The effect of listening to others remember on subsequent memory: The roles of expertise and trust in socially shared retrieval-induced forgetting and social contagion

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Abstract

Speakers reshape listeners' memories through at least two discrete means: (1) *social contagion* and (2) *socially shared retrieval-induced forgetting* (SS-RIF). Three experiments explored how social relationships between speaker and listener moderate these conversational effects, focusing specifically on two speaker characteristics, *expertise* and *trustworthiness*. We examined their effect on SS-RIF and contrasted, within-subjects, their effects on both SS-RIF and the previously studied social contagion. Experiments 1 and 2 explored the effects of perceived expertise; Experiment 3 explored trust. We found (1) that speakers who were perceived as experts induced greater levels of social contagion and lower levels of SS-RIF than non-expert speakers, and (2) that, likewise, trust in the speaker had similar mnemonic consequences, in that neutral speakers induced more social contagion and less SS-RIF than untrustworthy speakers. These findings suggest that how speakers shape listeners' memories depends on the social dynamic that exists between speaker and listener.

Keywords: socially shared retrieval-induced forgetting; social contagion; expertise; mistrust; warnings

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People often communicate with others about the past or about acquired knowledge, often through conversational interactions. Although in many instances these conversations convey new information from speaker to listeners, in many other instances speaker and listeners discuss a mutually experienced past or a shared body of knowledge. For instance, a couple will reminisce about when they first met, college alumni will recollect their college days while at a reunion, and Trekkies will discuss the details of various Star Trek episodes when at a convention. We are interested here in this possibly uniquely human form of remembering, that is, remembering information with others that the others already know. In such instances, participants do not recall all they are capable of remembering (Marsh, 2007; Rajaram & Pereira-Pasarin, 2010). Rather, the remembering is selective, with the rememberer mentioning some of their memories, but remaining unintentionally or intentionally silent about others (Stone, Coman, Brown, Koppel, & Hirst, 2012). Our interest here is to examine the effect of selective remembering by a speaker on the memory of listeners.

There is a growing body of literature addressing this issue (see Hirst & Echterhoff, 2012, for a review). For instance, in the so-called *saying-is-believing effect* (Echterhoff, Higgins, & Levine, 2009), speakers' audience tuning can change their own memory in ways that reflect this tuning. Furthermore, speakers can mislead listeners about the past and, in doing so, either change existing memories held by listeners or implant new memories in listeners, so-called *social contagion* or *memory conformity* (e.g., Gabbert, Memon, & Allan, 2003; Jaeger, Lauris, Selmeczy, & Dobbins, 2012; Roediger, Meade, & Bergman, 2001; Wright, Self, & Justice, 2000). Social contagion studies represent a social extension of

earlier paradigms, which, depending on your perspective, might or might not be viewed as social. Perhaps the most prominent of these putatively non-social paradigms is the *misinformation effect*, whereby an individual's memory for a given piece of source material (e.g., a video viewed in the laboratory) is distorted after she is exposed to a non-social source of misinformation, such as a written narrative (Loftus & Palmer, 1974; for a review, see Zaragoza, Belli, & Payment, 2006).

Speakers' selective remembering can also produce retrieval effects, not just on the speaker, but also the listener. For instance, selective remembering can reinforce the recalled memories. Additionally, and of particular interest here, it can also inducing forgetting for at least a subset of the unmentioned memories (Anderson, Bjork, & Bjork, 1994; for a review, see Anderson & Levy, 2007). This *retrieval-induced forgetting* (RIF) occurs when memories that remain unmentioned, but are *related* to what is recalled in a conversation, are remembered less well in a subsequent memory test than are *unrelated*, unrecalled memories. The ability of speakers to induce forgetting in themselves is referred to as *within-individual retrieval-induced forgetting* (WI-RIF); the ability of speakers to induce forgetting in listeners, *socially shared retrieval-induced forgetting* (SS-RIF; Barber & Mather, 2012; Brown, Kramer, Romano, & Hirst, 2012; A. Coman & Hirst, 2012; A. Coman, Manier, & Hirst, 2009; Cuc, Koppel, & Hirst, 2007; Stone, Barnier, Sutton, & Hirst, 2010; Stone, Barnier, Sutton, & Hirst, 2012).

