

Dr. Caitlin Mahy

A window into our thinking about the future



Dr. Mahy ...

is a Developmental Psychologist and Assistant Professor at Brock University, where she investigates future-oriented cognition in childhood and aging. Dr. Mahy obtained her Master's degree and Ph.D. in Developmental Psychology from the University of Oregon and her Postdoctoral Fellowships at the University of Geneva and the University of Oregon.

What's the bottom line?

Thinking about the future is something that people do everyday, often without conscious thought. Dr. Mahy's research suggests that future oriented abilities follow specific developmental paths throughout our lives, with marked increases during childhood and declines in older age. Her work connects these developments with gains in cognitive abilities and specific contextual influences - leading to a fuller understanding of how our abilities to plan, act upon and understand our futures develops and changes.

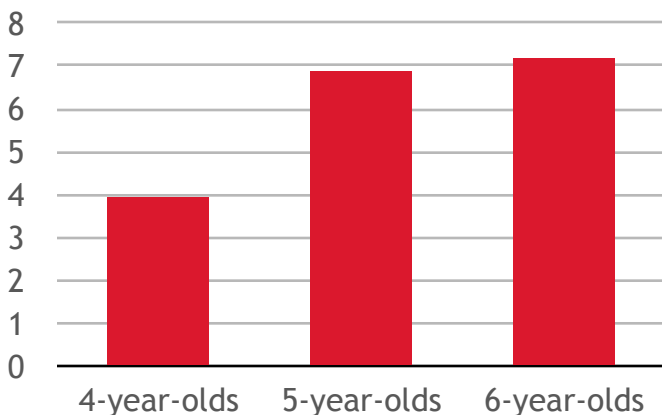
How does our thinking about the future develop and change – What is this research about?

Dr. Mahy and colleagues have made several interesting discoveries around how people think and remember their plans for the future. Specifically, Dr. Mahy has contributed to the understanding of how people's future oriented abilities, such as *Prospective Memory* and *Episodic Foresight*, develop.

Don't forget to...

Have you ever forgotten to do something that you intended to do? Perhaps it was forgetting to give someone a message or to pick-up your dry cleaning. The ability to remember to carry out future intentions refers to a specific type of memory called *Prospective Memory (PM)* - an essential skill for daily functioning, which typically begins to develop during early childhood. Why is PM essential? PM helps to prepare children for the responsibilities associated with school and to establish independence from caregivers through becoming responsible for their own intentions without help from others. Examples of PM in children include remembering to bring an item to show-and-tell or putting the juice container back into the refrigerator after pouring a drink.

Figure 1: Children's average score on PM task (possible range of scores 0-8)



The development of PM tends to follow an inverted-U shape path, with marked gains occurring during childhood (see Figure 1), peaks during middle age and declines in older adults. Dr. Mahy's research has supported this developmental pattern and connected specific mental processes and environmental factors with the age-related improvements during childhood.

One of the specific environmental factors that Dr. Mahy investigates are *prospective cues*, which refer to signals that trigger one's PM (e.g., an alarm reminding you to go somewhere). Dr. Mahy focuses a great deal of her work on researching how various aspects of these cues may affect the functioning of PM generally and across age groups.

Beyond prospective cues, Dr. Mahy also examines the relationship between PM and specific cognitive developments referred to as *Executive Functioning (EF)*. EF refers to specific mental processes that ‘coordinate’ many cognitive operations. These processes include working-memory, inhibitory control, planning, monitoring, etc. EF generally improves with age during childhood, with typically developing children gaining EF as they mature.

With PM, research has indicated that there are various ways in which EF may come into play. In terms of development, EF is still maturing during childhood, therefore younger children tend to have less EF capacity available to them as compared to older children - this may be why there are marked gains in PM throughout childhood while EF matures.

Additionally, the *multiprocess framework* states that specific attributes of a PM task (e.g., perceived importance, association between cue and action, engagement in ongoing task, etc.) may determine whether EF processes are needed for successful PM performance. For example, EF processes may be needed when one’s current environment requires a great deal of focus, but they may not come into play in the context of a less demanding environment. In general, this framework posits that complex environments may require and in turn ‘consume’ individuals’ finite EF capacity, therefore limiting the availability of these resources for assisting individual’s PM - with younger children’s EF capacity being further restricted as it is not fully developed, relating to the clear age differences in PM performance.

