

Cognition Through a Social Network: The Propagation of Induced Forgetting and Practice Effects

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Although a burgeoning literature has shown that practice effects and socially shared retrieval-induced forgetting can reshape the memories of speakers and listeners involved in a conversation, it has generally failed to examine whether such effects can propagate through a sequence of conversational interactions. This lacuna is unfortunate, since sequences of social interactions are more common than single, isolated ones. The present research explores how people exposed to attitudinally biased selective practice propagate the practice and forgetting effects into subsequent conversations with attitudinally similar and dissimilar others and, through these conversations, affect subsequent acts of remembering. The research establishes that the propagation of retrieval-induced forgetting and practice effects is transitive. It also determines when attitude influences propagation. These findings are discussed in the context of the formation of collective memories.

Keywords: attitudes, collective memory, diffusion of information, social networks, socially shared retrieval induced forgetting

In the past few years, there has been a burgeoning investigation of the way social—in particular, conversational—interactions shape memory. Although researchers have studied a range of topics (Hirst & Echterhoff, 2011), one area has remained relatively neglected: the propagation of memory through a sequence of social exchanges. Research to date has concentrated mainly on the effect of a single social interaction on memory. The effect of social interactions on memory is rarely so confined, however. John may talk to Mary and Peter separately about the election party last night, but the discussion does not end there. Peter and Mary may subsequently talk to each other. This subsequent conversation could amplify or negate the effect John had on Peter's and Mary's memory.

Here we address two unexplored issues about propagation. First, we examine the spread of mnemonic influence. The current literature on the social aspects of memory only indicates that John should separately influence the memories of Mary and Peter (see Hirst & Manier, 2008, for a review). Will his influence propagate into the conversation between Mary and Peter and subsequently produce a stronger effect on their postconversational memories? Two possibilities present themselves. First, John's postconversational influence may be transitive. In this case, if his initial influ-

ence on Mary and Peter propagates into their conversation then, it should, in turn, influence their postconversational memories; if his initial influence fails to propagate into the conversation, then it should, in turn, have little or no influence on their postconversational memories. Alternatively, the principle of transitivity may not hold, and what happens in the conversation between Mary and Peter may have no bearing on John's ultimate influence. This second possibility could occur, for instance, if John's initial influence on Mary and Peter was extremely strong, making it impervious to what happened in the conversation. The current literature provides little basis for deciding between these possibilities. It is important to explore this issue if we are to understand the conditions under which one person might have a sustaining influence on a network of connecting and, critically, interacting individuals.

The second issue examines whether attitudes moderate the propagation of mnemonic influences. The example of John, Mary, and Peter highlights this issue. The party was about an election. Will John be able to influence the memories of Mary and Peter if they have different attitudes than he does toward the election? Moreover, will the attitudes of Mary and Peter matter when considering the propagation of John's mnemonic influence into the conversation? That is, will propagation be more or less likely if Mary and Peter shared the same attitude—or have different attitudes? Again, there is little research to guide an answer to these questions. We decided to include attitude as a variable in the present study because, in most cases of remembering, participants approach the to-be-remembered material with an already present attitude toward it.

In the present study, we focus on two ways one person in a social interaction can influence the memory of another: through practice effects and through retrieval-induced forgetting (RIF; see Hirst & Echterhoff, 2011, for a more thorough discussion of social influences on memory). We are interested in the propagation of practice effects and RIF through a small sequence of social inter-

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actions and the way in which attitudes moderate this propagation. We focus on what might be viewed as retrieval effects as a source of social influence because in one form or another, they can have memory-altering consequences in almost every conversation.

Retrieval Effects: Strengthening Versus Forgetting

There is little doubt that in most cases, when a speaker remembers, her memory is strengthened. After all, retrieval is the “key to long-term retention” (Karpicke & Roediger, 2007, p. 151). Similarly, if listeners already possess a similar memory, it is also strengthened (Brown, Coman, & Hirst, 2009; Cuc, Koppel, & Hirst, 2007; Wittenbaum & Stasser, 1998). In one of the few studies that have examined the propagation of practice effects, Blumen and Rajaram (2008) showed that practice effects observed at the beginning of a short sequence of social interactions propagate through to the end of the sequence.

Apart from strengthening a preexisting memory, retrieval can also induce forgetting. When an individual selectively recalls previously studied material, she is more likely to forget the unmentioned but related memories than the unmentioned but unrelated memories. This phenomenon is known as retrieval-induced forgetting (RIF). In the standard RIF experiment, participants study category–exemplar pairs, such as *animal–cat*, *animal–dog*, *vegetable–broccoli*, and *vegetable–pea*. They then receive selective retrieval practice by completing cued words for some pairs (*animal–d_*) but not for other related pairs (*animal–cat*) or whole categories of pairs (e.g., all the vegetable pairs). This design establishes three types of retrieval-practice items: practiced items (Rp+; e.g., *animal–dog*), unpracticed items related to practiced items (Rp–; e.g., *animal–cat*), and unpracticed items unrelated to practiced items (Nrp; e.g., all the vegetable pairs). A practice effect is present if, in a subsequent recall test, Rp+ items are remembered better than Nrp items, whereas induced forgetting occurs when Nrp items are remembered better than Rp– items (for a review, see Anderson & Levy, 2009).

According to the most widely accepted theory of RIF (Anderson & Levy, 2007; cf. Camp, Pecher, & Schmidt, 2007; Racsmány & Conway, 2006), when people attempt to retrieve a specific memory, related memories compete for activation; to ensure that the desired memory comes to mind, the competing memories must be inhibited. This inhibition can linger over time and become evident in subsequent memory tests, producing the telltale RIF pattern. Under specific conditions, such as ample retrieval time, facilitation instead of induced forgetting can be found (Chan, McDermott, & Roediger, 2006). However, in many increasingly understood circumstances, researchers have shown RIF to be a robust phenomenon (Anderson & Levy, 2009; Chan, 2009).

As this discussion suggests, practice effects and retrieval-induced forgetting may involve different mechanisms. For instance, practice effects may involve the strengthening of a memory, whereas RIF may involve the inhibition of a memory. Thus, increased study alone does not lead to an increased level of RIF impairment (Anderson, Bjork, & Bjork, 2000). For RIF to occur, selective retrieval is necessary. Recently, Storm, Bjork, Bjork, and Nestojko (2006) found RIF without an accompanying practice effect, indicating that the simple attempt to retrieve the target item triggers the response competition associated with RIF.

RIF is relevant to the effects of social interaction on memory because it can occur not only for a speaker in a conversation—the person overtly remembering—but also for listeners (Cuc et al., 2007). In one experiment, for instance, Cuc et al. (2007) asked participants to study a story constructed on an episode–events structure similar to the category–exemplars structure used by Anderson et al. (1994). After studying the story, they were asked to jointly recount it. This recollection results in selective practice of some events from only some episodes and thus creates the retrieval practice pattern observed in standard RIF experiments. A final individual recall test followed. The experimenters transcribed the joint recounting and coded it so that they could classify Rp+, Rp–, or Nrp items for each participant and, for the Rp+ and Rp– items, whether the participant served as a speaker or a listener when the relevant memory was mentioned. To employ their terminology, Cuc et al. found *within-individual retrieval-induced forgetting* (WI-RIF) for speakers and *socially shared retrieval-induced forgetting* for listeners (SS-RIF).

According to Cuc et al. (2007), SS-RIF arises because listeners concurrently but covertly remember along with speakers. Consequently, listeners are essentially in the same retrieval state as the speakers and should manifest the same pattern of induced forgetting as the speakers. Cuc et al. argued that SS-RIF involves concurrent remembering because they found that the presence of SS-RIF depends on the way the listener monitors the speaker. SS-RIF emerges when listeners monitor for accuracy but not when they monitor for the fluidity of the speaker’s response. Such monitoring differences would not be expected if SS-RIF arose solely because of interference from the output of the speaker. This alternative posits that what the speaker says interferes with related memories that are left unmentioned in the conversation. Monitoring instructions should produce similar levels of SS-RIF if it is just a matter of the output of the speaker.

Whatever the explanation for SS-RIF, recent research has shown that the effect can be found for a wide variety of material, including schema relevant and irrelevant information (Stone, Barnier, Sutton, & Hirst, 2010), autobiographical memories (Stone et al., 2010), and emotional and highly rehearsed memories (A. Coman, Manier, & Hirst, 2009). It can even occur if speaker and listener share not the same but similar pasts (A. Coman, Manier, & Hirst, 2009). At present, there have been no studies that systematically track RIF through a sequence of social interactions.

Attitudes and Memory

As argued above, individuals involved in a conversation usually approach it with specific attitudes toward the topic at hand. Do these attitudes moderate the influence of social interactions on memory? Moreover, will these resulting mnemonic consequences, such as practice effects or RIF, produce a change in attitude?

According to the congeniality effect, attitudinal selectivity biases people’s memory in favor of information that they agree with. This bias is explained as a strategy to defend against uncongenial information (Levine & Murphy, 1943). One would expect, then, that when the practiced item is consistent with the attitude of a conversational participant, practice effects should increase. When it is inconsistent, practice effects should decrease. Along the same lines, if unmentioned items are consistent with the attitude of the conversational participant, RIF should decrease, because it is more

likely that the unmentioned, attitude-consistent information will come to mind. If, however, the unmentioned items are inconsistent with the attitude of the participant, they may be easier to inhibit and produce greater RIF. In other words, on the basis of the congeniality effect, attitude might influence the level of both practice effects and RIF.

On the other hand, subsequent research on the congeniality effect, including a meta-analysis, has indicated that people not only expose themselves to incongruous information but often attend to it, encode it, and successfully recall it (Eagly, Kulesa, Chen, & Chaiken, 2001). Thus, there may be no reason for practice effects and RIF to vary systematically with the attitude consistency of the to-be-remembered information. There is some evidence supporting this claim, at least as it applies to practice effects (Cacioppo & Petty, 1979). Little work has been done on attitude and RIF. The putative automatic nature of RIF suggests that people might be equally likely to suppress attitude-consistent and attitude-inconsistent information (Conway & Fthenaki, 2003; Román, Soriano, Gómez-Ariza, & Bajo, 2009).

The second issue about attitude that we want to consider is whether people's attitudes change as they better remember or forget information relevant to that attitude. The relation between attitudes and memory is well established. For instance, individuals exposed to confirming and disconfirming evidence evaluate confirming evidence as more convincing. This biased assimilation, in turn, leads to the subsequent polarization of attitudes (Lord, Ross, & Lepper, 1979). Phenomena such as this suggest that when people are induced to forget certain attitude-relevant information, their attitudes should shift in a manner that reflects this forgetting.

This predicted relation between RIF and attitude has been difficult to verify, however. Storm, Bjork, and Bjork (2005), for instance, failed to find a relation between forgetting effects and likeability ratings in a RIF paradigm. More recent work holds more promise, although it does not specifically examine the relation between RIF and attitude change. Iglesias-Parro and Gómez-Ariza (2006), for instance, found that RIF guided the decision making process of selecting job applicants. Moreover, D. Coman, Coman, and Hirst (2011) discovered that RIF for information supporting or opposing medical treatments affected decisions about the most appropriate treatment for a fictitious disease. The current research provides the first examination of whether RIF and practice effects (a) depend on the relationship between the nature of information and the attitude held by the person (i.e., congenial or uncongenial) and (b) can lead to attitude change.

