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Cognition in a Social Context: A Social-Interactionist Approach to Emergent Phenomena

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Abstract

The formation of collective memories, emotions, and beliefs is a fundamental characteristic of human communities. These emergent outcomes are thought to be the result of a dynamical system of communicative interactions among individuals. But despite recent psychological research on collective phenomena, no programmatic framework to explore the processes involved in their formation exists. Here, we propose a social-interactionist approach that bridges cognitive and social psychology to illuminate how microlevel cognitive phenomena give rise to large-scale social outcomes. It involves first establishing the boundary conditions of cognitive phenomena, then investigating how cognition is influenced by the social context in which it is manifested, and finally studying how dyadic-level influences propagate in social networks. This approach has the potential to (a) illuminate the large-scale consequences of well-established cognitive phenomena, (b) lead to interdisciplinary dialogues between psychology and the other social sciences, and (c) be more relevant for public policy than existing approaches.

Keywords

socially shared retrieval-induced forgetting, social interactionism, collective memory, social networks

Seventy years of investigations into the black box of cognition have revealed the complex ways in which the cognitive system transforms sensory input into behavioral output (Miller, 2003). Meaningful progress has been made in understanding how one perceives, remembers, reasons, and behaves. The focus has been on information processing within the individual, with investigations of cognitive functions and their interrelations. But the effect of cognition is not limited to individual behavior (Smith & Semin, 2007). The operations of the cognitive system influence (Kashima, 2014) and are influenced by (He, Lever, & Humphreys, 2011; Smith & Semin, 2007) the social contexts in which they are manifested. Indeed, a burgeoning literature has reported on the interaction between cognitive and social processes. These advances have led to a surge of interest in exploring the psychological processes involved in the emergence of large-scale phenomena. Recent research has shown, for instance, that communities of individuals are characterized by shared attention (Risko, Richardson, & Kingstone, 2016; Shteynberg, 2010), collective memory (Hirst, Yamashiro, & Coman, 2018), collective emotions (Mackie, Smith, & Ray, 2008; Yzerbyt, Kuppens, & Mathieu, 2016), and collective action (Sebanz, Bekkering, & Knoblich, 2006).

We advocate here for the development of an empirical framework aimed at exploring how the cognitive system's capacity constraints, its biases, and more generally, its operations have emergent properties at a social level. We propose investigating how the interactions among individuals give rise to collective-level outcomes. Previous attempts at bridging microlevel psychological processes and macrolevel social outcomes (i.e., symbolic interactionism, methodological individualism, and social constructivism) have been faulted for (a) overreliance on qualitative methods, (b) lack of theoretical development, and (c) low predictive power (Van Lange, 2006). To advance psychological research, we aim to overcome these limitations by focusing on the bidirectional influences between cognitive mechanisms and social contexts.

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We first illustrate the approach we are proposing by showing how a well-established cognitive phenomenon (i.e., retrieval-induced forgetting, or RIF) has emergent properties at a collective level (i.e., formation of collective memories). We next argue that, under specifiable conditions, any operation carried out by the cognitive system has consequences at a supra-individual level. Finally, we conclude by outlining how the proposed approach can expand the scope and depth of psychological science.

Emergent Cognition: Collective Memory as a Case Study

Defined as shared individual memories that bear on people's identities, collective memories are characteristic of groups as small as families or as large as nations (Hirst et al., 2018). But despite renewed attention on collective memory in psychology (Roediger & Abel, 2015; Roediger & DeSoto, 2014), no programmatic framework to mechanistically explore their emergence exists. Building on approaches that focus on conversations as the main engine of collective memories, we propose a social-interactionist framework to explore how individually held memories become widely shared across the community. When people encode an event and then discuss it with one another, they reciprocally influence one another's memories. These interactions, when they occur across the community, lead to convergence on a similar memory of the past. To rigorously understand this process, one must first establish how retrieval changes the memory of the encoded event. Second, one must explore the attenuation and facilitation of these mnemonic changes during conversational remembering. And third, one must conduct social network research to explore how mnemonic influences propagate across the community. In what follows, we present empirical support for this social-interactionist approach. We do so for illustrative purposes, acknowledging that illustrations are reductionist in nature. Nonetheless, we believe that providing a concrete example of how our approach generates testable hypotheses could be used to derive general principles that psychological scientists could apply to the study of emergent phenomena.