How does all of this come together?

In order to gain a more in-depth understanding of PM development, Dr. Mahy and colleagues have empirically tested both children and adult’s PM performance, while also monitoring the influence of EF and prospective cues.

Children

Focusing on the emergence of PM, Dr. Mahy has investigated how *delay* (i.e., the time between forming an intention and performing it) may affect children’s PM performance. In this work Dr. Mahy has found that both older and younger children tend to perform similarly on

PM tasks with short delays, but that older children’s PM tends to improve after longer delays. Dr. Mahy and colleagues propose that longer delays may provide children with more opportunities to encode and reflect on their intentions through introspection and cognitive monitoring, EF abilities that older children tend to be more skilled at than younger children - thus leading to the age effect of delay.

Beyond delay, Dr. Mahy and colleagues have also investigated the impact of prospective cues and an individual’s immediate context, finding that factors associated with both may influence PM performance and development.

Specifically, Dr. Mahy has found that the difficulty of a current task may not singularly affect PM performance, but when a current task is difficult and prospective cues are not salient, children’s PM performance may suffer - especially for young children. Dr. Mahy proposes that this may demonstrate that salient cues, especially within difficult tasks, may help younger children divide their attention between their current task and what they need to remember to do. In terms of EF, Dr. Mahy’s work implies that salient cues may provide younger children with ‘quicker’ access to important EF processes, particularly inhibition, which may help them differentiate and understand cues - older children may not need this added ‘boost’ to their more developed EF system.

Additionally, Dr. Mahy also had found that when children are highly *absorbed* in a task their PM performance may suffer, potentially because the EF process required to switch between two tasks (i.e., dual task control) are still developing. Interestingly, the affect of task absorption does not appear to differentially impact PM between younger and older children, indicating that the related EF processes may not contribute to the developmental trajectory of PM, as the multiprocess framework would imply.

Finally, Dr. Mahy has found that the *centrality* of a prospective cue may affect children’s PM performance, primarily when a cue is outside of their centre of attention. Moreover, Dr. Mahy’s research illustrates that this negative effect may be stronger with younger children as



older. Dr. Mahy and colleagues suggest that this finding may show that PM development in early childhood is related to the amount of monitoring that a cue requires, particularly if cues lie outside of a child's current focus of attention - with cue centrality determining the amount of EF resources required to monitor for and recognize cues.

Older Adults

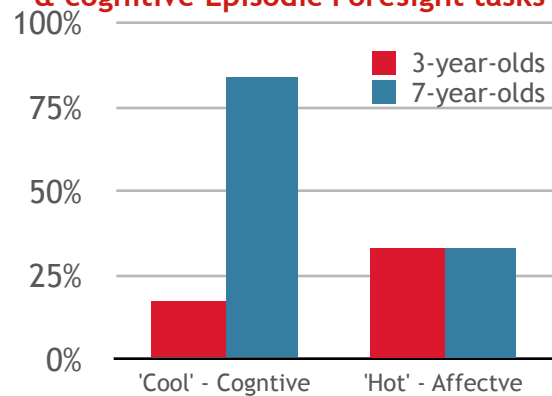
Beyond contributing to the understanding of PM during childhood, Dr. Mahy also has examined how this ability declines among older adults. Specifically, Dr. Mahy and colleagues conducted a large review of various studies on the topic and uncovered a pattern in previous research demonstrating that older adults PM performance may worsen when they are required to remember their intentions in specific orders as compared to unspecified orders (e.g., being required to complete the PM task first and then complete the current task versus being allowed to decide which order to complete the two tasks). Dr. Mahy proposes that this may be due to a decline in the cognitive control abilities required for accurate PM performance. Additionally, she posits that older adults may perform better when provided with focal cues as compared to nonfocal ones, due to the decline that older adults tend to experience with the strategic cognitive resources required in nonfocal situations.

What am I going to want tomorrow?

