler, B. comment on a working memory model theorized by Baddeley and Hitch. Baddeley and Hitch (1994) first proposed their idea of a working memory model in 1974. They propose that their idea has three separate uses in cognitive psychology, but there are more uses in other fields (p. 485). The first is using computation models (math, physics, etc) and a production system to explain the relevant productions. The second, is to see working memory (WM) as a system that uses the participants story and processing, while measuring it using tasks to find individual differences. Baddeley and Hitch (1994) were quick to point out that this second use of WM is more reliant on the way to measure reasoning and comprehension. The final use utilizes Baddeley and Hitch’s original 1974 WM model.

Their model included the idea of a phonological loop, visuospatial sketchpad, and central executive. The phonological loop (previously the articulatory loop) uses has two parts. Those parts are your phonological storage and subvocal rehearsal. Phonological storage is when your brain holds a memory trace until this is then rehearsed by the subvocal rehearsal of the model. The model also has this idea of a visuospatial sketchpad, which is primarily responsible for visual and spatial encoding. Baddeley and Hitch (1994) see this as a type of work space for incoming information. The final piece of their model is the central executive. The central executive is responsible for controlling when the phonological loop and visuospatial sketchpad are used, and how they interact with one another (Baddeley, 2002, p. 89).

**Measurement of Working Memory**

The best way to test working memory is to use an operation task (OSPAN) created by Turner and Engle (1989). Turner and Engle have written multiple papers on their validity and reliability of the OSPAN. Besides the creators of the task, Klein and Fiss (1999), also tested the validity and reliability of it to an astounding .78 alpha coefficient average. The only “bad” thing Klein and Fiss had to say was within their error, they used the same participants, so the participants may have had test-retest correlations from the three times they redid the OSPAN.

**Fluid Intelligence**

There are of course more factors that work into how much you can hold in your working memory that could affect the way you think. One of focus is intelligence, specifically fluid intelligence (*Gf*). Horn (1968) describes intelligence for those who study behavioral science as, “. . .observable, measurable behavior, whence it may become possible to relate this variable as important variables of neurology, sociology, etc. (p. 242).” He is describing that for behavioral sciences that intelligence needs to be measured in some aspect for it to be considered observable. Horn (1968) reports that Cattell presented the idea of *Gf* in 1941 at an APA convention. Since then it has grown popular in the behavioral sciences as a way to measure intelligence that is always expanding.

Jaeggi, Buschkuehl, Jonides, & Perrig, (2008) classify *Gf* as a human ability that allows participants to adapt their thinking to the problem at hand regardless of acquired knowledge. In addition to this, Gray, Chabris, and Braver (2003) highlight that *Gf* is related to attentional control, or “the ability to overcome interference that would otherwise disrupt performance. . . (p. 316).” Gray et al. also says that these attentional control is necessary for the abstract thinking needed for *Gf.*

**Expertise**

The last construct that may affect your working memory or fluid intelligence is expertise. Gobet,, and Ereku, (2016), spoke of Dreyfus and Dreyfus (1988) paper where they categorized expertise as, “fluid, automatic behavior without any conscious control,” which is how anyone should think of it. Although there is not a good overall way to test if someone has expertise, most articles just use a median split to separate participants into a novice group, or an expert group (Sattizahn, Moser, & Beilock, 2016). This may not be the best way to show or categorize a person’s expertise, but it is the best we have currently available and that has been used in research.

**Interplay between these systems**

With these three constructs combined, they could help shape how things may get stored in our short term or long-term memory. They each play an important part in how we view the world around us and evaluate everyday situations.

**References**

Baddeley, A. D. (2002). Is working memory still working? *European Psychologist*, *7*(2), 85–97. https://doi-org.proxy.missouristate.edu/10.1027//1016-9040.7.2.85

Baddeley, A. D., & Hitch, G. J. (1994). Developments in the concept of working memory. *Neuropsychology*, *8*(4), 485–493. https://doi-org.proxy.missouristate.edu/10.1037/0894-4105.8.4.485

Cattell, R. B. (1963). Theory of fluid and crystallized intelligence: A critical experiment. *Journal of Educational Psychology*, *54*(1), 1–22. https://doi.org/10.1037/h0046743

Geary, David. (2009). The evolution of general fluid intelligence. *Foundations in Evolutionary Cognitive Neuroscience*. 22-56. 10.1017/CBO9780511626586.002.

Gray, J. R., Chabris, C. F., & Braver, T.S (2003). Neural mechanisms of general fluid intelligence. *Nature*, 6(3), 316-322.

Horn, J. L. (1968). Organization of abilities and the development of intelligence. *Psychological Review*, *75*(3), 242–259. https://doi.org/10.1037/h0025662

Kane, M. J., Hambrick, D. Z., Conway, A. R. A. (2005). Working memory capacity and fluid intelligence are strongly related constructs: Comment on Ackerman, Beier, and Boyle (2005). *Psychological Bulletin*, 131(1), 66-71.

Robinson-Riegler, G., & Robinson-Riegler, B. (2004). *Cognitive psychology* (p. 157, 159, 506). Boston: Allyn and Bacon.

Shelton, J. T., Elliott, E. M., Matthews, R. A., Hill, B. D., Grouvier, Wm. D. (2010). The relationships of working memory, secondary memory, and general fluid intelligence: Working memory is special. *Journal of Experimental Psychology: Learning, Memory, and Cognition,* 36(3), 813-820.