Phase 1: finding the relevant cognitive phenomena

Studying the formation of collective memories begins with identifying conversations as the main engine for the synchronization of individually held memories. Because conversational remembering involves selective retrieval of previously encoded memories, we built on the extensive cognitive psychological literature on the effects of retrieval on memory. This literature established that selective retrieval influences previously encoded memories in at least two ways: (a) by strengthening the retrieved information and (b) by inducing forgetting of information related to the retrieved memories (Anderson, Bjork, & Bjork, 1994; Fig. 1). For example, if one's memory of the timing of the September 11th attacks consisted of waking up at 7:30 a.m. and learning about the terrorist attacks at 9:25 a.m., then subsequently recalling the fact that one woke up at 7:30 a.m. on September 11 should increase accessibility of this information (i.e., strengthening effect) but, at the same time, should reduce accessibility for the time of learning about the attacks (i.e., RIF effect), relative to information from an unretrieved category such as one's location when hearing of the attacks. Investigating September 11th memories among participants who lived in New York City at the time of the attack, Coman, Manier, and Hirst (2009) found support for both individual-level cognitive phenomena (i.e., strengthening and RIF). Importantly, an extensive literature has now emerged on the boundary conditions of RIF (Murayama, Miyatsu, Buchli, & Storm, 2014). Understanding these boundary conditions at an individual level allows for making predictions about which contexts might facilitate their occurrence at a social level.

Phase 2: the attenuation and facilitation of individual cognition in social settings

Retrieval is not limited to individuals remembering in isolation. Rather, it is oftentimes performed collaboratively in social contexts (Rajaram & Maswood, 2017). Joint conversational remembering could trigger similar strengthening and RIF effects in both speakers and listeners. Indeed, when listeners concurrently, and covertly, retrieved information along with a speaker, they also experienced strengthening of the discussed memories and socially shared RIF (SSRIF) of the unretrieved but related information (Cuc, Koppel, & Hirst, 2007). To continue with our example, listening to a speaker recall waking up at 7:30 a.m. reduced accessibility of the listener's own memory for when he or she learned about the attacks (Coman et al., 2009). This is because the listener was concurrently retrieving the information of when he or she woke up on September 11th, which triggered the suppression of related memories (i.e., the time when he or she learned about the attacks).

If strengthening and RIF effects occur in both speaker and listener at the same time, then their memories should become more similar following conversational remembering, which is what Coman and Hirst (2012) found. Importantly, listeners' concurrent retrieval can