Propagation and the Formation of Collective Memory

The study of propagation and the effects of attitude is important in itself. But these phenomena are also worthy of investigation because they bear in important ways on the formation of collective memories—a dynamic that may, in turn, influence the way cultures are established and maintained (DiMaggio, 1997; Halbwachs, 1992; Sperber & Hirschfeld, 2004). As Hirst and Manier (2008) claimed, the formation of collective memory involves the spread of memories through a network of connected individuals so that, in the end, the network converges on a shared rendering of the past (see also Atran, 2001; Barnier, Sutton, Harris, & Wilson, 2008; Boyer, 1998; Boyer & Ramble, 2001; Norenzayan, Atran,

Faulkner, & Schaller, 2006; Sperber, 1996; see also Kapferer, 1990, for a similar approach to the study of rumors).

The extant literature indicates that both practice effects and RIF may be vehicles for promoting the formation of collective memories. Inasmuch as what is recalled affects both speaker and listeners, as Roediger, Zaromb, and Butler (2008) noted, retrieval and reexposure effects are critical mechanisms underlying the formation of collective memory. Similarly, RIF is relevant to a study of collective memory, because the silences that appear in an act of conversational remembering produce similar patterns of induced forgetting in both speaker and listener (Stone, Coman, Brown, Koppel, & Hirst, 2010). As many scholars have noted, collective forgetting is as important an aspect of collective memory as collective remembering (A. Coman, Brown, Koppel, & Hirst, 2009; Schudson, 1997; Schwartz, 2009; Zerubavel, 2006).

Although discussions of collective memory should, in the end, investigate the spread of a memory across large networks, an exploration of smaller sequences, such as those involving John, Mary, and Peter, may constitute a solid starting point. The strategy would be to make predictions about the propagation of memory effects across a small sequence of interactions by building on what is known about these effects as they apply to exchanges between two people. The next step, which goes beyond what we offer here, would be to extend the findings obtained from small sequences of interactions to much larger networks by employing techniques such as agent-based simulations (Axelrod, 1997; Epstein, 2006; Watts, 2004).

Studying Propagation: Learning, Listening, and Conversing as Vehicles for Propagation

We explore propagation in a sequence of social interactions in which two people first learn about a topic, then listen to a third party selectively discuss the topic, and finally talk about the topic with each other. That is, we are interested in situations captured by our account of John, Mary, and Peter. There is no precedent for such an investigation. Bartlett's (1932) work on serial reproduction is, in essence, a study of mnemonic propagation (Wheeler & Roediger, 1992). His work, however, might be viewed as investigating a sequence consisting solely of one person lecturing about new information to another, who in turn lectures to an uninformed third party, and so on. It does not consider the social interactions in the form of a free-flowing conversation, nor does it study conversations about already learned information. Moreover, both the work of Bartlett and the subsequent work of Allport and Postman (1947) relied heavily on the concept of schema to interpret their results. Of course, there have been more recent follow-ups of Bartlett's work, but these have mainly sought to verify his findings in more rigorous experimental contexts (e.g., Bergman & Roediger, 1999; Kintsch, 1995; Mandler & Johnson, 1977). Kashima and his colleagues employed a serial reproduction task in their studies of stereotype formation across a network (Kashima, 2000; Lyons & Kashima, 2003; Stukas, Bratanova, Peters, Kashima, & Beatson, 2010). In discussing their results, they stressed the contribution of communicative, rather than mnemonic, constraints in shaping the flow of information through a network. As far as we know, no one has explicitly examined the extent to which recently studied phenomena such as social contagion and retrieval-induced forgetting play a role in serial reproduction.

We chose to move beyond the type of sequence examined in the serial reproduction task, because we thought it would be important to include conversational interactions as part of any sequence we considered. In situations outside the laboratory, the social interaction of one-way listening no doubt occurs (e.g., when one listens to a lecture at school or to a politician at a rally or on television). This one-way listening rarely leads to the chain of interactions found in the serial reproduction task: A lecturing to B, B then lecturing to C, and so on. Rather, the lecture or political speech is followed by discussions among the participants. To be sure, what follows may often be more complex than this. Nevertheless, the sequence we focus on here allows us to examine two important kinds of social interactions: one-way listening and conversational interactions. One can easily think of instances in which students read a textbook, then listen to a lecture, and then talk about the lecture with one another; or citizens follow the reporting of a current event in a newspaper, then listen to a politician describe this event in a speech, and finally talk to others about the event.

Moving Into the Laboratory

Figure 1 describes in more detail the sequence of social interactions we studied, along with the various assessments of memory and attitudes we incorporated into the study. As indicated in Figure 1, we studied memory for arguments in favor of or against the legalization of euthanasia in the United States. We chose this topic because pilot work suggested that the legalization of euthanasia would produce a range of attitudes in our experimental sample. As Figure 1 indicates, we first assessed participants' attitudes toward the legalization of euthanasia and then, in the study phase, exposed them to arguments for and against legalization, grouped into categories. Then, in the biased presentation phase, which we viewed as an equivalent to a biased lecture or political speech, we exposed participants to a slide presentation that supplied only some of the initially presented arguments for euthanasia. Participants were told that a proponent of legalization (PERSON-PRO) prepared the slide presentation. After the biased presentation, a cued recall task followed. Then, in the joint remembering phase, we paired participants and asked them to discuss as many arguments for and against euthanasia as they could remember. We studied all possible configurations of attitude pairings. Following the conversation, there was an individual cued recall test and an additional, final evaluation of participants' attitudes toward the legalization of euthanasia.

There are two social influences in this sequence: PERSON-PRO's presentation in Phase 3 and the conversation in Phase 5. We consider the presentation in Phase 3 a social influence, because participants were told that a person put together the presentation to

convey her views on legalization. In a way, the presentation is similar to a Microsoft PowerPoint slide presentation of a lecture. There are also three memory assessments (the preconversation individual recall, the postconversation individual recall, and what is remembered in the conversation) and two attitude assessments (Phases 1 and 7). The first social interaction—exposure to PERSON-PRO's presentation—can affect all three subsequent memory assessments, whereas the second social interaction—the conversation—can affect only the postconversation individual recall. Each of these social interactional effects on memory can be moderated by the attitudes of the participants. In the case of the presentation of PERSON-PRO, the content was always in favor of legalization, whereas the participant attending the presentation could be either pro- or antilegalization. In the case of the conversation, what matters is the pairing of attitudes, with some pairs homogeneous (Pro-Pro, and Anti-Anti) and others heterogeneous (Pro-Anti). This complex design allows us to examine a variety of issues.

The Slide Presentation: The Influence of PERSON-PRO

Does the selective presentation of PERSON-PRO lead to RIF and practice effects? Does attitude moderate these effects? We deal here with SS-RIF, not WI-RIF, inasmuch as the experimenter does not force participants to retrieve the arguments as they attend the presentation. Hirst and his colleagues (D. Coman, Coman, & Hirst, 2011; Cuc, Koppel, & Hirst, 2007) have found both practice effects and SS-RIF in conversations and after reading a pamphlet. The present experiment would extend the range of situations in which SS-RIF and practice effects arise. As to the effect of attitudes, as previously discussed, the issue is far from settled, but it is possible that the attitude of the listeners may not bear on the size of the RIF impairment.

Propagation Into the Conversation

Let us assume that we find RIF and practice effects in the preconversation individual recall and that it does not differ between participants who are prolegalization and participants who are antilegalization. Will the induced forgetting observed in this phase of the study transfer into the conversation? What emerges in the conversation will depend on at least two factors: the accessibility of the arguments as participants begin the conversation and the dynamics of the conversation. Conversational dynamics are important to consider, because they might make initially inaccessible arguments more accessible (Fazio, 1995; Higgins, Rholes, & Jones, 1977) or accessible arguments less accessible (Basden,

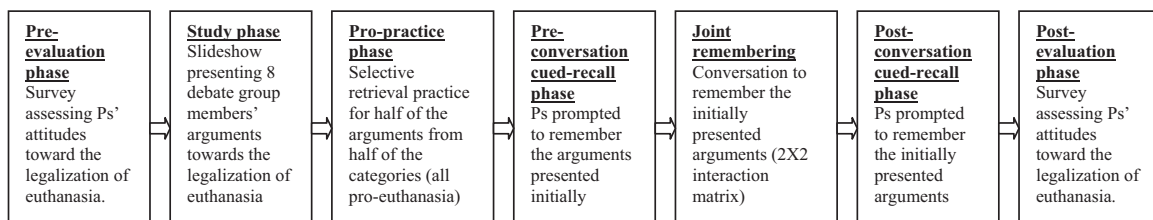


Figure 1. Phases of the experimental procedure.

Basden, Bryner, & Thomas, 1997; Weldon, Blair, & Huebsch, 2000; Wright & Klumpp, 2004). We explore these possibilities in detail in the Results section, particularly as they relate to the attitudes of the conversational participants.

Propagation From Conversation Into Subsequent Recall

Here we explore (a) whether the selective remembering in the conversation leads to practice effects and retrieval-induced forgetting in the postconversation recall, independent of the contribution of PERSON-PRO; and (b) whether PERSON-PRO's influence propagates through the conversation, even if it did not influence the conversation itself. Previous work by Hirst and colleagues (A. Coman, Manier, & Hirst, 2009; Cuc et al., 2007; Stone, Barnier, Sutton, & Hirst, 2010) suggests that the conversation itself should affect subsequent remembering.

Also important here is whether the dual presence of RIF and practice effects from PERSON-PRO and from a subsequent conversation could produce a cumulative effect in a postconversational recall. This clearly should apply to practice effects (e.g., Blumen & Rajaram, 2008). As to RIF, although some studies have repeated the practice phase two or three times in a blocked design (e.g., Kuhl, Dudukovic, Kahn, & Wagner, 2007), none have examined the cumulative effects with a spaced procedure. Finally, when examining the final recall, we are interested not only in propagation but also in whether the propagation (a) leads to a convergence on a shared memory and (b) impacts attitude change.

Method

Participants

Seventy participants (63% women) were recruited through posters displayed around the New School campus (located in Manhattan, New York, NY) and postings on the classified ad website Craigslist (<http://www.craigslist.org>). They participated in the study for either monetary compensation or research credit. The participants were paired with each other on the basis of their attitudes toward euthanasia as assessed in the initial stages of the experimental procedure.

Stimulus Materials

The controversial topic of the legalization of euthanasia was chosen on the basis of pilot work done within the student community of the New School and Craigslist participants in New York. In a preliminary survey, 48 participants who were not part of the main experiment were asked to rate their attitude toward three controversial topics (legalization of euthanasia in the United States, research on animals, and the death penalty), using a scale from 1 (*complete disagreement*) to 9 (*complete agreement*). The most polarizing topic was the legalization of euthanasia (58% agreement, 27% disagreement, and 15% undecided).

To construct the experimental material, we assembled a list of arguments for or against euthanasia and then selected from this list the arguments that would constitute the study material. Inasmuch as RIF experiments often employ category-exemplar pairs as the study material, we grouped arguments for and against the legal-

ization of euthanasia into conceptual categories. For example, the "consequences of legalizing euthanasia" category contained arguments such as "legalizing euthanasia might constitute the start of a slippery slope" (an argument against euthanasia; Anti) and "in countries where euthanasia was legalized, no abuses have been reported" (an argument for euthanasia; Pro). The structure of each argument included a brief one-phrase summary at the beginning followed by a short paragraph offering a more in-depth presentation of the argument. The paragraphs were 53 words long on average (with a range between 43 and 64). Eight such categories were constructed, each containing two arguments for and two arguments against the legalization of euthanasia.

An additional 10 participants, also not involved in the main experiment, rated each argument from this list on two dimensions: (a) whether each argument was for or against euthanasia; (b) whether the argument fit into the specified conceptual category. After completing this assessment, participants were asked to recall the arguments as an assessment of the memorability of the arguments. This pilot study established that there was wide agreement about which arguments were for or against euthanasia and whether the argument fell into the specified category. Finally, on the basis of recall scores, none of the arguments were particularly difficult to remember.

