Dealing with Distraction

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Our ability to deal with distraction forms a core component of working memory. Complex span tasks, which are used to measure working memory (see Factsheet 1 and Video 1), are designed to gauge how well an individual can keep information in mind, in the face of competing distraction. This means that when we talk about the link between working memory and reading, mathematics, or school behaviour, we are talking partly about the link between managing distraction and academic performance.

Theoretical background

In Factsheet 1, we talked about how working memory was made up of storage systems, speed of processing, and 'something extra' (the residual variance) - which could be thought of as executive or attentional control. In our own work, we have tried to determine what exactly this 'something extra' is, and how it protects memory when it works well, by helping us deal with distraction (and how it may fail).

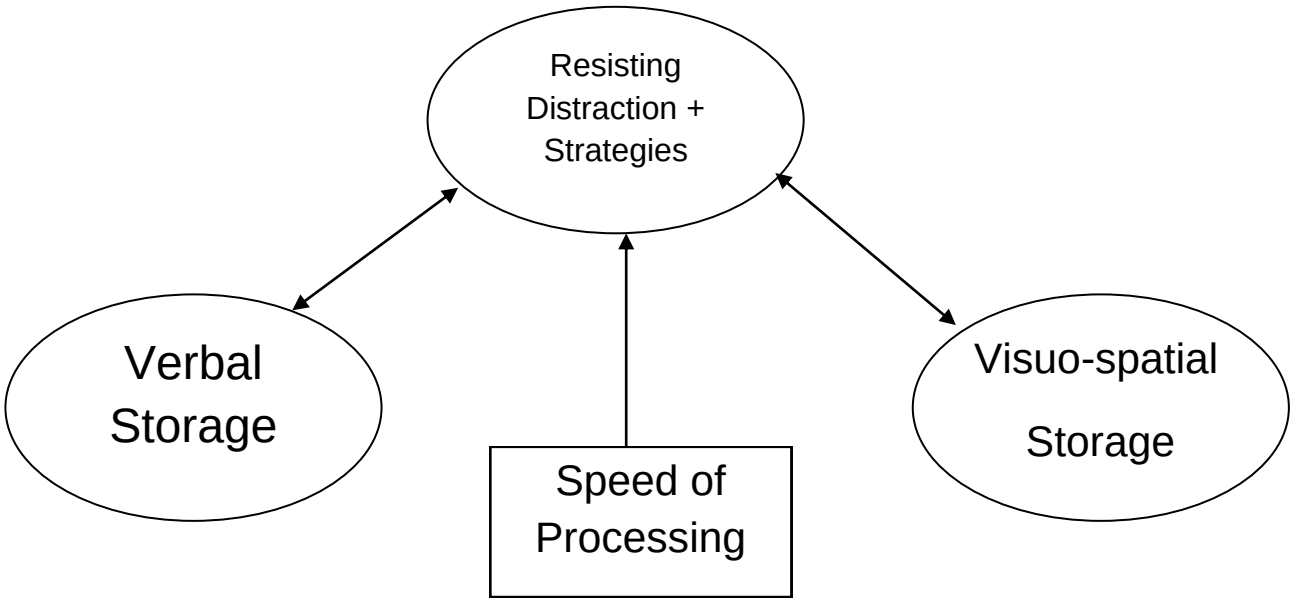

Figure 1: Contributions to working memory, as proposed in Factsheet 1.

Recent work by Bayliss and Jarrold (2015) and Hall et al. (2014) has shown that the residual variance in complex span (when storage capacity and processing speed are subtracted) is related to the rate at which we forget information when faced with distraction. They used a task in which individuals were presented with a list of words (Bayliss & Jarrold, 2015) or numbers (Hall et al., 2014) and then given various periods of time in which to complete distracting tasks.

