Strategies

Written in March 2015 by Debbora Hall and Chris Jarrold

Children and adults can use strategies to support their working memory. By identifying a child's needs, specific strategy training can be developed.

Rehearsal

One of the most widely used strategies is rehearsal, which is repeating information back to yourself in your head. Baddeley has proposed that of the use of rehearsal is evidenced by similarity effects (similar sounding items are more confusable in memory if held in a rehearsable form, and this results in poorer recall) and that the effectiveness of rehearsal is affected be word length (long words take longer to rehearse, so less can be rehearsed in a given time period) (Baddeley, 1986; Baddeley et al., 1975).

Until recently it was widely believed that children under the age of 7 could not rehearse (Gathercole, 1998), and indeed, had limited ability to engage in internal speech (Flavell et al., 1966). However, we believe that because children under the age of 7 have limited short-term and working memory capacities, rehearsal is of limited benefit to them (Jarrold & Hall, 2014).

For example, if a child has an STM capacity of only 2 items, yet is given a list of 3 items to remember, they will not be able to recall the list *even once* in order to rehearse it (Figure 1). Please see Factsheet 2 for average STM capacity in children of different ages, but bear in mind that individual assessment is critical to determine capacity (see Game 2).

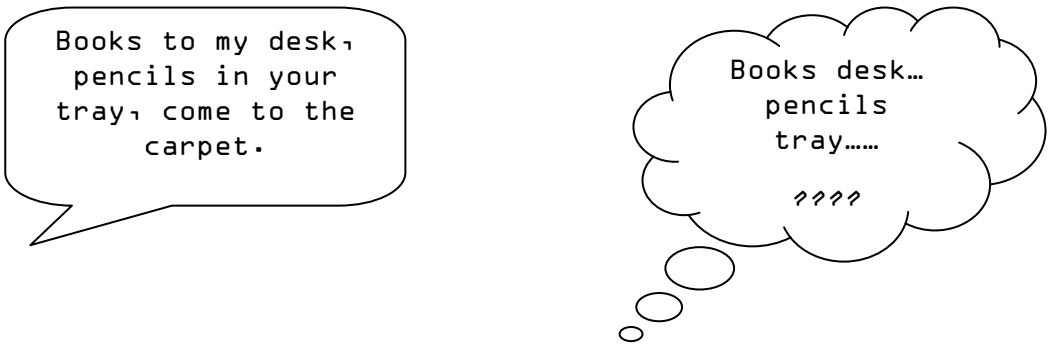

Figure 1: A list that exceeds memory capacity cannot be rehearsed.

Jarrold and Citroën (2013) and Tam et al. (2010) have shown that young children do show phonological similarity effects, and that these effects are proportional to their short-term memory capacity (Jarrold & Citroën, 2013; see also, Jarrold & Hall, 2013; Jarrold, Danielsson, & Wang, 2015). Young children typically recall so little, that in classic experiments, the potential markers of rehearsal (phonological similarity and the word

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length effect) are not obvious, but this does not mean that some children are not capable of rehearsal when items are within their capacity limitations.

It is therefore critical to determine if a child's memory span is limiting their use of rehearsal. They may also be unable to use rehearsal for other reasons. We provide a training game for rehearsal in Game 4 where you can see if rehearsal would help a child, or whether it would be better to focus on other techniques.

Rhythm and Song

Non-verbal rhythm awareness and rhythm memory is related to children's, and adults', short-term memory capacity (Hall & Gathercole, 2011; Hall & Gathercole, 2012; Huss et al., 2008; Hansen et al, 2012). Providing a rhythmic structure appears to lighten memory load. For example, grouping is a common strategy, where a simple rhythmic structure improves memory by creating chunks of information which appear to be easier to recall than a non-rhythmic list (Towse et al., 1999). For instance, the telephone number 016281076 is easier to remember if it is presented 016 281 076. The hierarchical rhythmic pattern may act as a mnemonic, to prompt recall (Morra & Epidendio, 2015).

Teachers will know anecdotally that creating chants and rhymes appears to help students recall information. Indeed, Ludke et al. (2013) have recently shown that teaching Hungarian using songs (to English speaking students) is more effective than teaching without songs. If a child has some information to remember, it may be worth creating a song or chant out of the information to help them recall it better.

Visuo-spatial support

A relatively new line of research has been investigating how visuo-spatial structure can help us to recall verbal material. Like rhythm, this may act as a mnemonic device which can help when recalling information. Ginsberg et al. (2014) and Smith and Jarrold (2014) have shown that a visuo-spatial map benefits verbal recall (Figure 3).

Smith and Jarrold (2015) found that this strategy was helpful for children with Down Syndrome, who have impaired verbal short-term memory. This is a promising finding and suggests that targeting an area of relative strength (visuo-spatial memory) can act as a scaffold, allowing a better recall of verbal material.

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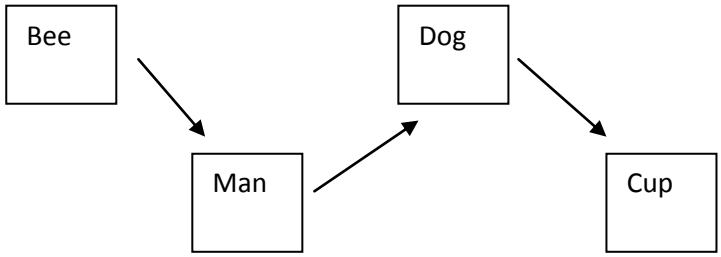

Figure 3: A simple visuo-spatial map to aid recall of a verbal list.

Long term memory and imagery

Short-term and working memory is influenced by long term knowledge. Familiar words are better recalled than unfamiliar or nonsense words, due to long term support which can help in rebuilding partially degraded memory traces (Hulme et al., 1991).

You may be familiar with the 'peg word' mnemonic strategy, which encourages individuals to build associations between familiar items and items they need to remember (e.g., one is a bun, two is a shoe). This strategy encourages the use of imagery and long term associations to support memory in the short-term.

Smith and Jarrold (2014) have been working with individuals with Down Syndrome to help them use imagery to support verbal short-term memory. They encouraged children to build images from unrelated words, by placing them closely together in a list, and encouraging them to link the words in some way. For example, if they were to remember 'dog' and 'shoe', they may imagine a dog sitting in the shoe.This resulted in better recall for typically developing children and with longer training may be suitable for children with Down Syndrome.

Game 4-Rehearsal and Suppression

Game 4 can help you assess whether rehearsal is being used by a child, and whether they may benefit from training in rehearsal strategies. Performance on Game 4 can be compared to the verbal memory element of Game 2. Rehearsal should improve performance, and suppression may reduce performance. If you see no difference between rehearsal and suppression games, then the child may require further training or it may be more appropriate to use other strategies. Please see Factsheet 2 for further information on average performance in verbal memory tasks.

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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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