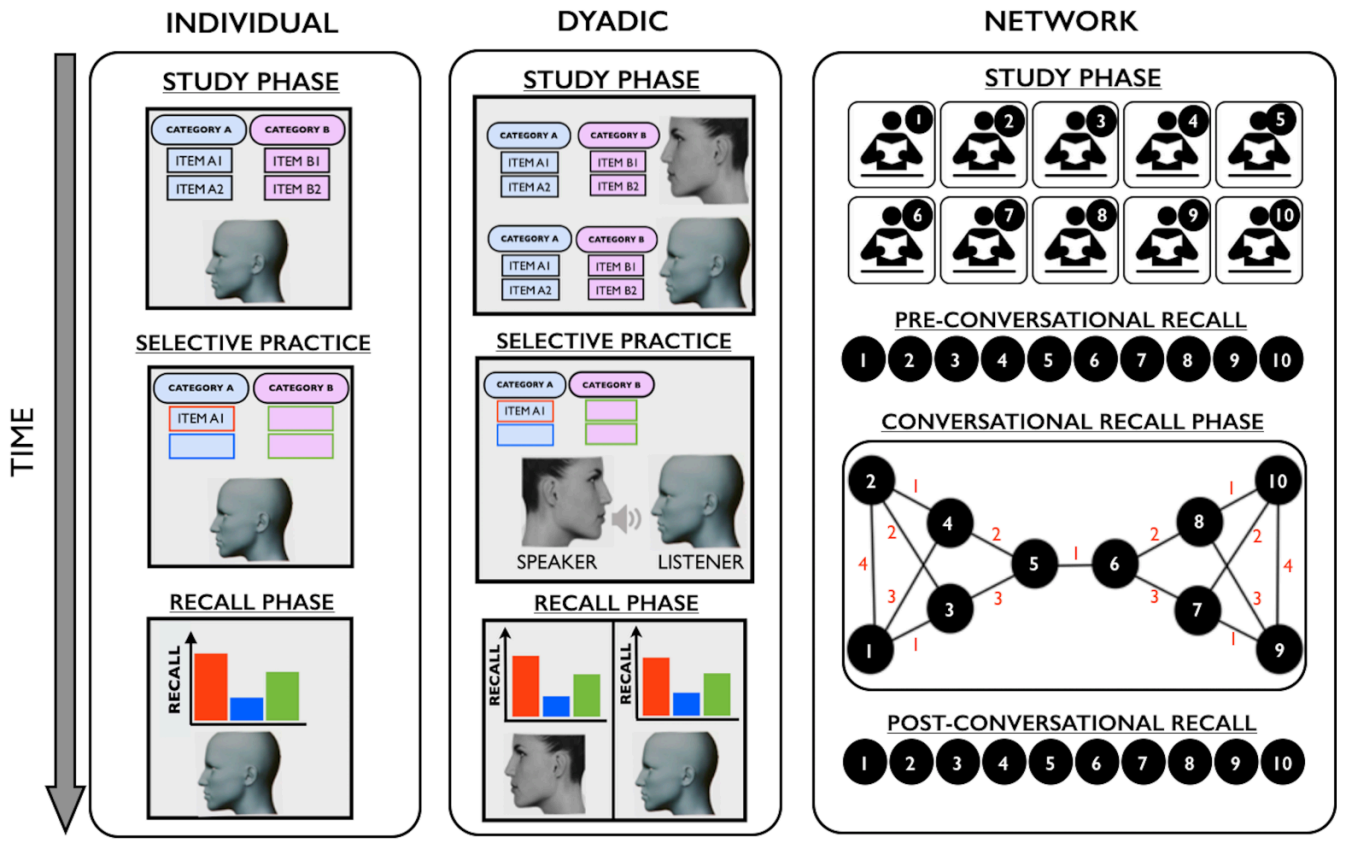

Fig. 1. Phases of the experimental procedure used to investigate retrieval-induced forgetting. In the individual paradigm, participants individually study category-exemplar pairs; they then selectively practice half of the items from half of the categories and then individually recall the initially presented information. Results from the recall phase show that practiced items (red bar) are remembered better than unpracticed unrelated items (green bar; strengthening effect), which in turn are remembered better than unpracticed related items (blue bar; retrieval-induced-forgetting effect). In the dyadic paradigm, pairs of participants study category-exemplar pairs. A speaker then selectively practices information during conversational remembering, and then both speaker and listener individually recall the initially presented information. Following this interaction, both the speaker and the listener experience strengthening and retrieval-induced-forgetting effects, as assessed in a final recall test. In the network paradigm, groups of participants study category-exemplar pairs, and they individually recall the studied information both before and after a conversational recall phase. In these conversations, participants jointly remember the information in dyadic sequential interactions. Circles represent participants, and links represent conversations. Red numbers indicate the sequence of conversational interactions.

be socially modulated. In some circumstances (e.g., when listeners are motivated to relate to the speaker), concurrent retrieval is facilitated (Coman & Hirst, 2015); in others (e.g., when listeners perceive the speakers as dissimilar), it is attenuated (Barber & Mather, 2012). These facilitating and attenuating factors not only inform the operation of cognition at an individual level, but they also affect outcomes that characterize larger communities of interacting individuals.

Phase 3: cognition in social networks

In order for mnemonic influence to spread through a community of individuals, and thus lead to mnemonic convergence, the effect a speaker has on a listener's memories must propagate beyond this local dyadic interaction (Drost-Lopez & Coman, 2018). As an example, if the influence that one New Yorker has on another's memories of the September 11th attacks propagates into subsequent conversations, then this local synchronization of memories should translate into mnemonic convergence at a community level. This convergence occurs, at least in part, because people strengthen the same memories and also forget similar memories following conversations.