These 32 arguments were presented in a series of Keynote slides (software for the Macintosh, corresponding to Microsoft PowerPoint). On each slide, the name and photograph of a member of a debate team appeared in the upper third of the screen. Immediately below was the title of one of the categories. In the lower third of the screen, one of the arguments associated with the category appeared. We conflated the name and photograph with a category to reinforce the distinctiveness of each category-based group of arguments. An argument from the "scientific implications" category, as presented during the study phase, follows.

Legalizing euthanasia could discourage the search for new cures and treatments for the terminally ill. If people choose to die whenever they feel that science has no cure, then scientists might not feel motivated to search for cures. This cycle might stop funding for cancer research, which will lead to even higher rates of people choosing euthanasia.

Design and Procedure

There were seven phases to the experiment (see the flow chart in Figure 1).

Preevaluation phase. At the beginning of the experiment, to obtain a baseline measure of attitude, we asked participants to complete surveys to indicate their attitude toward the legalization of euthanasia on a 9-point scale from 1 (*I completely disagree*) to 5 (*I am undecided*) to 9 (*I completely agree*).

Study phase. Immediately after the preevaluation phase ended, participants were told to pay attention to how and what eight debate group members argued on the topic of legalization of euthanasia. They were told that the slide presentation was constructed after viewing an actual debate on legalization. The two participants who would later form a conversational pair sat in front of a computer screen on which the Keynote presentation containing the arguments appeared. The presentation of the arguments was blocked so that all four arguments associated with each of the eight categories appeared consecutively. This blocking was meant to avoid cross-category confusions (see Storm, Bjork, & Bjork,

2005). The order of the four arguments within a category was random. Each slide appeared on the screen for 22 s, which pilot work had indicated was ample time for participants to read the material and to make a judgment about the argument. As the slide was presented, participants individually indicated on a paper-and-pencil form the degree to which they agreed with each of the 32 arguments, using a scale from 0 (*completely disagree*) to 10 (*completely agree*). In addition, for each argument, participants were asked to indicate whether it was new (never heard before) or old (they were familiar with it). The participants were positioned in front of the computer in such a way that it was impossible for them to see their counterpart's responses.

We categorized participants as either for or against the legalization of euthanasia on the basis of the agreement evaluation of each of the 32 arguments. We computed for each participant an agreement/disagreement score by subtracting the average score for agreement with arguments putatively against legalization from the average score for agreement with arguments putatively for legalization. Forty-eight participants had a positive agreement/disagreement score and were classified as for legalization (*pro-participant*); 22 participants had a negative score and were classified as against legalization (*anti-participant*). The difference scores were consistent with ratings supplied in the preevaluation phase. All the participants who rated their attitude from 1 to 4 in the preevaluation phase had negative agreement/disagreement difference scores; all the participants who rated their attitude from 6 to 9 in the preevaluation phase had positive difference scores. Of the 13 participants who were undecided in the preevaluation question (choosing 5 on the scale from 1 to 9), six participants had positive difference scores and seven had negative difference scores.

We also computed the percentage of arguments that had never been heard before the study by the participants, on the basis of their new/old evaluation. The percentage of new arguments did not differ between those participants who were for euthanasia ($M = 49.6\%$, $SD = 19.96$) and those who were against euthanasia ($M = 50.8\%$, $SD = 24.71$).

PERSON-PRO practice phase. After 10 min of a distracter task, consisting of a series of questions unrelated to the present experiment, participants were reexposed to half of the arguments from half of the categories, for a total of eight arguments from four categories. Participants were told that someone else (PERSON-PRO) had studied the same slides that they had just finished studying and had assembled from the previously studied slides a new visual presentation. They were told that the slides were not representative of what happened at the debate but rather reflected the assembler's attitude on the legalization of euthanasia. In point of fact, all the presented arguments were for legalization. We decided against employing a PERSON-ANTI slideshow, because there was no a priori reason why we would expect different results with a PERSON-ANTI slideshow. We wanted to keep an already complicated experimental design manageable. On each slide, as in the study phase, there was the name and picture of the person who made the argument in the original debate, a label for the category of arguments that this person made in the debate, and one of the arguments that fell into this general class. Here, the argument was a brief summary of the original, consisting of the first sentence of what participants were exposed to in the study phase. (This summary sentence is italicized in the example in the Stimulus Mate-

rials section.) The participants were instructed to read over the slide and covertly articulate the argument in full, as it was presented in the study phase. Slides during the practice phase appeared on the computer screen for 8 s, which pilot work had indicated was sufficient for participants to read its content and think about the full argument.

The design produced the three retrieval type conditions found in studies of RIF: Rp+, the arguments summarized in the slide; Rp-, the arguments in the same category of the practiced arguments but not featured in any slide in the practice phrase; and Nrp, arguments that were not practiced and were unrelated to the practiced ones. Rp+ arguments were always in favor of euthanasia; Rp- arguments were always against it; and in each Nrp category, half of the arguments were for and the other half were against the legalization of euthanasia. The practiced and unpracticed categories were counterbalanced to ensure that each argument figured an equal number of times as either an Rp or Nrp exemplar across participants.

Preconversational cued-recall phase. After 10 min of further distraction involving another unrelated questionnaire, participants were given a booklet. Each page of the booklet contained on the top a picture of the debate member, his or her name, and the label associated with the category of arguments that this person mentioned. Participants were asked to write down as many arguments they could for each of the eight categories. It was emphasized that they were to recall the arguments from the original slide presentation—that is, all the arguments that figured in the original debate. There were no time constraints placed on the participants. The order of the categories was randomly determined, so that each participant received one of the four possible booklets that had a different category order randomization. This phase of the experiment probed for the effect of the retrieval practice triggered by PERSON-PRO on subsequent memory.

Conversational remembering phase. After 10 min of a distracter task, participants were assembled as pairs and were asked to jointly remember all the arguments mentioned by the debaters. They were instructed to provide the name of the debate member and title of the category for each of the arguments that they remembered. Pairings were configured so that there were pairs in which both members were for euthanasia (34 participants), pairs in which both members were against euthanasia (eight participants), and pairs in which members had contrary positions (28 participants). It is important to note that participants did not know their partner's attitude toward the legalization. Pro-Pro was the most frequent pairing and Anti-Anti the least frequent; a preponderance of participants were in favor of euthanasia, despite our selection of a seemingly controversial topic. The conversation was tape recorded for later coding. There were no time constraints; the only instruction to participants was to remember as much as they could about the original set of arguments that they had studied. The conversation ended only after both members of the pair agreed that they could not remember anything else.

Postconversational recall phase. After 10 min of an unrelated distracter task, a final cued-recall test (similar to the preconversational recall phase) followed. A category label was provided as well as the name and picture of the debater. Participants were instructed to remember as many arguments as they could from the originally studied material. The category labels were there to help them to remember. The major task was to remember as many arguments as possible.

Postevaluation phase. In a final evaluation phase, participants were asked to indicate one more time the degree to which they agreed or disagreed with the legalization of euthanasia, using the same procedure employed in Phase 1.

Analyses and Coding

Following the procedure of Cuc et al. (2007), in all instances, an argument was scored as successfully recalled if the recall captured the gist of the original. From this coding, we could determine the proportion of Rp+, Rp-, and Nrp items recalled, using the original presentation of PERSON-PRO to determine which items were practiced. We calculated these proportions for all three recall assessments: preconversation, conversation, and postconversation. The coding was done by the first author of the present article. A research assistant blind to the study’s hypotheses dual coded 10% of the material from all the different phases of the study. The analyses revealed good reliability, with kappas always greater than .75. Discrepancies were resolved. When coding for the influence of the conversation on the final recall (independent of the influence of PERSON-PRO), we did not code for speaker and listener roles to streamline the presentation of our results. A number of studies have found similar levels of RIF for both speaker and listener (A. Coman, Manier, & Hirst, 2009; Cuc et al., 2007; Stone et al., 2010a). We simply indicated whether an argument was mentioned in the conversation and then used this coding to classify the original arguments as conversationally based (rather than PERSON-PRO based) Rp+, Rp-, or Nrp items. On average, in the conversational remembering, each pair remembered at least one item for 6.14 categories (range = 4–8; maximum possible is 8). Overall, an average of 10.54 unique arguments were remembered per conversation (range = 7–20; maximum possible is 32). In four conversations, at least one argument from each of the eight categories was mentioned. In these instances, we could not assess the practice effects and RIF caused by the conversation on subsequent recalls.

Results

In what follows, we discuss the propagation of induced forgetting and practice effects through the different phases of the experimental procedure. In a separate section, we focus on the contrast between the results for the homogeneous (Anti–Anti and Pro–Pro) and heterogeneous (Anti–Pro) pairs. We then consider the effects

of memory on attitude, and at the end we explore the dynamics of mnemonic consensus.

Induced Forgetting and Practice Effects

There are four subsections to this section. The first three subsections assess memory performance at one of three memory assessments: (a) preconversational, (b) conversational, and (c) postconversational. The last subsection discusses the cumulative effect of PERSON-PRO and the conversation on the final memory performance. We probed both for practice effects and RIF, as well as the extent to which the two are moderated by attitude. Consequently, we undertook a series of repeated-measures analyses of variance (ANOVAs) with attitude as a between-subjects factor and retrieval type as a within-subject factor. For the retrieval type factor, we compared Rp+ with Nrp-Pro when probing for the presence of a practice effect and Rp- with Nrp-Anti when probing for the presence of RIF. For the practice effects, we examined only Nrp arguments for legalization, as Rp+ arguments were always for legalization. In this way, we compared arguments of the same type. Similarly, for RIF we examined only Nrp arguments against legalization, as Rp- arguments were always against legalization.

As for the attitude factor, the number of levels varied from one analysis to another. In the preconversational analyses, we compared participants who had a positive attitude toward legalization (Pro participants) with participants who had a negative attitude toward legalization (Anti participants). For the conversational and postconversational phases, we compared scores that took into account the different combination of attitudes within a pair: Pro–Pro, Anti–Anti, Anti–Pro, Pro–Anti. We refer to the first two as homogenous pairs and the latter two as heterogeneous pairs. In what follows, we occasionally report impairment scores, which were computed by subtracting the recall proportion of Rp- from the proportion of Nrp-Anti and practice effects scores, computed by subtracting the recall proportion of Nrp-Pro from that of Rp+. Tables 1 and 2 contain the relevant RIF scores (Nrp-Anti, Rp-) and the practice effect scores (Nrp-Pro, Rp+) across all three assessment phases. Table 3 contains the values associated with the relevant ANOVAs.

