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Age differences in the mechanisms underlying remembering events vividly and confidently

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The way humans remember events changes across the lifespan. Older adults rely to a greater extent on gist rather than perceptual detail for episodic memory judgements. Additionally, older adults subjectively rate their memory's vividness as greater or equally high as young adults despite poorer performance on episodic memory tasks. This study aims to explore how the content and specificity (semantic gist versus perceptual detail) of event memories relate to the subjective experience of memory vividness and memory confidence, and how this relationship is affected by healthy ageing. 100 healthy older adults and 100 young adults will be tested online, using an adapted version of a paradigm developed by Cooper and Ritchey (2022). At encoding, participants will be asked to generate a distinctive story in order to associate together (1) a theme word, (2) a person, (3) a place, and (4) an object, to create unique events. Immediately afterwards, participants will be tested on their memory for the identities of the event components (indexing semantic gist), and on a lure discrimination task (indexing memory for perceptual details). The performance on the memory tasks will then be used to explore the relationship between episodic specificity and content and subjective memory measures, obtained via continuous subjective ratings of vividness and confidence at memory test. This research will contribute to the limited body of evidence exploring the relationship between subjective and objective attributes of episodic memory across the lifespan.

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Modeling familiarity through the combination of deep learning and Hebbian training

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In this work, we designed a connectionist model for familiarity recognition to understand the mechanisms behind familiarity on natural images. Past computational models successfully reproduced familiarity on abstract patterns with continuous neurons. They were inspired by the perirhinal cortex (PRC) which has been shown to be crucial during familiarity recognition (Bogacz & Brown, 2003). In fact, a small fraction of neurons in the PRC called *novelty neurons* respond in a stronger manner when new stimuli are presented. Besides, when a stimulus become familiar, its activity in the PRC is reduced compared to novel ones (Brown & Aggleton, 2001). Here, we implemented familiarity recognition on natural images with the combination of a Convolutional Neural Network and a two-layers Feedforward Network, the latter uses Hebbian training to learn natural images (Fig. 1). To test the abilities of the model, we implemented a forced-choice recognition (FCR) task and performed four simulations. During the training phase, a number N of images were learned by the model. During the testing phase, two images were presented simultaneously to the network: a new image and an image learned during training. The model had to

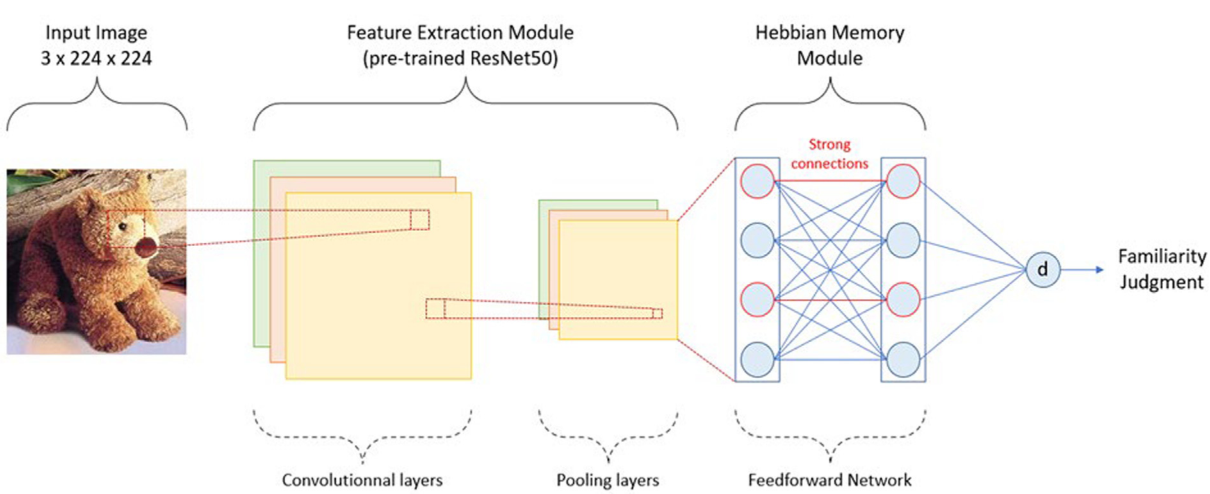

Fig. 1. Global architecture of the model. This model was designed with three successive modules. In the first module, a convolutional neural network is used to mimic the processing of a stimulus by the visual brain area. We used a pre-trained version of ResNet50 to extract the features of an image. The second module is a two-layers forward-propagation neural network. It learns the features of an image extracted previously with an Hebbian learning rule. This memory module projects on an inhibitory interneuron called *d* which is used for the familiarity decision about an image. When two images are presented, the one with the highest level of inhibition *d* is chosen by the model as familiar.

decide which of the two images is familiar. The first simulation showed that the model has a memory capacity of up to 40 images. The second showed that the model seems to exhibit a recency-like effect only when the number of learned images does not exceed its memory capacity. The third consisted of a FCR task only with images from the same semantic category. Results showed that the model performed significantly worse than when targets and lures are from different categories, thus showing an effect of similarity on the performance. These results suggest that the Hebbian model for familiarity learns the global representation of a stimulus by encoding correlations shared by several stimuli (Bogacz & Brown, 2003). When too many stimuli are presented, the model seems to learn prototypal patterns which couldn't allow familiarity recognition. Nevertheless, even though the model seems promising to unravel familiarity mechanisms, more complete models are still needed.

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The role of working memory in encoding the temporal structure of events in episodic memory

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Past events are represented in episodic memory as a sequence of experience units (EUs)—a succession of moments of prior experience. These EUs are separated by temporal discontinuities (moments of prior experience that are not represented), such that the time taken to remember past events is inferior to their actual duration. This temporal compression is not constant: for a given duration, the more an event is represented in memory by many EUs, the higher its remembering duration (and the lower its temporal compression). The number of EUs formed to represent an event in memory depends on the amount of event boundaries (EBs; moments perceived as the end of one subevent and the beginning of another; Zacks, 2020) it contains. Moreover, the amount of working memory (WM) resources available during perception could also play a central role in the formation of EUs (when fewer resources are available, fewer EUs would be formed; Loschky et al., 2020). To test this hypothesis, 60 healthy young adults had to watch and mentally replay sixteen 60-s videos (with either many or few EBs), and then wrote down the content of their mental replay. For half of the trials, participants had to perform a concurrent WM task (counting backwards by 3; Fig. 1). The results showed that performing the concurrent task during viewing led to a decrease in the number of recalled EUs and remembering duration. Furthermore, both the number of recalled EUs and remembering duration were superior for videos with many EBs. Finally, the number of recalled EUs predicted remembering duration, such that the higher the number of recalled EUs, the higher the remembering duration. Taken together, these results suggest a role of WM in the formation of EUs representing the unfolding of events in episodic memory and therefore in determining their temporal compression.

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Face the future: The impact of self-reference and temporality on mind-wandering

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Mind wandering, the automatic drift of attention away from the task at hand and towards inner, unrelated contents, is a prominent feature of human mental life. According to a recent model (Ciaramelli and Treves, 2019), the ventromedial prefrontal cortex (vmPFC) activates schematic knowledge that is necessary to initiate mind wandering endogenously. In line with this view, the activation of the self schema was found to increase future-oriented mind wandering (Smallwood