Real-world communities are not simple chainlike structures; rather, they involve a multitude of social influences that are time dependent and oftentimes redundant. It is not always possible to simply extrapolate from dyads or chains to real-world networks. The network-level outcomes of dyadic-level interactions could often involve nonlinear dynamics, such that more synchronization at a dyadic level could produce less convergence at a collective level. One such context is when the community

is characterized by subgroups that have diverging opinions on a given topic (e.g., liberals and conservatives). Within these subgroups, the more people talk with one another the more they synchronize their memories, but at a collective level, the community's memories become more and more divergent (Hastorf & Cantril, 1954).

To address the complexity of real-world communities, researchers have recently developed two novel approaches: (a) lab-created social networks and (b) agent-based simulations. First, experimental studies involving sequential dyadic interactions in social networks revealed that the dynamics of mnemonic convergence are dependent on the strengthening and SSRIF effects triggered in conversations (Coman, Momennejad, Drach, & Geana, 2016). Items that were discussed in these conversations became widely shared across community members, while undiscussed but related items were forgotten by the community members to a larger extent than undiscussed and unrelated items (Fig. 1). Social influences on individual memory thus impact the content of the community's collective memory (Fig. 2a).

Second, researchers have employed agent-based simulations (Epstein, 2006). These simulations involve interactions among artificial agents who are part of communities (akin to human societies) and are imbued with psychologically relevant characteristics (e.g., identity, memory). Using simulations, researchers can explore not only whether microlevel cognitive mechanisms give rise to large-scale social phenomena but also the conditions under which these social phenomena might be attenuated or facilitated. Luhmann and Rajaram (2015) and Coman, Kolling, Lewis, and Hirst (2012), for instance, showed that the magnitude of strengthening and SSRIF effects experienced by agents after networked conversations affects the degree of convergence the community reaches. Equally important, the connectivity among agents significantly impacted convergence, with smaller, densely connected communities (i.e., 30 agents) reaching faster convergence than equally dense larger communities (i.e., 100 agents).

On the basis of these findings, we claim that psychological research on the formation of collective memories from a social-interactionist perspective exhibits the type of methodological and theoretical refinement that could serve as a model for other phenomena (Fig. 2b). Below, we briefly elaborate on the strengths of the proposed approach, and we provide guidelines for researchers interested in pursuing social-interactionist investigations of emergent phenomena.

Bridging Microlevel Cognitive Phenomena and Macrolevel Social Outcomes

We are advocating for a mechanistic exploration of the emergent properties of cognition at a large-scale social level. This framework is by no means limited to investigating memory effects in social networks. Rather, this approach has three characteristics that make it suitable for the advancement of psychological science: (a) It is generalizable, (b) it provides bridges to other social sciences, and (c) it makes psychology more relevant for public policy compared with traditional approaches.

First, the social-interactionist approach can be applied to any cognitive mechanisms whose effect is manifested in a social context. At a basic level, cognitive-capacity constraints will influence collective-level phenomena. If, for instance, people can attend only to a limited number of objects in a visual display, then these attentional constraints will influence the amount of information they can encode and communicate and, in turn, will limit the degree to which they could collectively reconstruct the visual display (Miller, 2003). Similarly, the preferential processing of emotionally arousing and negative information (Rozin, & Royzman, 2001) could result in the encoding of more similar information across a community of individuals, which, when manifested in communicative exchanges, would accelerate convergence processes (see Fig. 2b for a proposed investigation of collective emotions). In the domain of risk preferences, the finding that a loss frame is cognitively "stickier" than a gain frame (Ledgerwood & Boydstun, 2014) might impact collective decision making if the majority of individuals in a community show the same bias. Similar conjectures apply to other psychological phenomena that have been widely investigated by cognitive and social psychologists (Kahneman, 2011; see Fig. 3 for an overview of existing research using a social-interactionist approach).

Second, an approach that provides a mechanistic investigation of how microlevel psychological phenomena give rise to macrolevel social outcomes has the potential to bridge psychology and other social sciences, such as sociology (DiMaggio, 1997), anthropology (Sperber & Hirschfeld, 2004), and political science (Balcells & Justino, 2014). For example, a burgeoning literature in psychology has shown that communication could drastically affect the synchronization of memories across a community of individuals (Hirst et al., 2018). Although psychological research rarely deals with large groups characterized by networked interactions, sociologists have long established that a community's network structure affects a whole host of outcomes, from information propagation (Bakshy, Hofman, Mason, & Watts, 2011) to adoption of health behaviors (Centola, 2011).