Preconversational recall. We first examined the effect of the selective presentation of PERSON-PRO on the preconversational individual recall (Phase 3 on Phase 4 in Figure 1). To assess the effect of attitude, we compared participants in favor of legalization of euthanasia (Pro) with those against it (Anti). For both practice

Table 1
Recall Proportion for Rp- and Nrp-Anti Items as a Function of the Attitude of Participant, for the Different Assessment Phases

Attitude	Preconversation				Paired with	Conversation				Postconversation				Cumulative			
	Rp-		Nrp-Anti			Rp-		Nrp-Anti		Rp-		Nrp-Anti		Rp- Rp-		NrpNrp-Anti	
	M	SD	M	SD		M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
PRO	.31	.18	.43	.20	PRO	.19	.13	.26	.16	.33	.19	.45	.19	.14	.17	.34	.24
					ANTI	.30	.14	.22	.21	.40	.18	.43	.18	.15	.18	.27	.26
ANTI	.34	.21	.45	.16	PRO	.20	.15	.21	.15	.34	.21	.40	.12	.10	.12	.28	.33
					ANTI	.09	.10	.31	.16	.27	.19	.46	.17	.12	.19	.50	.35

Table 2

Recall Proportion for Rp+ and Nrp-Pro Items as a Function of the Attitude of Participant, for the Different Assessment Phases

Attitude	Preconversation				Paired with:	Conversation				Postconversation				Cumulative			
	Rp+		Nrp-Pro			Rp+		Nrp-Pro		Rp+		Nrp-Pro		Rp+ Rp+		NrpNrp-Pro	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PRO	.48	.20	.31	.18	PRO	.23	.14	.17	.15	.42	.19	.34	.24	.75	.24	.19	.29
					ANTI	.22	.12	.17	.18	.42	.16	.30	.18	.79	.32	.23	.33
ANTI	.40	.17	.30	.17	PRO	.11	.14	.16	.10	.34	.19	.35	.20	.57	.36	.16	.24
					ANTI	.29	.14	.11	.11	.47	.17	.17	.09	.76	.23	.06	.12

effects and induced forgetting, we failed to find main effects for attitude but did find significant main effects for retrieval type. The interactions between attitude and retrieval type were not significant (see Tables 1, 2, and 3 for relevant results). These results indicate that PERSON-PRO's presentation was successful in inducing forgetting and eliciting practice effects, independent of the attitude of the listener. The induced forgetting and the practice effect are consistent with other studies on RIF, but, as noted in the introduction, no one has studied SS-RIF in the context of reading a presentation. The presence of both RIF and practice effects for those against euthanasia is noteworthy in that these participants remembered information counter to their attitude and forgot information consistent with it.

In further analysis, we separated those participants with extreme attitudes against euthanasia (ratings of 1 or 2 in the preevaluation phase) from those with more moderate negative attitudes (ratings of 3 or 4). To examine the effect of extreme attitudes on RIF, we conducted two paired sample *t* tests with retrieval type (Rp- and

Nrp-Anti) as an independent variable and recall in pre-conversational test as the dependent variable: one for the extreme participants, the other for moderate participants. For the extreme Anti participants, we found neither a significant impairment effect, $t(6) = 0.31, p = .76$ (Nrp-Anti $M = 0.30$; Rp- $M = .32$) nor a practice effect, $t(6) = 0.48, p = .65$ (Nrp-Pro $M = 0.34$; Rp+ $M = 0.30$). For the moderate Anti participants, there was both a significant impairment effect, $t(7) = 3.15, p < .02, d = 1.17$ (Nrp-Anti $M = 0.49$; Rp- $M = 0.29$) and a significant practice effect, $t(7) = 5.44, p < .001, d = 1.86$ (Nrp-Pro $M = 0.24$; Rp+ $M = 0.50$). Both extreme (ratings of 8 or 9 in the preevaluation phase) and moderate (ratings of 6 or 7) Pro participants exhibited practice effects and induced forgetting effects (all $ps < .03$). Although the analyses on the Anti participants were performed on a small subsample, the pattern suggests that participants who have an extreme attitude against euthanasia may not be susceptible to either induced forgetting or a practice effect originating with PERSON-PRO. This finding did not arise because participants

Table 3

Main Effects for Attitude, Retrieval Type, and Their Interaction for the Different Phases of the Experimental Procedure

Time and type of assessment	Attitude				Retrieval type				Interaction			
	<i>df</i>	<i>F</i>	η^2	<i>p</i>	<i>df</i>	<i>F</i>	η^2	<i>p</i>	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Preconversational recall												
Induced forgetting	1, 68	0.26	.00	>.10	1, 68	18.23	.21	<.001	1, 68	0.00	.00	>.10
Practice	1, 68	1.64	.02	>.10	1, 68	17.11	.20	<.001	1, 68	1.34	.02	>.10
Conversational remembering												
Induced forgetting	3, 66	0.69	.03	>.10	1, 66	3.54	.05	<.06	3, 66	3.90	.15	<.02
Practice	3, 66	1.27	.05	>.10	1, 66	5.88	.08	<.02	3, 66	3.07	.12	<.04
Postconversation recall												
Influence of conversation												
Induced forgetting	3, 58	0.36	.02	>.10	1, 58	26.93	.32	<.001	3, 58	1.78	.08	>.10
Practice	3, 58	0.53	.03	>.10	1, 58	121.8	.68	<.001	3, 58	0.14	.01	>.10
Influence of PERSON-PRO												
Induced forgetting	3, 66	0.27	.01	>.10	1, 66	14.32	.18	<.001	3, 66	3.27	.08	<.05
Practice	3, 66	0.45	.02	>.10	1, 66	12.80	.17	<.001	3, 66	2.63	.07	<.06
Cumulative effect												
Induced forgetting	3, 46	0.36	.02	>.10	1, 46	21.23	.32	<.001	3, 46	1.03	.06	>.10
Practice	3, 48	0.52	.03	>.10	1, 48	48.44	.50	<.001	3, 48	1.38	.08	>.10

Note. The differences in degrees of freedom from one phase to another are because, in the pair-wise comparison (Rp compared with Nrp), one of the variables may have been missing (e.g., in four pairs, in the conversational remembering phase at least one argument from each of the eight categories was mentioned, which resulted in the impossibility of having a comparison term for Rp items). For Attitude we performed comparisons as follows: Pre- Conversational Recall: Pro vs. Anti; Conversational Remembering and Post- Conversational Recall: Pro-Pro, Pro-Anti, Anti-Pro, Anti-Anti. For Retrieval Type we performed comparisons as follows: Induced Forgetting: Rp- vs. Nrp-Anti; Practice: Rp+ vs. Nrp-Pro; Cumulative Induced Forgetting Effect: Rp-Rp- vs. NrpNrp-Anti; Cumulative Practice Effect: Rp+Rp+ vs. NrpNrp-Pro.

with extreme attitudes were more knowledgeable about the arguments for and against euthanasia. The percentage of arguments new to a participant did not differ between those participants who were extremely against euthanasia ($M = 46\%$, $SD = 32.1$) and those who were moderately against euthanasia ($M = 44\%$, $SD = 21.5$). It most likely arose because participants with extreme negative attitudes either ignored what the participants said or covertly remembered the unmentioned arguments against euthanasia.

Conversational remembering. Does the induced forgetting we observed in the preconversation recall propagate into the subsequent conversation? That is, was the effect of PERSON-PRO's message on memory powerful enough to emerge in the conversation? We used a scoring procedure similar to the calculations of Rp+, Rp-, and Nrp for the preconversation recall and focused on the recall performance of each participant in the conversation. Unlike the previous analysis, as noted, we consider here four different levels of the attitude factor: Pro-Pro, Pro-Anti, Anti-Pro, and Anti-Anti. The first item in the designation of a pair type represents the attitude of the participants whose recall score went into the analysis, so that an Anti-Pro designation means that the score that went into the analysis was that of a person against legalization who was paired with a participant for legalization. Because we were examining behavior within a group, individual responses may not have been independent of each other (Kenny, Kashy, & Cook, 2006). Consequently, we undertook two types of ANOVAs; one treated individuals as the unit of analysis and the other treated groups as the unit of analysis. As the two were comparable, we report only the individual-based analyses to streamline the presentation.

The ANOVAs revealed that for both induced forgetting and for practice effects, there were no main effects of attitudes. Moreover, for retrieval type, there was a marginally significant main effect when considering induced forgetting ($p < .06$) and a significant main effect when considering practice effects. Finally, unlike the preconversational analyses, there were also significant interactions between attitudes and retrieval type for both induced forgetting and practice. Focusing first on the interaction found for induced forgetting, post hoc analyses using a paired sample t test revealed that an induced forgetting effect emerged for Pro-Pro pairings, impairment = .08, $t(33) = 2.44$, $p < .02$, $d = 0.44$, and for Anti-Anti pairings, impairment = .20, $t(7) = 3.21$, $p < .02$, $d = 0.42$, but not for Pro-Anti pairings (impairment = $-.08$; $p > .14$) or Anti-Pro pairings (impairment = $.00$, $p > .90$). Similarly, for the practice effect, paired sample t tests uncovered significant or marginally significant practice effects for Pro-Pro pairings, $t(33) = 1.82$, $p < .08$, $d = 0.32$, and for Anti-Anti pairings, $t(7) = 3.65$, $p < .001$, $d = 1.31$, but not for Pro-Anti pairings ($p = .25$) or Anti-Pro pairings ($p = .20$). These analyses indicate that PERSON-PRO's influence only propagated into the conversations within homogenous pairs (Pro-Pro or Anti-Anti).

Postconversational recall. Let us first examine the influence of the conversation on the final recall, independent of PERSON-PRO's influence. In this analysis, what constituted Rp- and Nrp items was defined in terms of what was or was not said in the conversation, not in terms of what PERSON-PRO said. Once again, the attitude factor had four levels: Pro-Pro, Pro-Anti, Anti-Pro and Anti-Anti. We used the postconversational recall of arguments against euthanasia as a dependent variable for induced forgetting; for practice effects, we used the postconversational

recall of arguments in favor of euthanasia. This procedure allowed us to be consistent with other analyses that explore the effect PERSON-PRO has on the final recall.

In this analysis, for both induced forgetting and practice, we failed to find main effects for attitude but once again found main effects for retrieval type (practice effect: Mean Rp+ Pro = .66, $SD = 0.18$, Mean Nrp-Pro = .29, $SD = 0.19$; induced forgetting: Mean Rp-Anti = 0.18, $SD = 0.17$, Mean Nrp-Anti = .36, $SD = 0.27$). The interactions between attitude and retrieval type were not significant. These results replicate previous work, in that they establish that the selective remembering in a free-flowing conversation can produce RIF and practice effects (e.g., Cuc et al., 2007). Interestingly, the absence of a main effect of attitude suggests that conversations can be a powerful source of RIF impairment, irrespective of the attitudes of the participants.

The above analysis does not address the question, Does the influence of PERSON-PRO propagate through the conversation into the final recall? Thus far, we have established that (a) PERSON-PRO induced forgetting and generated a practice effect in the preconversation recall, (b) the induced forgetting and practice effect emerging in the preconversation recall only shaped what was recounted in the conversation for the homogenous pairs, and (c) regardless of the nature of the pair and independent of the influence of PERSON-PRO, what was said in the conversation induced forgetting in the postconversation recall. On principles of transitivity, one would expect that PERSON-PRO should have an effect on the postconversation recall only when the mediating conversation involved homogenous pairs. In what follows, Rp+, Rp-, and Nrp items are defined in terms of PERSON-PRO's presentation, not in terms of what is said or not said in the conversation.

We again used four levels for the attitude variable (Pro-Pro, Pro-Anti, Anti-Pro, Anti-Anti) as a between-subjects factors and retrieval type (induced forgetting: Rp- and Nrp-Anti or practice effect: Rp+ and Nrp-Pro) as a within-subject factor. The postconversational recall was the dependent variable. For both induced forgetting and practice, there were no main effects for attitude, but significant main effects for retrieval type. The interactions between attitude and retrieval type were significant. Paired sample t tests comparing Rp- recall proportion with Nrp-Anti recall proportion found RIF impairment for Pro-Pro pairs, impairment = .12, $t(33) = 3.72$, $p < .001$, $d = 0.63$, and Anti-Anti pairs, impairment = .19, $t(7) = 3.02$, $p < .02$, $d = 1.05$, but not in Pro-Anti pairs ($p = .61$) or Anti-Pro pairs ($p = .32$). The results for the practice effect were similar, in that paired samples t tests revealed that there was a marginally significant practice effect for Pro-Pro, practice effect = .08, $t(33) = 1.79$, $p < .08$, $d = 0.31$, and a significant effect for Anti-Anti pairs, practice effect = .30, $t(7) = 5.30$, $p < .001$, $d = 1.87$, but not for Pro-Anti ($p = .13$) or Anti-Pro ($p = .90$) pairs. These results suggest that RIF impairment and the practice effect caused by PERSON-PRO, as observed in the preconversation recall, propagated into the postconversation recall when the conversation was between similar others and not when it was between different others. Taking part in a conversation with a person who has an opposing view limits the impact of PERSON-PRO on participants' final memories. In this sense, a principle of transitivity holds.

