

COMPUTATIONAL SOCIAL SCIENCE

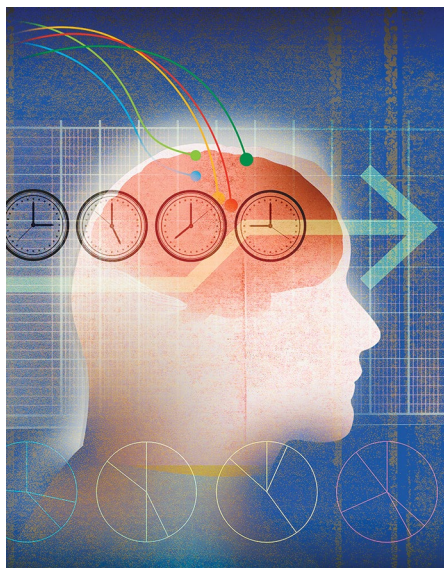
Predicting the decay of collective memory

Cultural products have a life of their own: academic papers get cited and songs get downloaded. Surprisingly, public attention to these products shows a consistent pattern over time: a constant decline characterized by an inflexion point. This pattern might be due to how cultural products are discussed in the community and archived as cultural memories.

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Take the public attention to the 9/11 terrorist attacks as an example. Days after the attacks, New Yorkers tended to congregate in small groups of close friends to discuss the events and their experiences¹. They communicated with one another as a way to share information and to cope with the trauma. Following the immediate aftermath of the 9/11 events, makeshift memorials, newspaper articles, books on the topic and formal commemorations served as constant reminders of the terrible tragedy. Both the communicative exchanges that occurred right after the attacks (that is, communicative memories) as well as the artefacts that served as reminders in the wake of the attacks (that is, cultural memories) fundamentally impacted the collective memories of New Yorkers. Writing in *Nature Human Behaviour*, remarkably, Candia and colleagues² now show that there might be a universal pattern of decay of attention that characterizes a wide range of cultural products, from academic papers describing the Higgs boson to Taylor Swift's 'Shake it Off'. This universal decay is circumscribed by the two factors illustrated in the 9/11 example: the communicative interactions occurring right after the release of a cultural product and the physical records that are subsequently established. The main contribution of the paper is in taking a big-data approach to exploring the dynamics of collective attention, and by extension, to understanding the formation of collective memories.

The topic of the formation of collective memories has been intensely debated among the social sciences³. Sociologists tend to conceptualize collective memories as objectified symbols that have a physical manifestation. Textbooks, monuments and memorials represent the instantiation of collective memories in society. Sociologists are mainly interested in understanding the structural and institutional struggles that play out as these objectified symbols are constructed, demolished and reconstructed. These struggles, sociologists contend,



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reveal the fundamental forces that shape societies' collective memories⁴. In contrast, psychologists conceptualize collective memories as shared individual memories that bear on people's identities⁵. For them, the main factors that shape collective memories go beyond the forces that are responsible for creating objectified symbols. Rather, it is the reception and filtering through people's minds of the information present in the environment (for example, the textbook or monument) that is of interest to psychologists. Candia and colleagues take a big-data approach to understand how collective memories — operationalized as public attention — are influenced by both the conversations that people have with one another as well as by the artefacts that are created following initial communicative interactions.

The approach taken by the authors involves collecting data that captures the public attention given to a wide range of cultural products, from academic papers published in a physics journal to popular

songs rated on Spotify. For each cultural product, they operationalize public attention in different ways: for papers, how many new citations an academic paper received for a period of time after publication, while for movies, how many views their trailers had on YouTube for a period of time after release. They then fit three mathematical functions to try to approximate the observed pattern of public attention: an exponential decay function, a bi-exponential decay function and a log-normal decay function. Results show that a bi-exponential function (that is, decay of attention interrupted by an inflexion point) constituted the best fit of the data. More surprisingly, this decay pattern describes all the types of cultural products they tested.

While previous studies established that one cannot predict whether a particular cultural product would be successful or not on the market⁵, this paper indicates that once it's out there in the world, we know how the public attention to the product will decay over time: in a bi-exponential fashion.

There is tremendous promise in the current approach, but further refinement is certainly warranted. First, as useful as this framework differentiating communicative and cultural memories is, empirical evidence of its explanatory power is just tentative. It is inferred that the observed pattern is produced by forces that involve communicative and cultural memory, but this assumption has not yet been tested. Therefore, more direct evidence of this potential mechanism of collective attention should be sought. Second is the question of universality: how universal is the pattern observed? Papers, patents, songs and movies might show this bi-exponential pattern, but other cultural products that clearly fall under the category of collective memories (for example, the 9/11 terrorist attacks) might predictably show a different pattern. In the case of the 9/11 events, one could imagine that a cyclical pattern indicating renewed communicative processes at every commemoration (that is, sinusoidal decay)

would more accurately describe the decay of collective memories. Consideration of violations of the general pattern discovered by Candia and colleagues² has the potential to lead to the meaningful expansion of the proposed model.

Finally, the present research has meaningful practical implications. What are the factors that might expand or contract the inflexion point of the bi-exponential function? Previous research has shown that these factors range from obvious psychological phenomena (that is, emotion elicited by particular cultural products⁶) to socio-structural ones (that is, network connectivity that characterizes the community in which the cultural products diffuse⁷). These expansion/contraction dynamics are critically important, since being able to extend the communicative inflexion

point could have real-world consequences. For instance, Hurricane Sandy had horrible consequences for New Yorkers in 2012, with extensive flooding and electricity loss for parts of Manhattan for weeks. The communicative processes following the hurricane could only be sustained for a limited period of time, a period in which individuals in the New York region probably adjusted their beliefs about climate change. Once these communicative processes are attenuated and no artefacts serve as reminders, the collective attention — and memory — of the severity of the hurricane decays, and with it, the belief that climate change is endangering life on the planet. Understanding how one could delay the inflexion point of the bi-exponential function could offer policymakers much needed time to lock in commitment devices at a population level⁸. □

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References

1. Mehl, M. R. & Pennebaker, J. W. *Psychol. Sci.* **14**, 579–585 (2003).
2. Candia, C., Jara-Figueroa, C., Rodriguez-Sickert, C., Barabási, A.-L. & Hidalgo, C. A. *Nat. Hum. Behav.* <https://doi.org/10.1038/s41562-018-0474-5> (2018).
3. Hirst, W., Yamashiro, J. & Coman, A. *Trends Cogn. Sci.* **22**, 438–451 (2018).
4. Olick, J. K. *Sociol. Theory* **17**, 333–348 (1999).
5. Salganik, M. J., Dodds, P. S. & Watts, D. J. *Science* **311**, 854–856 (2006).
6. Brady, W. J., Wills, J. A., Jost, J. T., Tucker, J. A. & Van Bavel, J. J. *Proc. Natl Acad. Sci. USA* **114**, 7313–7318 (2017).
7. Coman, A., Momennejad, I., Geana, A. & Drach, D. R. *Proc. Natl Acad. Sci. USA* **113**, 8171–8176 (2016).
8. Rogers, T., Milkman, K. L. & Volpp, K. G. M. *J. Am. Med. Assoc.* **311**, 2065–2066 (2014).

Competing interests

The author declares no competing interests.