One seminal sociological finding is that the weak ties among community members, those connecting individuals across clusters, have a disproportionate influence on information propagation across the network (Granovetter, 1973). There is limited research on how these weak ties might impact psychologically relevant

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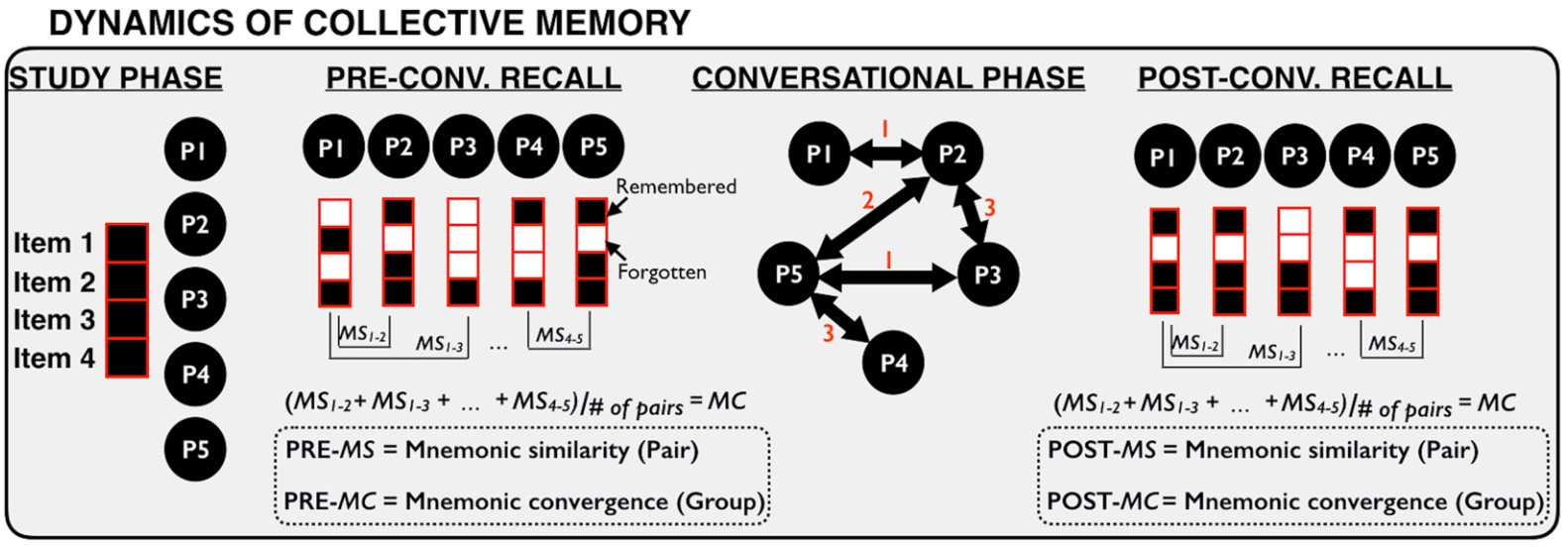