Cumulative effects. In the present experiment, selective practice could occur through the presentation of PERSON-PRO

and/or the conversation. Do these different instances of selective practice combine to increase the level of induced forgetting and practice effects in the final recall test? A cumulative score was computed by taking into account the two selective practice phases—that is, PERSON-PRO's presentation and the conversation. When considering the cumulative effects of induced forgetting, we first obtained a measure of the cumulative failure to mention a related argument. We counted the number of arguments that went (a) unmentioned by PERSON-PRO and (b) unmentioned in the conversation and related to both what PERSON-PRO mentioned and what emerged in the conversation ($Rp-$ by PERSON-PRO and by conversation: $Rp-Rp-$). We then obtained a measure of a cumulative failure to mention an unrelated argument by counting the number of arguments that were (a) unmentioned by PERSON-PRO and (b) unmentioned in the conversation and unrelated to both what PERSON-PRO mentioned and what emerged in the conversation (Nrp by PERSON-PRO and by conversation: $NrpNrp-Anti$). Here we confined ourselves to arguments against euthanasia, so that we had an appropriate comparison with $Rp-Rp-$ items, which were always against euthanasia. We computed the proportion of $Rp-Rp-$ arguments and $NrpNrp-Anti$ arguments remembered in the postconversation recall for each participant. The difference between these two proportions is the cumulative impairment score.

In a similar way, we assessed the cumulative effect of practice. Arguments were categorized (a) as $Rp+Rp+$ if they were mentioned both by PERSON-PRO and during the conversation and (b) as $NrpNrp-Pro$ if they went unmentioned by PERSON-PRO and unmentioned in the conversation and were unrelated to the arguments mentioned by PERSON-PRO and in the conversation. Now we confined our analyses to arguments in favor of euthanasia, since the $Rp+Rp+$ arguments were always in favor of euthanasia.

To assess the cumulative RIF scores, we employed a repeated-measures ANOVA with attitude (Pro-Pro, Pro-Anti, Anti-Pro and Anti-Anti) as a between-subjects factor and retrieval type ($Rp-Rp-$ and $NrpNrp-Anti$) as a within-subject factor. To assess the cumulative practice effect, we employed a similar ANOVA for the cumulative practice effect, but now with the levels of retrieval type as $Rp+Rp+$ and $NrpNrp-Pro$. As Table 3 indicates, for both induced forgetting and practice effects these ANOVAs revealed no main effects for attitude, significant main effects for retrieval type, and no interactions between attitude and retrieval type. We probably failed to find a main effect for attitude or an interaction because what was relevant here was whether there were repeated chances for RIF or practice. The matching or mismatching of attitudes within the conversation may have affected the level of opportunity for RIF or practice, but when the opportunity arose, their presence had a predicted cumulative effect. Of notice, both the cumulative practice effect and the cumulative induced forgetting effect were larger than their respective pre-conversational and post-conversational counterparts, as can be seen in Tables 2 and 3. Importantly, this finding suggests that with distributed opportunities for retrieval practice, there is an amplification of both practice and induced forgetting effects over time.

The Differential Effects of Heterogeneous and Homogeneous Pairs

As we noted in the introduction, what emerges in a conversation involves an interaction between the accessibility of memories prior to the conversation and the conversational dynamics between the members of a pair as they conversationally remember. As all participants, regardless of their attitude toward the legalization of euthanasia, were equally affected by PERSON-PRO, the accessibility of the memories at the beginning of the conversation could not account for the differences we observed between homogeneous and heterogeneous pairs. Moreover, an analysis of Nrp items suggests that the difference in the type of memories that emerged in the conversation does not involve a preference to recall advantages over disadvantages or vice versa. We assessed this claim using Nrp items, as their accessibility was unaffected by PERSON-PRO. Using independent samples t tests, we found no significant differences between homogeneous and heterogeneous pairs in terms of the recall of $Nrp-Pro$ or $Nrp-Anti$ arguments.

It appears, then, that the difference between the homogeneous and heterogeneous pairs may be traced to conversational dynamics. To be precise, the difference may rest with the way the pairs' conversations follow the framework presented by PERSON-PRO. As Marsh (2007) asserted, the schema guiding a particular goal-oriented retelling can persist into subsequent recollections (Marsh & Tversky, 2004; Pasupathi, 2001; Pasupathi, Stallworth, & Murdoch, 1998; Tversky & Marsh, 2000). News commentators often make the same point in discussing politics when they opine that a politician has "framed the debate." PERSON-PRO essentially frames the debate. In response, at least one member of the pair might take up PERSON-PRO's lead and recall $Rp+$ items as well. Let us identify the participant in a pair who follows this lead as the one who recalls more $Rp+$ items and refer to her as the *Rp+ dominant narrator*. The extent to which this $Rp+$ dominant narrator followed the lead of PERSON-PRO did not vary with the type of pair. A one-way ANOVA performed on just the $Rp+$ dominant narrator scores, with attitude (Pro-Pro, Pro-Anti, Anti-Pro and Anti-Anti) as a between-subjects factor and proportion of $Rp+$ items remembered in the conversation as a dependent variable, was not significant, $F(3, 28) = 1.57, p = .22, \eta^2 = .16$. This indicates that narrators in homogeneous pairs contributed a percentage of $Rp+$ arguments similar to those in heterogeneous pairings. In this regard, the pair types were similar.

The homogeneous and heterogeneous pairs differed, however, in the way the nondominant members responded to the recall of the $Rp+$ dominant narrator. The nondominant members could respond in at least two possible ways: (a) They could follow the trend established by the dominant member and recall more $Rp+$ arguments as well, or (b) they could assert their distinctiveness from the dominant member and begin to recall $Rp-$ arguments (Festinger, 1954; Suls, Martin, & Wheeler, 2002). The latter strategy may require additional effort on the part of the nondominant member, partly because $Rp-$ arguments are generally less accessible than $Rp+$ arguments and partly because the retrieval strategy introduced by the $Rp+$ dominant member may block the execution of successful retrieval strategies for accessing $Rp-$ arguments for the other member of the pair (Baden et al., 1997; Weldon et al., 2000; Wright & Klumpp, 2004). We posit that the nondominant member would only adopt Strategy (b) and recall $Rp-$ arguments

if they felt the need to assert their distinctiveness from the dominant member. This effort is more likely to occur for the heterogeneous pairs than the homogeneous pairs. As nondominant members were against legalization in 12 out of the 14 heterogeneous pairs, their assertion of their distinctiveness should involve the recall of Rp- arguments. And indeed, nondominant members of heterogeneous pairs recalled more Rp- arguments than the nondominant members of homogeneous pairs, $t(27) = 2.41, p < .03, d = 0.92$ (M Homogeneous = .12, M Heterogeneous = .23). This increased recall of Rp- items would negate any evidence of RIF impairment. Thus, RIF and practice effects may not have propagated into heterogeneous pairs because the members against legalization wanted to assert their distinctiveness and recall Rp- items. Members in the homogeneous pairing (which include Anti-Anti pairs) may not have felt the need to make this effort.

In essence, the conversational dynamics in the heterogeneous pairs created a functional relation among dominance, attitude, and RIF impairment: When one member dominated in recalling Rp+ items and the attitudes of the members differed, RIF impairment declined. We assessed this functional relation in a regression analysis. We measured the level of dominance of one member of a pair over another by subtracting the proportion of recalled Rp+ arguments for the nondominant member from the similar proportion for the dominant member. For an attitude difference measure, we subtracted the attitude of the dominant member from the attitude of the nondominant member, as captured by the rating collected in the preevaluation phase of the experiment (Phase 1, Figure 1). As in other instances in this article, RIF impairment was the difference between Nrp-Anti and Rp-. A regression of Rp+ dominance on impairment found the expected negative β , $R^2 = .36, F(1, 13) = 6.65, p < .03, \beta = -.60, t(13) = -2.58, p < .03$. This result indicates that as the contributions of Rp+ of the two members became less uniform, the degree to which the RIF impairment induced by PERSON-PRO propagated into the conversation decreased. A regression of attitude difference on impairment also found an expected negative β , $R^2 = .73, F(1, 6) = 13.37, p < .02, \beta = -.85, t(6) = -3.66, p < .02$. As the difference between the attitudes increased (i.e., as the pair became more attitudinally heterogeneous), the propagation of the PERSON-PRO-induced impairment decreased. Although based on a small number of participants, these results are suggestive of the complex dynamics governing the propagation of mnemonic influence into a conversation.

RIF Propagation and Order of Recall

The presence or absence of RIF propagation did not depend on the order of recalled arguments (the output) in the conversation. According to the output interference hypothesis, RIF impairment arises because the recalled Rp+ items interfere with the recall of Rp- items (Anderson & Spellman, 1995). As a test of this possibility, we followed Macrae and Roseveare (2002; see also Barnier, Hung, & Conway, 2004) and ranked the Rp+ and Rp- arguments according to the order in which they appeared in the conversation, with the lower ranking indicating an earlier recall. We then averaged the rankings for recalled Rp+ and Rp- arguments. For the homogeneous pairs, the mean for Rp+ items was 5.10 ($SD = 2.09$); for Rp- items, 7.11 ($SD = 2.48$). For the heterogeneous pairs, the mean for Rp+ items was 5.63 ($SD =$

2.63); for Rp- items, 5.66 ($SD = 2.82$). This pattern is consistent with our characterization of the conversational dynamics of the two types of pairs. According to the argument above, the nondominant members of the heterogeneous pairs were inclined to respond to the dominant members with Rp- items, whereas the nondominant members of the homogeneous pairs were not. As a result, we might expect that Rp- items should be mentioned earlier for the heterogeneous pairs than the homogeneous pairs, which is what we found, $t(30) = 1.92, p < .06, d = 0.41$. Our interest here, however, is whether we can observe RIF impairment even when Rp+ items did not occur early in the recounting. We focus on the homogeneous pairs, because it was in this type of pair that RIF occurred. Again, following Macrae and Roseveare, we subtracted the average position rankings for Rp+ items from the average for Rp- items and sorted pairs using a median split of the difference. We found no difference in the size of the impairment for the early Rp+ group and the early Rp- group, $t(16) = 0.70, p = .49$. This rules out output interference as an explanation of our conversational findings.