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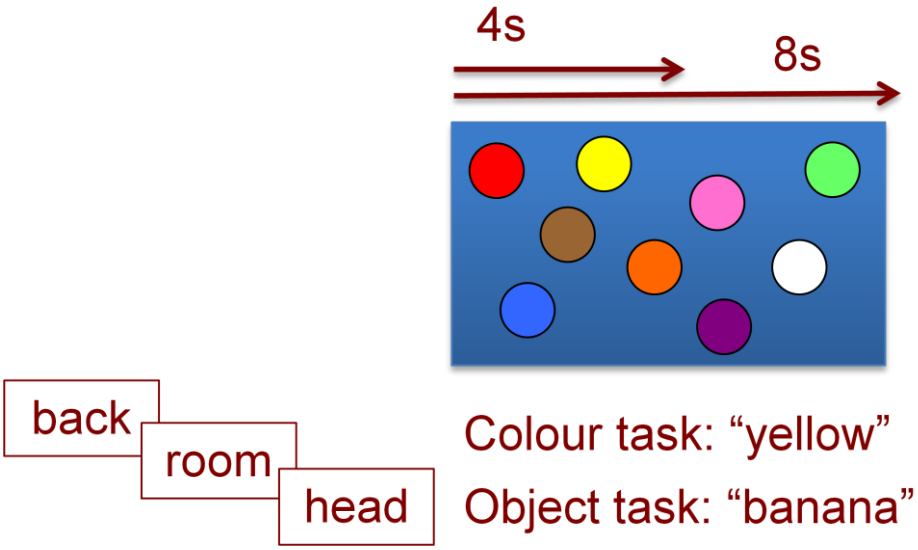

Figure 2: The forgetting rate task used by Bayliss & Jarrold, 2015.A list of three words was presented to the child followed by 4 or 8 seconds in which they had to complete successive screens of the colour task or the object task. In the colour task, the children were required to name the colour of the circle with the bevelled edge. In the object task, the children were required to point to the circle which was the identifying colour of a word e.g. banana – point to yellow.

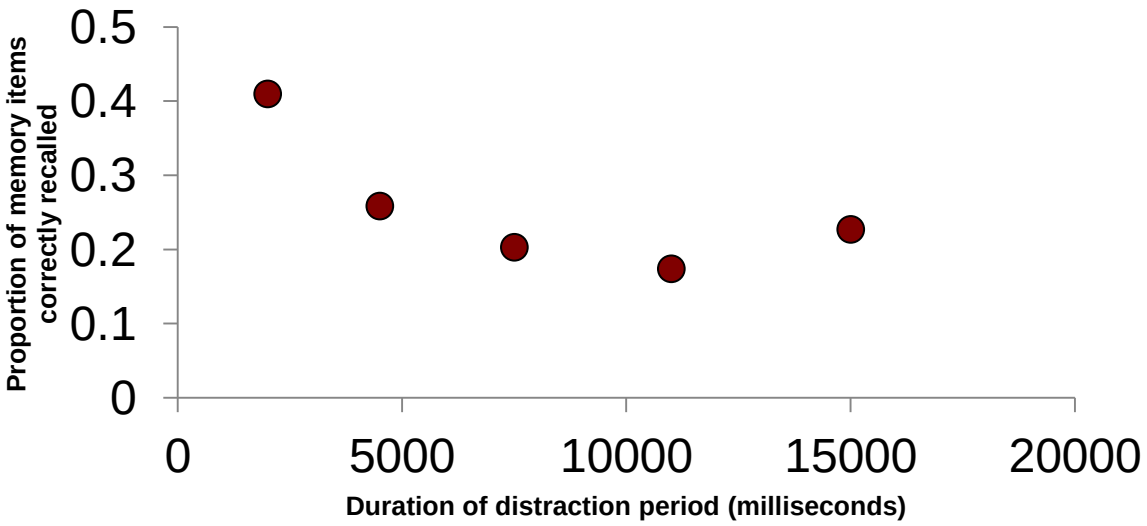

Figure 3: Rate of forgetting in children found by Hall et al. (2014)

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This work has led us to believe that individuals vary in how quickly they forget information when faced with distraction. In recent work (Hall et al., 2014) we have found that in a working memory task, the use of rehearsal strategies, or the speed at which individuals use rehearsal, is not related to the rate of forgetting. Rehearsal is therefore unlikely to protect memory from some of the effects of forgetting under distraction, and therefore efforts must be made to minimise the effects of distracting material.