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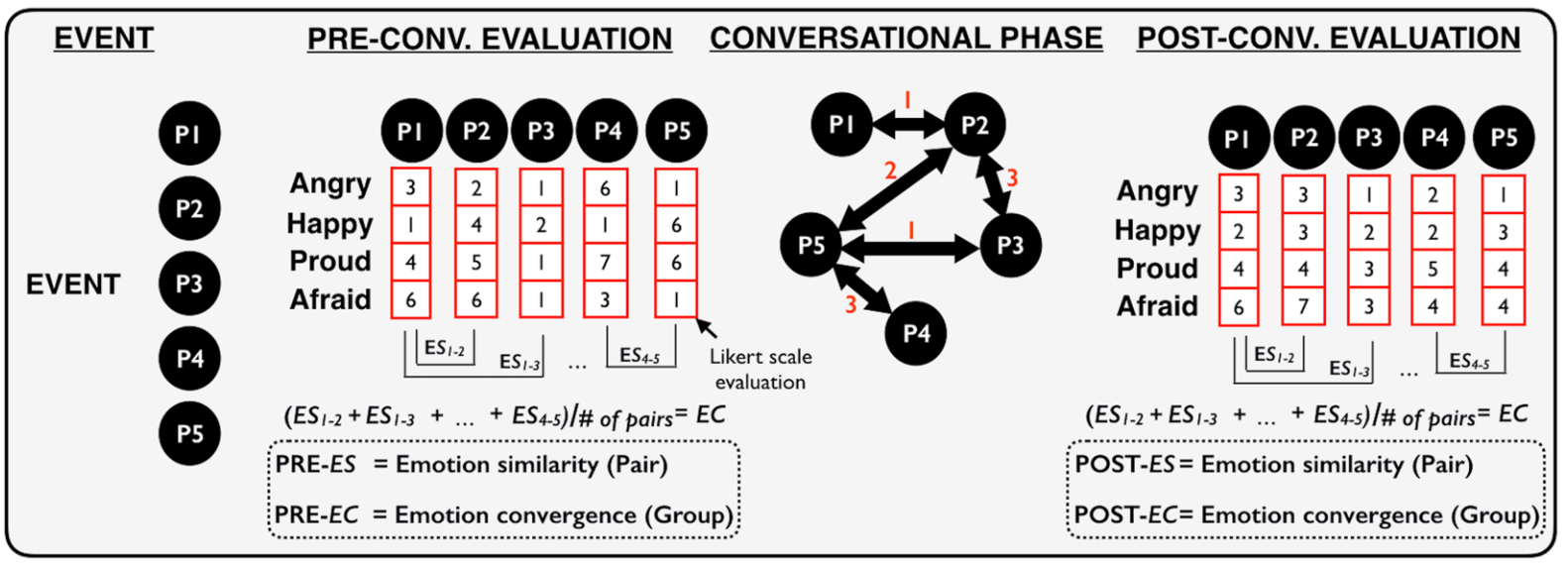

Fig. 2. *(continued on next page)*

Fig. 2. Experimental procedure used to investigate collective memories in small communities (a; Coman, Momennejad, Drach, & Geana, 2016) and a proposed social-interactionist paradigm to investigate the dynamics of collective emotions (b). In investigations of collective memories in small communities (a), each participant (P) first studies a story comprised of several items. Participants then individually recall the items, engage in a sequence of conversations to jointly remember them, and once again recall the story individually. Mnemonic-similarity (MS) scores for all participant pairs in the community are computed as the sum of the number of items remembered in common and the number of items forgotten in common by the 2 participants, divided by the total number of items in the stimulus set. Mnemonic-convergence (MC) scores are computed as the average of all pairwise MS scores. Red numbers in the conversational phase indicate the sequence of conversational interactions. In the social-interactionist paradigm, aimed at exploring the formation of collective emotions (b), participants experience an event. They then individually evaluate their emotional reaction to the event on a 7-point Likert scale, after which they engage in a sequence of conversations to discuss the event. Finally, in a postconversational evaluation phase, they once again evaluate their emotional reaction to the event. Emotion-similarity (ES) scores are computed as the absolute differences between every pair of participants' scores, separately for each emotion. Emotion-convergence (EC) scores are computed as the average of all pairwise emotion similarity scores.

collective phenomena. Such investigation would focus on the interaction between individual-level processes (e.g., emotional contagion) and network structure (e.g., the ratio of weak to strong ties in lab-created communities) to understand the emergence of large-scale outcomes (e.g., collective emotion). In recent research, for instance, we have shown that the temporal sequencing of conversations in the network impacts the formation of collective memories by affecting the intercluster propagation of information (Momennejad, Duker, & Coman, 2018).