Attitude Change

We assessed participants' attitude toward euthanasia at two time points on a 1-9 Likert scale, as shown in Figure 1. Participants who were in favor of euthanasia had a significantly higher score than participants against euthanasia both preevaluation (M Pro = 7.02, $SD = 1.28$; M Anti = 3.23, $SD = 1.63$) and postevaluation (M Pro = 6.80, $SD = 1.61$; M Anti = 3.59, $SD = 1.99$). To explore whether induced forgetting and practice effects are related to attitude change, we ran six simple linear regressions. For each regression, the subtraction of the postevaluation attitude rating from the preevaluation attitude rating served as a dependent variable (attitude change score). Each of the six regressions contained one predictor: either (a) the practice effects (difference between Rp+ and Nrp-Pro) or (b) the induced forgetting effects (difference between Rp- and Nrp-Anti) caused by PERSON-PRO as measured in the (c) preconversation recall, (d) conversational remembering, and (e) postconversation recall. We limited our analyses to the homogeneous pairings, since it was in this type of pairs that we obtained significant practice and induced forgetting effects. The regression analyses revealed that attitude change was at least marginally significantly predicted by the practice effect caused by PERSON-PRO: (a) on the preconversation recall, $R^2 = .08, F(1, 41) = 3.32, p < .08, \beta = .28, t(41) = 1.82, p < .08$; (b) on the conversation, $R^2 = .12, F(1, 40) = 5.19, p < .03, \beta = .34, t(40) = 2.28, p < .03$; and (c) on the postconversation recall, $R^2 = .08, F(1, 41) = 3.61, p < .07, \beta = .29, t(41) = 1.90, p < .07$. Importantly, the induced forgetting effect attributed to PERSON-PRO on the postconversation recall was also a marginally significant predictor of attitude change, $R^2 = .09, F(1, 41) = 3.94, p < .06, \beta = .30, t(41) = 1.99, p < .06$. These results are consistent with and add to the emerging overall picture: For the homogeneous pairs, PERSON-PRO could shape not only the final recall of the members of a pair but also their attitude.

Inasmuch as attitude change could be attributed to both practice and induced forgetting effects, we undertook a regression analysis with two predictors: (a) the practice effect and (b) the induced forgetting effect attributed to PERSON-PRO in the postconversational recall, as captured by the final recall score. We analyzed the

entire sample here, and again, attitude change was the dependent variable. We found that both practice and induced forgetting effects were marginally significant predictors of attitude change, $R^2 = .16$, $F(1, 41) = 3.68$, $p < .04$, β practice = .26, $t(41) = 1.79$, $p < .08$, β impairment = .28, $t(41) = 1.88$, $p < .07$. In addition, the induced forgetting effect contributed as a marginally significant predictor above the contribution of the practice effect, R^2 change = .08, F change(1, 39) = 3.51, $p < .07$, $\beta = .28$, $t(39) = 1.88$, $p < .07$. This pattern of predictions suggests that what PERSON-PRO mentions has the potential to change one's attitude toward a specific topic by both allowing additional practice of some items and inducing forgetting in others. These results suggest that attitude was more likely to change in the predicted direction as the influence of PERSON-PRO propagated through the sequence of social interactions. Without this propagation, PERSON-PRO was less influential in shaping the final attitude of the participants.

Mnemonic Convergence

As we noted in the introduction, we investigated propagation, in part, because it bears on issues surrounding the formation of a collective memory: specifically, how individual memories become shared memories. With respect to the present findings, are those in the homogeneous pairs more likely to converge on a shared memory than those in the heterogeneous pairs at the end of the sequence? Does the convergence hold both for what is remembered and what is forgotten? Is this more likely to reflect the presentation of PERSON-PRO?

First, consider the issue of whether memories become more shared after the sequence of social influences. Following Stone et al. (2010a), we determined the proportion of arguments remembered in common by both members of the pair (RR), and forgotten in common by both members of the pair (FF), both preconversation and postconversation. For RR items, a paired sample t test comparing the proportion of arguments remembered in common preconversation with the proportion of items remembered in common postconversation (M preconversation = .18, M postconversation = .22) was significant, $t(34) = 2.40$, $p < .03$, $d = 0.67$. Similarly, the participants forgot more arguments in common after the conversation (M postconversation = .49) than before the conversation (M preconversation = .44), $t(34) = 3.71$, $p < .001$, $d = 0.71$. These findings are consistent with those of Stone et al. (2010a) and indicate that mnemonic consensus occurred due to both commonly remembered memories and commonly forgotten memories.

We also explored whether the emerging mnemonic consensus resembled that of PERSON-PRO. That is, now that we know that pairs tend to converge on a shared rendering of the past, is this shared rendering the one advanced by PERSON-PRO? If so, then PERSON-PRO is not only promoting the formation of a collective memory but also imposing her own rendering of the past onto the group's collective memory. Our results to this point suggest that PERSON-PRO should be more capable of achieving this imposition for the homogeneous pairings than for the heterogeneous pairings. Consequently we recalculated RR and FF, but now separately for Rp+, Rp-, and Nrp items. We focused on the post-conversational recall. In what follows, we capture a particular relation between RR and FF in the postconversational recall using a remembering/forgetting measure, $RR + (1 - FF)$. The higher

this score, the more mutually remembered arguments; the lower the score, the more mutually forgotten arguments. If PERSON-PRO is imposing her rendering onto the collective memory of homogeneous pairs, but not the heterogeneous pairs, then she should increase the number of Rp+ items mutually remembered by the participants in homogeneous pairs relative to the participants in heterogeneous pairs, while decreasing the number of Rp+ items mutually forgotten by the homogeneous pairs relative to the heterogeneous pairs. That is, the remembering/forgetting score for Rp+ items should be greater for the homogeneous pairs than the heterogeneous pairs. On the other hand, PERSON-PRO should decrease the number of Rp- items mutually remembered by homogeneous pairs relative to heterogeneous pairs, while increasing the number of Rp- items mutually forgotten by homogeneous pairs relative to heterogeneous pairs. That is, the remembering/forgetting score for Rp- items should be smaller for the homogeneous pairs than the heterogeneous pairs. In other words, there should be an interaction between retrieval type (Rp+ and Rp-) and type of pair (homogeneous and heterogeneous) when the dependent measure is the remembering/forgetting score (see Figure 2). An ANOVA revealed no significant main effects but the expected interaction, $F(1, 33) = 4.47$, $p < .04$, $\eta^2 = .14$. This result indicates that members of homogeneous, but not heterogeneous, pairings are converging on an understanding of the legalization of euthanasia that resembles the position advanced by PERSON-PRO.

General Discussion

This research contributes to the burgeoning literature on the effects of social interaction on memory by moving beyond a single social interaction. Outside the laboratory, the effects of social dynamics on memory are rarely confined to a single interaction but

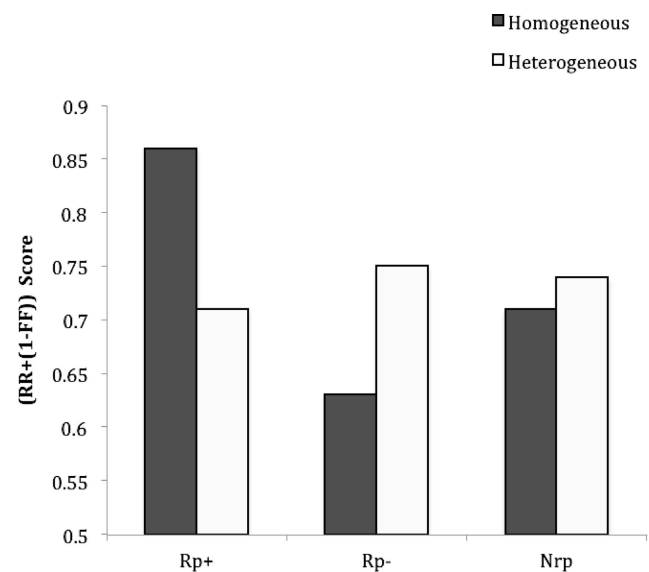


Figure 2. Remembering/forgetting scores ($RR + [1 - FF]$) for the post-conversational recall as a function of PERSON-PRO's retrieval practice. The higher the score, the more mutually remembered arguments; the lower the score, the more mutually forgotten arguments.

are usually the result of a complex cascade of interactions. The current research focused on two memory phenomena often discussed in relation to how conversations affect subsequent memory: practice effects and retrieval-induced forgetting. We were chiefly interested in determining if and when a principle of transitivity could describe the propagation of these two effects of retrieval through a sequence of conversational interactions when taking into account the attitude of the participants. As we noted in the introduction, in exploring this issue, we also find ourselves examining several other issues concerning retrieval-induced forgetting and practice that have heretofore remained unexplored. Let us address two of these up front.

First, we established for the first time that SS-RIF can be produced by attending to a selective presentation of previously studied material. Previous studies have shown that SS-RIF—and the associated concurrent remembering—can be found when people monitor for accuracy (Cuc, Ozuru, Manier, & Hirst, 2006), when they jointly recount a story with another in a free-flowing conversation (Cuc et al., 2006; A. Coman, Manier, & Hirst, 2009), and when they jointly recall autobiographical memories (A. Coman, Manier, & Hirst, 2009; Stone et al., 2010a). The present results add to this list. Of course, we cannot determine whether participants concurrently remembered in this study because they were inclined to do so when attending to a presentation or because of a perceived bias in the presentation. In the case of the latter, participants would not simply be using the presentation as a study device. One studies material only if one believes it is valid. Participants may have believed that the presenter might have provided misleading information. In that case, they would have carefully monitored the presentation. Inasmuch as it takes more effort to search for unmentioned material than to merely verify mentioned material, most of our participants clearly contented themselves with undertaking only the latter. It was only when participants held an extreme view about euthanasia that they went beyond the information given. What is clear is that, at least under some circumstances, attending to a presentation can induce forgetting in the attendee. The implications of this induced forgetting for the mnemonic consequences of students listening to a lecture or citizens attending to a politician's speech need to be further explored.

Second, the current research also establishes that the attitude of the attendee need affect neither SS-RIF nor the effects of practice, except in cases in which the attitudes are extreme. We found the same level of SS-RIF and practice effects in the preconversation recall for those in favor of or against legalization. Consider SS-RIF. Attitude could affect it by altering the level of (a) response competition, (b) concurrent retrieval, or (c) covert remembering of unmentioned material. The first two would enhance RIF, whereas the last would diminish it. Our failure to find an effect of attitude may not mean that the level of SS-RIF is unaffected by any of these processes. Rather, we suspect that each of them played a role, but at different times, and as a result, they canceled each other out. The finding suggests that for those with moderate attitudes toward a controversial issues (which we suspect is a substantial portion of the population) the attitude of listeners plays an unimportant role in the way a speaker can shape the memory of a listener.

Transitivity

As to the principle of transitivity—our main concern—the results were unambiguous. The practice effect and RIF promoted by PERSON-PRO emerged in the final recall only if they also emerged in the conversation. If the conversational dynamics did not prevent the level of accessibility induced by PERSON-PRO from shaping what was remembered in the conversation, then the PERSON-PRO-originated practice effects and RIF could be observed in both the conversation and the final recall. We recognize that the propagation of PERSON-PRO-originated RIF into the conversation may have been enhanced by the presence of a pre-conversational recall, but we view the pre-conversational recall as a measure of the accessibility of $Rp+$, $Rp-$, and Nrp items prior to the conversation, not as the sole source of the induced forgetting and practice effects observed in the conversations. Although in some circumstances RIF might fail to propagate without the pre-conversational recall, a pre-conversation recall should not be a necessary condition. It reflects shifts in accessibility elicited by PERSON-PRO rather than determines in and of itself the accessibility levels.

Although not a necessary condition for transitivity, it is noteworthy that practice effects and induced forgetting accumulate across social interactions. For RIF, this cumulative effect can be straightforwardly understood in terms of additive effects of inhibition. In the past, the effects of repeated selective practice on RIF has been confined to instances of mass practice. Our result represents the first time researchers have shown a cumulative effect for spaced practice. Although the present experiment does not allow for a systematic comparison of spaced practice with mass practice when it comes to the buildup of RIF, on the basis of our findings, we expect a similar result to what is well established for practice effects—that spaced practice will yield a greater cumulative effect than mass practice.