Another future oriented memory process that Dr. Mahy researches is called *Episodic Foresight*, which refers to the ability to project one's self into the future and understand how one might experience an event (e.g., how will I spend this paycheck?). Episodic foresight has implications for individual's decision making - with good episodic foresight relating to higher accuracy in predicting future thoughts, feelings and behavioural consequences (e.g., if I eat this now, I will not be able to eat at my party later). There are generally thought to be two types of episodic foresight - 'cool' which refers to foresight that relies more heavily on cognitive processes and 'hot' which refers to foresight that mainly relies on affective and motivational processes. Dr. Mahy has investigated the different developmental paths associated with hot and cool processes - finding

that children's ability to perform accurately in 'cool' episodic foresight tasks may develop earlier than their ability to perform accurately within 'hot' episodic foresight tasks (see Figure 2).

Figure 2: Children's accuracy on affective & cognitive Episodic Foresight tasks



With her research Dr. Mahy has proposed that foresight tasks which involve 'hot' affective processes - particularly when current and future states contradict one another (e.g., seeing past how you currently feel to correctly understand your future situations) - may pose a challenge for both older and younger children, with this bias sometimes extending into adulthood, whereas 'cool' cognitive abilities appear to develop earlier and are less difficult for individuals.

I know what's hidden in the box, but do you?

As indicated within her work on PM and episodic foresight, Dr. Mahy focuses a great deal of her research on understanding the role of EF in the development of future oriented abilities. Beyond her focus on future orientation, Dr. Mahy also has examined an interesting cognitive ability entitled *Theory of Mind (ToM)*, working to provide researchers with a deeper understanding of this complex process.

ToM is the ability to attribute thoughts/beliefs/desires to oneself and others and also understand that others may have differing thoughts/beliefs/desires. Typically there are two fields of study on ToM, with developmental psychologists focusing on *how* ToM develops and social neuroscientists focusing on *where* in the brain the ToM develops. Unfortunately these two related fields do not always collaborate, leading to a gap in understanding. Dr. Mahy has revolutionized the study of ToM through presenting clear frameworks from which developmentalists and neuroscientists can work together, using neuroimaging techniques to

study ToM development in the brain while also addressing the associated theories - potentially leading to a theoretically supported and neurologically tested understanding of ToM.

In terms of ToM development, there are clear age effects - with ToM emerging first in young children, increasing throughout childhood and then declining in older adults. Dr. Mahy has investigated the relationship between inhibition and age related declines in ToM, with her work indicating that these declines may not be associated with inhibition, but rather reflect general deficits experienced by older adults (e.g., perceptual deficits). However, Dr. Mahy has noted that older adults may rely on other skills (e.g., vocabulary) while performing ToM tasks and suggests that ecologically valid ToM tasks are needed to fully understand ToM in older adults.

So what – Where is this research being used?

Dr. Mahy’s work clearly lends to the advancement of the field of future oriented thinking, contributing unique insights and empirically tested examinations of the associated processes. Her work serves to extend and enhance the research base on the topic - in turn progressing the understanding of human development.

Beyond serving to further the field and inform future research, Dr. Mahy’s work also has practical applications, particularly for caregivers. Whether it be caring for children who are obtaining future orienting thinking or caring for older adults who may be experiencing declines in these abilities, Dr. Mahy’s work provides caregivers with a deeper understanding what may be occurring with these developments and potential strategies for managing them.

How do they do it?

Dr. Mahy employs interesting methods:

- Strong experimental designs, including neuroimaging
- Assessments of individual differences
- Creative measurements of PM that allow for variance of prospective cues, task difficulty and EF
- Episodic foresight tasks that allow for developmental investigations

What’s next?

Dr. Mahy will be starting her position at Brock University in July 2014 and is currently working to set up a lab and program of study. As such, Dr. Mahy is looking to recruit students and volunteers for her lab. If you are interested in becoming involved in her work, please contact Dr. Mahy - caitlin.mahy@brocku.ca

Referred Works

Ihle, A., Hering, A., Mahy, C. E. V., Bisiacchi, P. S., & Kliegel, M. (2013). Adult age differences, response management, and cue focality in event-based prospective memory: A meta-analysis on the role of task order specificity. *Psychology and Aging, 28*, 714-720. doi: 10.1037/a0033653

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Want More Information?

Are you a student, researcher or parent who would like to be involved in Dr. Mahy’s work?

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Or scan this!

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