Relatedly, the notion that individuals in a social network are separated from one another by a certain number of links (i.e., "six degrees of separation") could be

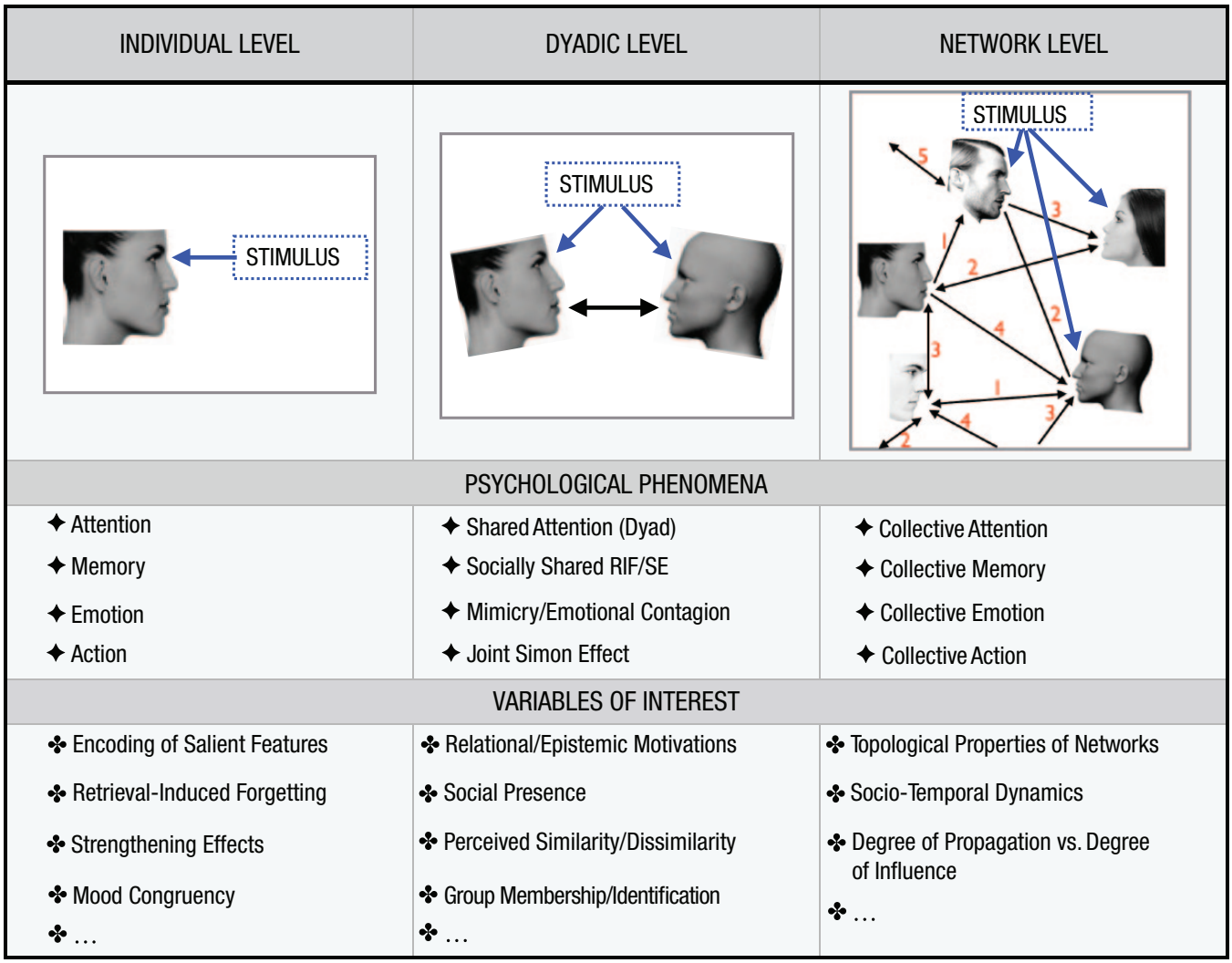

Fig. 3. An illustration of the social-interactionist framework proposed in the current article. Psychological phenomena and variables of interest in experimental investigations are shown separately for each of the three phases of the proposed framework: individual level, dyadic level, and network level. In the top row, the blue arrows indicate that participants are exposed to a stimulus (e.g., experienced event, story, hypothetical scenario), the black arrows represent conversations among participants, and the red numbers indicate the sequencing of the conversations in a conversational network. RIF = retrieval-induced forgetting, SE = strengthening effect.

relevant for investigating psychologically grounded collective phenomena. There may be six degrees of separation, but as Christakis and Fowler (2009) observed, there are only three degrees of influence. In fact, the extent to which the influence observed in a single interaction propagates through a chain of social exchanges varies for different psychological phenomena (Drost-Lopez & Coman, 2018). We conjecture that tipping points (Granovetter, 1973), where the community starts exhibiting a qualitatively different behavior than in the previous state, will occur when the degree of influence is equal to or exceeds the average degree of separation among members in the community.