Attitude Change

Changes in memory lead to changes in attitude. The observed change cannot be attributed solely to practice effects. Attitude change was also a function of RIF impairments. In particular, PERSON-PRO influenced the attitudes of participants not only because of what she presented but also what she was silent about (Pasupathi & Hoyt, 2010; Stone, Coman, et al., 2010; Zerubavel, 2006). Her silences had more of an effect on attitude because they were embedded in a presentation of related arguments rather than presented in isolation.

Our results suggest that a person—be it a political figure or a lecturer—might have a profound influence on the attitudes of individuals, even if these attitudes are contrary to what this person is promoting. To be sure, in many instances there is a larger sequence of social interactions than we explored, but the sequence we examined is a realistic one. The finding that this propagation effect is present mostly for homogeneous pairs deserves particular attention, since there is a tendency toward homophily—that is, a preference to associate with individuals sharing similar values, beliefs, convictions, and characteristics (McPherson, Smith-Lovin, & Cook, 2001; Visser & Mirabile, 2004). This trend toward homophily is exploited, for example, by organizations such as Google and Facebook, which have recently altered their search

algorithms so that users are exposed to information preferred by similar others (Pariser, 2011). According to the present results, one way to limit the influence that a person exerts on an audience may be to promote discussion between individuals with divergent attitudes.

Collective Memories

As scholars from a wide variety of disciplines have recently argued, collective memories, attitudes, and behaviors can be understood as emergent properties whose roots can be found in how one individual can affect another (Borgatti, Mehra, Brass, & Labianca, 2009; Carley, 1995; Epstein, 2006). In this regard, it is important that we not only showed that practice effects and RIF elicited by PERSON-PRO can propagate through a sequence of social exchanges but also that this propagation could lead to a greater consensus among those involved in the sequence. In particular, with her presentation PERSON-PRO could impose onto others her understanding of the issues surrounding legalization and do so more effectively when participants were members of homogeneous rather than heterogeneous pairs. The latter result suggests that conversations among like-minded persons will consolidate the effects of a speaker or presenter in a manner that should accelerate the formation of a collective memory.

Group Polarization

The conversation phase of this study resembles, to an extent, experiments on group polarization (see Baron & Kerr, 2002, for a review; Moscovici & Zavalloni, 1969). In these experiments, members of a group first learn arguments for or against a politically charged topic, then converse about it. Attitudes are assessed at the beginning and end of the experiment. As a result of the conversation, attitudes tend to become more polarized (Mackie & Cooper, 1984; McGarty, Turner, Hogg, David, & Wheterell, 1992; Myers & Bishop, 1970). Explanations of group polarization tend to fall into two classes: (a) those evoking social comparison, and (b) those relying on persuasive argument theory (Isenberg, 1986). In the present study, we tracked the influence of PERSON-PRO as well as the influence of a conversation. This dual focus differentiates the present study from those on group polarization. Nevertheless, we found that conversations altered the attitude of like-minded groups. Although the connection between the present study and the work on group polarization needs to be explored in more detail, the present study does suggest that the range of possible mechanisms underlying group polarization might need to be expanded to include practice effects and RIF.

Final Remarks

We suspect that the lessons learned by studying the specific sequence of social interactions explored herein may generalize to other sequences and that the principle of transitivity may be quite general. To be sure, one must carefully study whether practice effects and induced forgetting propagates from one social interaction into another in other types of social exchanges. As we have shown, propagation is not guaranteed. Mnemonic accessibility altered by one social interaction may be overcome in the next social interaction. All things being equal, however, practice effects

and induced forgetting should propagate through social interactions along the lines indicated by a principle of transitivity.

Moreover, the results from this study indicate that influences tend to be cumulative as they traverse sequences of social interactions. Consequently, the influence of someone like PERSON-PRO in shaping the memories and attitudes of an individual on a particular topic can be enormous. This influence is not confined to individual memories and individual attitudes. It can also shape collective memories. Biased presentations are often delivered not to individuals but to groups. In the end, political figures, for instance, can have a profound effect on the memories and attitudes of those who listen to them, especially if, after listening to the politician, the public spends most of its time talking to similar others.

References

- Allport, G. W., & Postman, L. (1947). *The psychology of rumor*. New York, NY: Holt.
- Anderson, M. C., Bjork, R. A., & Bjork, E. L. (1994). Remembering can cause forgetting: Retrieval dynamics in long-term memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *20*, 1063–1087. doi:10.1037/0278-7393.20.5.1063
- Anderson, M. C., Bjork, R. A., & Bjork, E. L. (2000). Retrieval induced forgetting: Evidence for recall specific mechanism. *Psychonomic Bulletin & Review*, *7*, 522–530. doi:10.3758/BF03214366
- Anderson, M. C., & Levy, B. J. (2007). Theoretical issues in inhibition: Insights from research on human memory. In D. S. Gorfein & C. M. MacLeod (Eds.), *Inhibition in cognition* (pp. 81–102). Washington, DC: American Psychological Association. doi:10.1037/11587-005
- Anderson, M. C., & Levy, B. J. (2009). Suppressing unwanted memories. *Current Directions in Psychological Science*, *18*, 189–194. doi:10.1111/j.1467-8721.2009.01634.x
- Anderson, M. C., & Spellman, B. A. (1995). On the status of inhibitory mechanisms in cognition: Memory retrieval as a model case. *Psychological Review*, *102*, 68–100. doi:10.1037/0033-295X.102.1.68
- Atran, S. (2001). The trouble with memes. *Human Nature*, *12*, 351–381. doi:10.1007/s12110-001-1003-0
- Axelrod, R. (1997). The dissemination of culture: A model with local convergence and global polarization. *Journal of Conflict Resolution*, *41*, 203–226. doi:10.1177/0022002797041002001
- Barnier, A., Hung, L., & Conway, M. A. (2004). Retrieval-induced forgetting of autobiographical episodes. *Cognition & Emotion*, *18*, 457–477. doi:10.1080/0269993034000392
- Barnier, A. J., Sutton, J., Harris, C. B., & Wilson, R. A. (2008). A conceptual and empirical framework for the social distribution of cognition: the case of memory. *Cognitive Systems Research*, *9*, 33–51.
- Baron, R. S., & Kerr, N. L. (2002). *Group process, group decision, group action* (2nd ed.). Philadelphia, PA: Open University Press.
- Bartlett, F. C. (1932). *Remembering: A study in experimental and social psychology*. Cambridge, England: Cambridge University Press.
- Basden, B. H., Basden, D. R., Bryner, S., & Thomas, R. L. (1997). A comparison of group and individual remembering: Does collaboration disrupt retrieval strategies? *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *23*, 1176–1189. doi:10.1037/0278-7393.23.5.1176
- Bergman, E., & Roediger, H. L. (1999). Can Bartlett's repeated reproduction experiments be replicated? *Memory & Cognition*, *27*, 937–947.
- Blumen, S., & Rajaram, S. (2008). Effects of group collaboration and repeated retrieval on individual recall. *Memory*, *16*, 231–244. doi:10.1080/09658210701804495
- Borgatti, S. P., Mehra, A., Brass, D. J., & Labianca, G. (2009). Network analyses in the social sciences. *Science*, *323*, 892–895. doi:10.1126/science.1165821

- Boyer, P. (1998). Cognitive tracks of cultural inheritance: How evolved intuitive ontology governs cultural transmission. *American Anthropologist*, *100*, 876–889. doi:10.1525/aa.1998.100.4.876
- Boyer, P., & Ramble, C. (2001). Cognitive templates for religious concepts: Cross-cultural evidence for recall of counter-intuitive representations. *Cognitive Science*, *25*, 535–564. doi:10.1207/s15516709cog2504_2
- Brown, A. D., Coman, A., & Hirst, W. (2009). The role of narratorship and expertise in social remembering. *Social Psychology*, *40*, 119–129. doi:10.1027/1864-9335.40.3.119
- Cacioppo, J. T., & Petty, R. E. (1979). Effects of message repetition and position on cognitive response, recall, and persuasion. *Journal of Personality and Social Psychology*, *37*, 97–109. doi:10.1037/0022-3514.37.1.97
- Camp, G., Pecher, D., & Schmidt, H. G. (2007). No retrieval-induced forgetting using item-specific independent cues: Evidence against a general inhibitory account. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *33*, 950–958. doi:10.1037/0278-7393.33.5.950
- Carley, K. M. (1995). Communication technologies and their effect on cultural homogeneity, consensus, and the diffusion of new ideas. *Sociological Perspectives*, *38*, 547–571.
- Chan, J. C. K. (2009). When does retrieval induce forgetting and when does it induce facilitation? Implications for retrieval inhibition, testing effect, and text processing. *Journal of Memory and Language*, *61*, 153–170. doi:10.1016/j.jml.2009.04.004
- Chan, J. C. K., McDermott, K. B., & Roediger, H. L., III. (2006). Retrieval-induced facilitation: Initially non-tested material can benefit from prior testing of related material. *Journal of Experimental Psychology: General*, *135*, 553–571. doi:10.1037/0096-3445.135.4.553
- Coman, A., Brown, A. D., Koppel, J., & Hirst, W. (2009). Collective memory from a psychological perspective. *International Journal of Politics, Culture, and Society*, *22*, 125–141.
- Coman, A., Manier, D., & Hirst, W. (2009). Forgetting the unforgettable through conversation: Socially-shared retrieval-induced forgetting of September 11 memories. *Psychological Science*, *20*, pp. 627–633. doi:10.1111/j.1467-9280.2009.02343.x
- Coman, D., Coman, A., & Hirst, W. (2011). *Induced forgetting drives decision-making for medical treatment*. Manuscript submitted for publication.
- Conway, M. A., & Fthenaki, A. (2003). Disruption of inhibitory control of memory following lesions to the frontal and temporal lobes. *Cortex*, *39*, 667–686. doi:10.1016/S0010-9452(08)70859-1
- Cuc, A., Koppel, J., & Hirst, W. (2007). Silence is not golden: A case for socially-shared retrieval-induced forgetting. *Psychological Science*, *18*, 727–733. doi:10.1111/j.1467-9280.2007.01967.x
- Cuc, A., Ozuru, Y., Manier, D., & Hirst, W. (2006). On the formation of collective memories: The role of a dominant narrator. *Memory & Cognition*, *34*, 752–762. doi:10.3758/BF03193423
- DiMaggio, P. (1997). Culture and cognition. *Annual Review of Sociology*, *23*, 263–287. doi:10.1146/annurev.soc.23.1.263
- Eagly, A. H., Kulesa, P., Chen, S., & Chaiken, S. (2001). Do attitudes affect memory? Tests of the congeniality hypothesis. *Current Directions in Psychological Science*, *10*, 5–9. doi:10.1111/1467-8721.00102
- Epstein, J. (2006). *Generative social science: Studies in agent-based computational modeling*. Princeton, NJ: Princeton University Press.
- Fazio, R. H. (1995). Attitudes as object-evaluation associations: Determinants, consequences, and correlates of attitude accessibility. In R. E. Petty & J. A. Krosnick (Eds.), *Attitude strength: Antecedents and consequences* (pp. 247–282). Hillsdale, NJ: Erlbaum.
- Festinger, L. (1954). A theory of social comparison processes. *Human Relations*, *7*, 117–140. doi:10.1177/001872675400700202
- Grice, H. P. (1975). Logic and conversation. In P. Cole & J. Morgan (Eds.), *Syntax and semantics* (Vol. 3, pp. 41–58). New York, NY: Academic Press.
- Halbwachs, M. (1992). *On collective memory*. Chicago, IL: University of Chicago Press. (Original work published 1952)
- Higgins, E. T., Rholes, W. S., & Jones, C. R. (1977). Category accessibility and impression formation. *Journal of Experimental Social Psychology*, *13*, 141–154. doi:10.1016/S0022-1031(77)80007-3
- Hirst, W. (2010). A virtue of memory: The contribution of mnemonic malleability to collective memory. In P. A. Reuter-Lorenz, K. Baynes, G. R. Mangun, & E. A. Phelps (Eds.), *The cognitive neuroscience of the mind: A tribute to Michael S. Gazzaniga* (pp. 1–23). Cambridge, MA: MIT Press.
- Hirst, W., & Echterhoff, G. (2008). Creating shared memories in conversation: Towards a psychology of collective memory. *Social Research*, *75*, 78–91.
- Hirst, W., & Echterhoff, G. (in press). Conversational remembering and shared memory. *Annual Review of Psychology*.
- Hirst, W., & Manier, D. (2008). Towards a psychology of collective memory. *Memory*, *16*, 183–200. doi:10.1080/09658210701811912
- Iglesias-Parro, S., & Gómez-Ariza, C. J. (2006). Biasing decision making by means of retrieval practice. *European Journal of Cognitive Psychology*, *18*, 899–908. doi:10.1080/09541440500501189
- Isenberg, D. J. (1986). Group polarization: A critical review and meta-analysis. *Journal of Personality and Social Psychology*, *50*, 1141–1151. doi:10.1037/0022-3514.50.6.1141
- Kapferer, J.-N. (1990). *Rumor*. London, England: Transaction.
- Karpicke, J. D., & Roediger, H. L. (2007). Repeated retrieval during learning is the key to long-term retention. *Journal of Memory and Language*, *57*, 151–162. doi:10.1016/j.jml.2006.09.004
- Kashima, Y. (2000). Maintaining cultural stereotypes in the serial reproduction of narratives. *Personality and Social Psychology Bulletin*, *26*, 594–604. doi:10.1177/0146167200267007
- Kenny, D. A., Kashy, D. A., & Cook, W. L. (2006). *Dyadic data analysis*. New York, NY: Guilford Press.
- Kintsch, W. (1995). Introduction. In F. C. Bartlett, *Remembering: A study in experimental and social psychology* (pp. xi–xv). Cambridge, United Kingdom: Cambridge University Press.
- Kuhl, B. A., Dudukovic, N. M., Kahn, I., & Wagner, A. D. (2007). Decreased demands on cognitive control reveal the neural processing benefits of forgetting. *Nature Neuroscience*, *10*, 908–914. doi:10.1038/nn1918
- Levine, J. M., & Murphy, G. (1943). The learning and forgetting of controversial material. *Journal of Abnormal and Social Psychology*, *38*, 507–517. doi:10.1037/h0062586
- Lord, C. G., Ross, L., & Lepper, M. R. (1979). Biased assimilation and attitude polarization: The effects of prior theories on subsequently considered evidence. *Journal of Personality and Social Psychology*, *37*, 2098–2109. doi:10.1037/0022-3514.37.11.2098
- Lynch, A. (1996). *Thought contagion: How belief spreads through society*. New York, NY: Basic Books.
- Lyons, A., & Kashima, Y. (2003). How are stereotypes maintained through communication? The influence of stereotype sharedness. *Journal of Personality and Social Psychology*, *85*, 989–1005. doi:10.1037/0022-3514.85.6.989
- Mackie, D. M., & Cooper, J. (1984). Attitude polarization: The effects of group membership. *Journal of Personality and Social Psychology*, *46*, 575–585. doi:10.1037/0022-3514.46.3.575
- MacLeod, M. D., & Macrae, C. N. (2001). Gone but not forgotten: The transient nature of retrieval-induced forgetting. *Psychological Science*, *12*, 148–152. doi:10.1111/1467-9280.00325
- Macrae, C. N., & Roseveare, T. A. (2002). I was always on my mind: The self and temporary forgetting. *Psychonomic Bulletin & Review*, *9*, 611–614. doi:10.3758/BF03196320
- Mandler, I. M., & Johnson, N. S. (1977). Remembrance of things parsed: Story structure and recall. *Cognitive Psychology*, *9*, 111–151. doi:10.1016/0010-0285(77)90006-8