Inasmuch as there is always an underlying social relationship between speaker and listener, one might wonder whether this relationship moderates these conversational effects. Surprisingly, the extant literature is extremely limited. This lacuna is surprising, not simply because social relationships among conversational participants are rarely neutral, but also because conversational effects on memory could be viewed as relevant to the literature on attitude change and persuasion. This literature has stressed the importance of not just the

message being conveyed, but also the characteristics of the source of the message, specifically, the credibility of the source (for a review, see Bohner & Dickel, 2011). The relevance of the persuasion literature becomes even stronger if one views conversations broadly, as we do here. That is, conversations may not only involve the free exchange between two or more people, but may be one-way, for instance, between lecturers and their audience. Such one-way exchanges are often viewed as dialogic in character (Bakhtin, 1991).

A limited body of work suggests that the social relationship between speaker and listener does matter. The saying-is-believing effect, for instance, is stronger when speaker and listener are in-group members, as opposed to out-group members (for a review, see Echterhoff et al., 2009). The social contagion literature has mainly focused on expertise and trustworthiness. The by now well-established results are that social contagion is more likely when speakers are perceived as experts by listeners (Brown, Coman, & Hirst, 2009; Dodd & Bradshaw, 1980; Smith & Ellsworth, 1987). Conversely, social contagion is less likely when their listeners do not trust the speaker's recollections. In experiments studying the latter effect, mistrust is often induced through a warning about the unreliability of the speaker's recollection (Boon & Baxter, 2000; Chambers & Zaragoza, 2001; Echterhoff, Hirst, & Hussy, 2005; Ecker, Lewandowsky, & Tang, 2010; McCabe & Smith, 2002; Muller & Hirst, 2010; see also Wood & Quinn, 2003).

The effects of expertise and mnemonic trustworthiness on social contagion are often accounted for by focusing on the degree to which listeners are motivated to make the effort to monitor for the source of a memory (Johnson, Hashtroudi, & Lindsay, 1993). If one assumes that source monitoring takes effort, then listeners may not make the effort to source monitor when they perceive the speaker to be an expert, in that there is no reason to believe that the expert speaker is remembering the previously studied material incorrectly. As a result,

listeners should be likely to confuse the source of a memory, and thereby be open to social contagion. Following a similar line of reasoning, if listeners do not trust a speaker, they should be inclined to monitor for the source of what the speaker recollects.

A more recent meta-cognitive explanation of social contagion offers a different account. By this explanation, when listeners are exposed to a speaker's recollection of an event that contradicts their own, they decide whether to adopt the speakers' recollection, in part, by weighing the relative credibility their respective memories (Allan, Mijdord, Martin, & Gabbert, 2012; French, Garry, & Mori, 2011; Jaeger et al., 2012; Wright & Schwartz, 2010). Individuals are more likely to conform to the speaker's memory if they view it as more credible than their own, as may be the case if the speaker is viewed as an expert, or if the listener trusts the speaker. This explanation also involves motivations, in that listeners must decide whether to make the effort to weigh a message's credibility rather than merely accept it.

Unlike the work on the saying-is-believing effect and social contagion, little is known about how social relationships between speaker and listener moderate SS-RIF, even if we confine ourselves to expertise and mnemonic trustworthiness. According to Cuc et al. (2007), SS-RIF occurs when listeners concurrently, albeit covertly, retrieve along with the speaker. This selective retrieval on the part of the listener produces conditions similar to those found for the speaker. That is, according to the most widely accepted explanation of the mechanisms underlying RIF, as rememberers attempt to retrieve an item, they inhibit competing responses (Anderson & Levy, 2007). This inhibition lingers, making it difficult for the rememberers to subsequently recollect the inhibited memories. As competing responses, these inhibited memories are more likely to be related to the remembered items than to be unrelated to them. Cuc et al. aver that a similar inhibition occurs as listeners concurrently retrieve with the speaker.

A salient difference between WI-RIF and SS-RIF is that retrieval is mandatory for speakers, but optional for listeners. In the standard WI-RIF experiment, the experimenter instructs the participant to retrieve specific memories. Even if WI-RIF occurs within a free-flowing conversation, the retrieval for the speaker is, in a sense, mandatory, in that speakers are those remembering aloud. The same is not the case for listeners. Listeners do not have to retrieve memories along with the speaker; in their case, retrieval is optional. As a result, one might expect that listeners will rarely make the effort to concurrently retrieve, especially as the retrieval becomes demanding. What is striking about the consistent findings of SS-RIF is that they suggest that, in many instances, listeners do make this effort.