Third, the findings derived from social-interactionist experiments following this framework will be more relevant for public policy than current approaches. These investigations could reveal phenomena at a level of analysis that is more appropriate for policymakers: communities of individuals (Coman & Berry, 2015; Dovidio & Esses, 2007). Once one discovers how psychological processes interact with network structure to produce collective-level outcomes, one could use these findings to promote real-world change. For example, findings derived from social-interactionist investigations aimed at discovering "sweet spots" of network connectivity that result in maximal diffusion of information should be useful to policymakers during public-health crises. These investigations could provide insights to policymakers from a whole host of domains, from conflict resolution, where collective memories and collective emotions likely play a role in conflict dynamics, to organizational management, where collective decision making takes center stage.

Conclusion

In order for this social-interactionist framework to guide the production of innovative research, a series of conditions will need to be met. First, given that network-level studies involve multiple interacting participants, we need both large samples of participants and the technology for interactions to take place seamlessly. With the development of platforms such as Amazon Mechanical Turk, participant recruitment has been drastically expedited. On the technical side, new software platforms that allow for computer-mediated networked interactions (e.g., Chatplat, POGS, SoPHIE, Breadboard) make the study of collective-level phenomena much more feasible. The expansion of such platforms from social interactions involving chat messaging to audio or video interactions should allow for the programmatic investigation of the impact of different communication media on collective-level phenomena. Given modern communication, such programmatic investigation is not only ecologically valid but also theoretically relevant. For instance, we found a sizable impact of conversations on the community's mnemonic convergence with fairly limited social presence (i.e., computer-mediated chat interactions among participants; Coman et al., 2016). Increasing the social presence of the conversational partners by employing video interactions will likely accelerate mnemonic convergence because of the increased social pressure to conform, a conjecture in need of testing.

Second, the field needs to develop data-analysis capabilities to make sense of the collective-level findings. One of the most important challenges that this social-interactionist approach will need to overcome is dealing with the changing nature of the outcomes that it investigates. Memories, emotions, and behaviors are highly dynamic at both the individual and, by extension, the collective level (Fig. 2a). Understanding the dynamical nature of these phenomena requires, thus, a sophisticated statistical framework, which is yet to be developed.

Third, the approach will be most effective if the investigation is grounded in specific psychological phenomena. Understanding the formation of collective memories is different from understanding collective emotion dynamics or the mobilization of collective identities. At a methodological level, memories could be evaluated against an objective ground truth (the stimulus material) and coded as either accurate or not, but emotions could be coded as present or not present, as well as on continuous scales that capture their intensity (Fig. 2b). At a theoretical level, the processes involved in strengthening and suppressing memories in conversations are of a different nature than the processes involved in emotional contagion (Peters & Kashima, 2007).

Finally, the framework we are proposing should not be seen as an alternative to more traditional approaches undertaken in psychology. Basic discoveries in cognitive and social psychology constitute the premise for investigations one could undertake using the social-interactionist approach. Our efforts should be seen as an attempt to offer guidance on how to programmatically investigate the relation between cognitive phenomena and their emergent outcomes. In this sense, we are building on approaches that recognize the interconnected nature of the processes carried out by cognitive systems in social settings (e.g., Vallacher, Read, & Nowak, 2017).

Recommended Reading

Coman, A., Momennejad, I, Geana, A, & Drach, D.R. (2016). (See References). Shows how dyadic-level interactions align the interactants' memories and how this process leads to the formation of collective memories in 10-member, lab-created communities.

DiMaggio, P. (1997). (See References). A sociology article on the interaction between cognition and culture.

Hirst, W., Yamashiro, J., & Coman, A. (2018). (See References). A review article on how conversational remembering affects the interactants' memories.

Roediger, H. L., III, & DeSoto, K. A. (2014). (See References). An empirical article investigating how Americans remember and forget publicly available group-relevant events.

Sperber, D. & Hirschfeld, L. A. (2004). (See References). A review about how cultural dynamics are grounded in cognitive phenomena.

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