

PSYCHOLOGY

Remembering together

What is the connection between the curated narrative of a society and the representations of memories in the individual brains of its members? In a new study, Gagnepain and colleagues show that the organization of memories in the brain reflects the structure of a culture's shared discourse.

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Sociologists have long been fascinated by the ways in which societies and generations construct a collective memory of shared knowledge about the past and how these social representations can in turn impact the identities and actions of group members¹. The traditional view of collective memory has emphasized the importance of external symbols and media maintained by a society, outside of the knowledge possessed by any specific person². Recently, psychologists and neuroscientists have begun addressing this question through a more individualistic perspective, studying the ways in which psychological processes within each group member can drive or be driven by collective memory¹. A compelling new study in *Nature Human Behaviour* by Gagnepain and colleagues³ explores a bridge between these approaches, providing evidence of a connection between culturally curated narratives and the neural representations of memories in individual brains. Specifically, the authors found that the way in which French media has conceptualized the events of World War II was reflected in the organization of French participants' memories (as measured with functional MRI).

The standard psychological paradigm for studying memory is to use a set of stimuli that are, by design, unrelated to one another and not part of a pre-existing set of associations or schema. This is a useful approach for studying the cognitive and biological processes by which memories for individual items are formed and recalled in isolation. Realistic episodic experiences, however, almost always take place within familiar spatial, temporal or semantic landscapes, and this pre-existing schematic knowledge can form a scaffold for supporting memory encoding and retrieval⁴.

Schemas reflect the "extraction of regularities"⁵ from the statistical structure of the world, "binding multiple features that consistently co-occur,"⁶ and they are often assumed to be derived from natural properties or affordances of the environment. In this study, the authors



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instead focused on a memory schema which has been socially constructed through shared experiences and decades of shared dialogue, causing members of a community to form a set of culturally specific associations between topics. The experimental design, in which participants first encountered images and captions in the Caen Memorial Museum, was intended to help activate this collective schema in the participants' minds during encoding. Indeed, the authors found that the behavioural similarity ratings of the participants were more closely related to the collective schema than those of a control group that did not explore the Memorial.

Quantifying collective knowledge is inherently challenging, since it cannot be derived from the definitions of symbols and events in a dictionary or encyclopedia and since it exists in a distributed, decentralized form across the minds and media of a community. The study made use of a unique repository from the French National Audiovisual Institute, which includes 3,766 television news bulletins and reports

on the topic of World War II, broadcast from 1980 to 2010. This corpus provides a window into the way that a country actually discusses a set of topics and provides a proxy for the media environment that the participants had been exposed to during their lives. As an increasing proportion of our society's communication moves to digitally recorded media and as tools for data-mining these corpora continue to advance (thanks to ongoing progress in the fields of natural language processing and computer vision), this kind of data-driven approach may become a more standard tool for psychologists to quantitatively model a group's collective understanding.

A critical comparison in the experiments compares topic similarity established by this media-derived corpus to a topic model based on French Wikipedia articles related to World War II. These articles contain semantic knowledge about the people and events of the war, but do not necessarily reflect the cultural context that surrounds these pieces of factual information. The study found that the collective media

model was a better predictor of both behavioural image similarity ratings and the similarity of neural patterns in the dorsal portion of medial prefrontal cortex (mPFC) during retrieval, providing evidence that such context-aware corpora may be more appropriate for modelling human behaviour than a purely meaning-based set of documents.

An intriguing result in the study is that the strength of this alignment between neural representations and the collective schema increased with age, with the weakest effects in the younger participants (22 years old) and the strongest effects in the older participants (39 years old). As noted by the authors, this may be evidence that a slow acquisition of cultural memories takes place over a lifetime. Alternatively, this finding could reflect dynamic changes in collective memory; the broadcast corpus is well-matched to cover the experiences of the older participants, but may be outdated for capturing the recent cultural environment that has shaped the younger participants' schemas. Future work could investigate whether decades-long shifts in collective

memory are reflected in differing neural representations across generations.

An exploratory whole-brain analysis confirmed that collective memory representations were largely restricted to mPFC. These results extend previous work implicating this region in schema-based recall for simpler, artificially generated schematic associations⁷, showing that mPFC also represents rich associative structures that have been accumulated over a lifetime. Lesion studies in both rodents⁸ and humans⁹ have in fact shown that mPFC can support memory for schema-consistent information with no involvement (or only brief involvement) of traditional episodic memory systems in the medial temporal lobe.

Gagnepain and colleagues provide compelling evidence that cultural symbols and media are internalized within the mPFC of individuals, in much the same way that specific episodic memories become schematized as semantic knowledge. These results open up exciting new avenues for quantitatively studying the interplay between collective and personal memories and for embedding the neurobiological

mechanisms of individual minds into a broader cultural context. □

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Competing interests

The authors declare no competing interests.