Some things are more distracting than others

It is a long-standing finding that verbal memory is affected more by verbal distraction, and visual memory by visual distraction (Baddeley et al, 1975; Hitch et al., 1988). This may be a result of features in common which cause confusion, or common processing for both the memory items and the distracting information, which causes disruption to a fragile short-term memory representation (see also Oberauer, 2009). This means that when completing a verbal task, visual support can be particularly helpful, as it does not interfere as much with the resources needed to do the verbal task, and vice versa.

More cognitively demanding tasks also produce more interference in working memory, as they are more distracting, either as a virtue of requiring more cognitive resources or by taking time away from our attention to the memory items (St. Clair-Thompson, 2007).

Processing speed and cognitive load

If it takes longer to complete a task, regardless of how demanding it is, attention will be diverted from memory for longer. This means that that information may be lost from memory. Further, a lot of distraction in a short space of time hurts working memory more than a small amount of distraction in a long period of time. This is the effect of cognitive load.

Barrouillet and colleagues have shown that if individuals are given more free time after a distraction then this can benefit working memory, as they can use the free time to refresh their memory (Barrouillet et al., 2009), or to deal with the otherwise interfering effects of distraction (Oberauer et al., 2012). Younger children need more time to complete a distracting task than do older children, and slowing the pace of a task can be beneficial to working memory (Barrouillet et al., 2009).

How is this important to children's learning?

Individual differences in managing distraction has been estimated using the residual variance in complex span (when storage capacity and processing speed are subtracted from working memory performance; see Factsheet 1 for details) and this residual variance is related to fluid intelligence, reading, and mathematics. In our recent forgetting rate

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studies, we have found that forgetting rate (when resisting distraction) is related to reading and mathematics performance.

How can we help children manage distraction in the classroom?

For a child who is susceptible to distraction, even looking up to the board and glancing around the room can take them off task. When considering a child's level of distractibility, firstly, we recommend checking that storage and processing speed are not issues. In Film 3, we have provided some suggestions which may be useful to support a child who is struggling with distraction in the classroom.

Game 1 can be used to determine whether *slowing the rate of distraction* can benefit working memory. In *Game 3-Dealing with Distraction*, we provide an assessment where you can examine how *similar and dissimilar distraction* affects memory. This may be key to developing suitable support for a child.

See Factsheet 1 for estimates of how you should expect a child to perform on the verbal version of the tasks in Game 3. The visual distraction task in Game 3 may be slightly easier for most children, but this may not always be the case if a child is particularly susceptible to visual distraction.

References

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Barrouillet, P., Gavens, N., Vergauwe, E., Gaillard, V., Camos, V. (2009)Working memory span development: a time-based resource-sharing model account. *Developmental psychology,* **45** (2), 477.

Bayliss, D.M. & Jarrold, C. (2015). How quickly they forget: The relationship between forgetting and working memory performance. *Journal of Experimental Psychology: Learning, Memory and Language*, **41**, 163-177.

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Oberauer, K. (2009). Interference between storage and processing in working memory: Feature overwriting, not similarity-based competition. *Memory & Cognition*, **37**, 346-357 .

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Oberauer, K., Lewandowsky, S., Farrell, S., Jarrold, C., & Greaves, M. (2012). Modeling working memory: an interference model of complex span. *Psychonomic Bulletin and Review*, *19*, 779-819.

St Clair-Thompson HL. (2007) The effects of cognitive demand upon relationships between working memory and cognitive skills. *Quarterly Journal of Experimental Psychology*, **60,** 1378-1388.

Further reading:

Gathercole, S. E., & Alloway, T. P. (2007). *Understanding working memory: A classroom guide.* London: Harcourt Assessment.

The CALM clinic is based in Cambridge, UK, and is run by Dr Joni Holmes and Professor Sue Gathercole. They have a set of resources available on the website at:

http://calm.mrc-cbu.cam.ac.uk/

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