Why would a special FM process exist in adults, when it does not appear to exist in children?

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Invited commentary on:

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Cooper, Greve and Henson (2018) caution restraint before accepting that a fast mapping (FM) process exists in adults. We welcome this, but would also add that the original rationale for studying FM in adults is not currently supported by developmental research. Despite the claims of several adult FM researchers, there is little evidence from developmental word learning research for a special hippocampus-independent FM process critical for children's word learning.

The seminal FM research with adult amnesiac patients was motivated by the assumption that children use a special FM memory process to learn words (Sharon, Moscovitch & Gilboa, 2011). This process purportedly allows rapid acquisition of new words following specific learning conditions, including disambiguation of the referent and minimal exposure, through bypassing hippocampus-dependent memory systems. Cooper et al. (2018) ask the important question as to whether there is anything special about FM learning and are rightly sceptical as to whether the developmental literature provides support in that regard. As psychologists interested in the development of word learning, we are even less convinced. The existence of a special FM process in children is not currently supported by developmental research, despite such claims being made in the adult literature on fast mapping (e.g., Sharon et al. 2011, Merhav, Karni & Gilboa, 2015; Himmer, Muller, Gais & Schonauer, 2017).

Within the developmental literature, any sense in which FM is 'special' lies within the learning conditions rather than claims about underlying neural mechanism. FM could be

considered special by virtue of the ability of children to infer the referent of a novel word from an ambiguous context, and for some children to show long-term retention of that information after minimal exposure (e.g., Carey & Bartlett, 1978). However, contrary to the claims made in the adult literature (e.g., Sharon et al., 2011), this does not imply that a special hippocampus-independent FM process underlies such learning.

If a hippocampus-independent FM process did exist in children, then one might expect children to show long-term retention of words following FM learning conditions at ages when they otherwise fail memory tasks typically considered hippocampus-dependent (e.g., before 2 years old; for reviews see Bauer, 2013; Gomez & Edgin, 2016). However, as Cooper et al. note, Horst and Samuelson (2008) found no evidence for retention after FM learning conditions in 2-year-old children, despite only using a 5-minute delay between learning and testing. Where retention has been seen in 2-year-old children (Spiegel & Halberda, 2011; Bion, Borovsky & Fernald, 2013), retention has been tested almost immediately after FM learning (e.g., a delay of 3 minutes for Speigel & Halberda, 2011). It is doubtful whether retention after such a minimal delay reflects long-term word learning in a meaningful sense. Where more significant delays have been introduced between FM learning and retention (e.g., 24 hrs or more), it is only with 3 to 5 year-old children that evidence has been found for long-term retention (e.g., Vlach & Sandhofer, 2012; Holland, Simpson & Riggs, 2015; Holland, Hyde, Simpson & Riggs, 2018).

Critically, by three years old children already show successful memory performance on tasks typically considered hippocampus-dependent (e.g., long-term delayed recall of a temporal sequence following a single exposure, Bauer & Leventon, 2013). Thus where children have actually shown long-term retention following FM learning conditions, this is not evidence for a hippocampus-independent learning process. Indeed, one could argue that

the developmental evidence for FM leading to long term retention in three year olds and older is consistent with reliance on the development of a hippocampus-dependent memory system.

Furthermore, if one follows the logic used in the adult FM literature (e.g., Sharon et al., 2011) then one might expect children with a still-developing hippocampus to show better retention of word-object pairings following FM conditions compared to conditions known to be hippocampus-dependent, such as explicit encoding (EE). That is, children ought to show a pattern of performance broadly similar to that of adults with hippocampal damage, as in Sharon et al. (2011). However, where studies have directly compared performance between such EE and FM conditions in children, there is no reliable evidence that retention after FM is better (e.g., Jaswal & Markman, 2003; Zosh, Brinster & Halberda, 2013; Sakhon, Edwards, Luongo, Murphy & Edgin, 2018). This is true even in developing populations with impaired hippocampal development, such as children with Down's syndrome (Sakhon et al., 2018).

In summary, the original basis for exploring FM in adults – the claimed existence of a special hippocampus-independent FM process in children – is not well supported by developmental research. It is therefore perhaps not surprising that the adult FM literature contains puzzling findings and failures to replicate. We welcome Cooper et al.'s caution before accepting that a hippocampus-independent FM process in adults exists. Current evidence suggests that such a process does not appear to exist in children either.

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