- Marsh, E. (2007). Retelling is not the same as recalling: Implications for memory. *Current Directions in Psychological Science*, *16*, 16–20. doi:10.1111/j.1467-8721.2007.00467.x
- Marsh, E. J., & Tversky, B. (2004). Spinning the stories of our lives. *Applied Cognitive Psychology*, *18*, 491–503. doi:10.1002/acp.1001
- McGarty, C., Turner, J. C., Hogg, M. A., David, B., & Wetherell, M. S. (1992). Group polarization as conformity to the prototypical group member. *British Journal of Social Psychology*, *31*, 1–19.
- McPherson, M., Smith-Lovin, L., & Cook, J. (2001). Birds of a feather: Homophily in social networks. *Annual Review of Sociology*, *27*, 415–444. doi:10.1146/annurev.soc.27.1.415
- Middleton, D., & Edwards, D. (Eds.). (1990). *Collective remembering*. London, England: Sage.
- Moscovici, S., & Zavalloni, M. (1969). The group as a polarizer of attitudes. *Journal of Personality and Social Psychology*, *12*, 125–135. doi:10.1037/h0027568
- Myers, D. G., & Bishop, G. D. (1970). Discussion effects on racial attitudes. *Science*, *169*, 778–779. doi:10.1126/science.169.3947.778
- Nishida, H. (1999). Cultural schema theory. In W. B. Gudykunst (Ed.), *Theorizing about intercultural communication* (pp. 401–418). Thousand Oaks, CA: Sage.
- Norenzayan, A., Atran, S., Faulkner, J., & Schaller, M. (2006). Memory and mystery: The cultural selection of minimally counterintuitive narratives. *Cognitive Science*, *30*, 531–553. doi:10.1207/s15516709cog0000_68
- Pariser, E. (2011). *The filter bubble: What the Internet is hiding from you*. New York, NY: Penguin Press.
- Pasupathi, M. (2001). The social construction of the personal past and its implications for adult development. *Psychological Bulletin*, *127*, 651–672. doi:10.1037/0033-2909.127.5.651
- Pasupathi, M., & Hoyt, T. (2010). Silence and the shaping of memory: How distracted listeners affect speakers' subsequent recall of a computer game experience. *Memory*, *18*, 159–169. doi:10.1080/09658210902992917
- Pasupathi, M., Stallworth, L. M., & Murdoch, K. (1998). How what we tell becomes what we know: Listener effects on speakers' long-term memory for events. *Discourse Processes*, *26*, 1–25. doi:10.1080/01638539809545035
- Racsmány, M., & Conway, M. A. (2006). Episodic inhibition. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *32*, 44–57. doi:10.1037/0278-7393.32.1.44
- Roediger, H. L., Zaromb, F. M., & Butler, A. C. (2008). The role of repeated retrieval in shaping collective memory. In P. Boyer & J. V. Wertsch (Eds.), *Memory in mind and culture* (pp. 29–58). Cambridge, England: Cambridge University Press.
- Román, P., Soriano, M. F., Gómez-Ariza, C. J., & Bajo, M. T. (2009). Retrieval-induced forgetting and executive control. *Psychological Science*, *20*, 1053–1058. doi:10.1111/j.1467-9280.2009.02415.x
- Ross, M. (1989). Relation of implicit theories to the construction of personal histories. *Psychological Review*, *96*, 341–357. doi:10.1037/0033-295X.96.2.341
- Schudson, M. (1997). Dynamics of distortion in collective memory. In D. L. Schacter (Ed.), *Memory distortions* (pp. 346–364). Cambridge, MA: Harvard University Press.
- Schwartz, B. (2009). Collective forgetting and the symbolic power of oneness: The strange apotheosis of Rosa Parks. *Social Psychology Quarterly*, *72*, 123–142. doi:10.1177/019027250907200204
- Sperber, D. (1996). *Explaining culture: A naturalistic approach*. Oxford, England: Blackwell.
- Sperber, D., & Hirschfeld, L. (2004). The cognitive foundations of cultural stability and diversity. *Trends in Cognitive Sciences*, *8*, 40–46. doi:10.1016/j.tics.2003.11.002
- Stone, C. B., Barnier, A. J., Sutton, J., & Hirst, W. (2010a). Building consensus about the past: Schema consistency and convergence in socially-shared retrieval-induced forgetting. *Memory*, *18*, 170–184. doi:10.1080/09658210903159003
- Stone, C. B., Barnier, A. J., Sutton, J., & Hirst, W. (2010b). *Forgetting each other's pasts*. Manuscript submitted for publication.
- Stone, C. B., Coman, A., Brown, A. D., Koppel, J., & Hirst, W. (2010). *A taxonomy of silence from a psychological perspective*. Manuscript submitted for publication.
- Storm, B. C., Bjork, E. L., & Bjork, R. A. (2005). Social meta-cognitive judgments: The role of retrieval-induced forgetting in person memory and impressions. *Journal of Memory and Language*, *52*, 535–550. doi:10.1016/j.jml.2005.01.008
- Storm, B. C., Bjork, E. L., Bjork, R. A., & Nestojko, J. (2006). Is retrieval success necessary for retrieval-induced forgetting? *Psychonomic Bulletin & Review*, *13*, 1023–1027. doi:10.3758/BF03213919
- Stukas, A. A., Bratanova, B., Peters, K., Kashima, Y., & Beatson, R. M. (2010). Confirmatory processes in attitude transmission: The role of shared reality. *Social Influence*, *5*, 101–117. doi:10.1080/15534510903384916
- Suls, J., Martin, R., & Wheeler, L. (2002). Social comparison: Why, with whom and with what effect? *Current Directions in Psychological Science*, *11*, 159–163. doi:10.1111/1467-8721.00191
- Tversky, B., & Marsh, E. (2000). Biased retellings of events yield biased memories. *Cognitive Psychology*, *40*, 1–38. doi:10.1006/cogp.1999.0720
- Visser, P. S., & Mirabile, R. R. (2004). Attitudes in the social context: The impact of social network composition on individual-level attitude strength. *Journal of Personality and Social Psychology*, *87*, 779–795. doi:10.1037/0022-3514.87.6.779
- Watts, D. J. (2004). *Six degrees: The science of a connected age*. New York, NY: Norton.
- Weldon, M. S. (2001). Remembering as a social process. In D. L. Medin (Ed.), *The psychology of learning and motivation: Advances in research and theory* (pp. 67–120). San Diego, CA: Academic Press.
- Weldon, M. S., Blair, C., & Huesch, P. D. (2000). Group remembering: Does social loafing underlie collaborative inhibition? *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *26*, 1568–1577. doi:10.1037/0278-7393.26.6.1568
- Wertsch, J. V. (2002). *Voices of collective remembering*. Cambridge, England: Cambridge University Press. doi:10.1017/CBO9780511613715
- Wheeler, M. A., & Roediger, H. L. (1992). Disparate effects of repeated testing: Reconciling Ballard's (1913) and Bartlett's (1932) results. *Psychological Science*, *3*, 240–245. doi:10.1111/j.1467-9280.1992.tb00036.x
- Wittenbaum, G. M., & Stasser, G. (1998). The reevaluation of information during discussion. *Group Processes and Interpersonal Relations*, *1*, 21–34. doi:10.1177/1368430298011003
- Wright, D. B., & Klumpp, A. (2004). Collaborative inhibition is due to the product not the process, of recalling in groups. *Psychonomic Bulletin & Review*, *11*, 1080–1083.
- Zerubavel, E. (2006). *The elephant in the room: Silence and denial in everyday life*. New York, NY: Oxford University Press.

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