Following the lead of those interested in the social factors affecting social contagion, we can ask, when might listeners be motivated to make the effort to concurrently retrieve? Cuc et al. (2007) showed that how listeners monitor what a speaker says matters. They instructed listeners to monitor either for the accuracy of the speaker's recollection or for the degree to which the speaker responded to a memory probe "fluidly." Socially shared retrieval-induced forgetting was observed when listeners monitored speakers for accuracy, but not for the fluidity of their responses. Other experiments have shown that the joint responsibility of recounting a past experience in a conversation is generally sufficient to motivate listeners to concurrently retrieve, and thereby elicit SS-RIF (e.g., Brown et al., 2012; Cuc et al., 2007; Stone et al., 2010).

These findings do not, however, examine the degree to which the social relationship between speaker and listeners, such as the degrees of perceived expertise and mnemonic trust the listener grants to the speaker, might motivate concurrent retrieval. We claim here that these two factors should have an effect, and hence should influence the level of SS-RIF. Building on the findings of Cuc et al. (2007), we posit that the more listeners perceive the need to assess the accuracy of what the speaker recollects, the more likely they will be to

make the effort to concurrently remember along with the speaker. When speakers are perceived as being expert, there is little need to assess the accuracy of their recollections. As a result, listeners may not be motivated to make the effort to concurrently retrieve. Socially shared retrieval-induced forgetting should, then, be less likely to occur when speakers are perceived as experts than when they are perceived as non-experts. Along similar lines, if speakers are viewed as untrustworthy, listeners may be motivated to concurrently retrieve. As a result, SS-RIF should be more likely to occur the less trustworthy the speaker is perceived to be.

Interestingly, these predictions offer a pattern of social influences opposite of what has been observed with social contagion. That is, as perceived expertise increases, SS-RIF should decrease while social contagion increases. Moreover, as trustworthiness decreases, SS-RIF should increase while social contagion decreases. In other words, the social relationship between speaker and listener may always matter, but how it affects the subsequent memory of the listener will depend on the relationship. Because of the possibility of contrasting effects, we decided not only to test our predictions about SS-RIF, but also to replicate the findings concerning social contagion, and to do so using a within-subjects design. In this way, we hoped to establish for the first time the effects of expertise and trustworthiness on SS-RIF, while underscoring the differential effects of these two factors on SS-RIF and social contagion. Experiments 1 and 2 explored the effect of perceived expertise; Experiment 3, the effect of trust. In order to test the generality of our findings, we varied the character of the social interaction across experiments, as well as the nature of the to-be-remembered material.

Experiment 1

In this experiment, following Cuc et al. (2007), we carefully controlled the social interactions between speaker and listener in this experiment: One person selectively

remembered previously studied material, along the lines suggested by the experimenter, as another participant listened. We employed a narrative story as the source material. In one condition, the "speaker" was an expert on the story; in the other condition, the speaker's familiarity with the story was equivalent to that of the "listener."

As outlined above, we predicted there should be a reduction in SS-RIF as a consequence of this perceived expertise, inasmuch as the listener should engage in less concurrent retrieval when he considers the speaker to be an expert. Building on the extant literature on social contagion, we also predicted that perceived expertise should lead to heightened levels of social contagion.

Method

Participants. Ninety-six participants were recruited from the student body of The New School and through the website Craigslist, which includes, among other features, a forum in which researchers can place advertisements soliciting research participants. The participants were run in pairs, for a total of 48 participant pairs. Within each pair, one participant was randomly assigned to serve as the *speaker*, with the other participant serving as the *listener*, in either the *expert* or the *non-expert* condition. Students were compensated with research credit, with would-be expert speakers additionally paid $10 if, as described below, they tested at expert level. Participants recruited from Craigslist were paid $20, with, again, a $10 bonus for would-be expert speakers who subsequently tested at expert level.

Material.

Story. The source material, modeled after the source material employed in Cuc et al. (2007), consisted of a narrative about a boy's day. The story had an episode-event structure, comprising six critical episodes, each containing six *critical events*, that is, events for which we would later test participants' recollection. For each of these critical events, we chose a *critical element*, that is, an element of the event that could be altered across the versions of

the story read by the speaker and the listener, respectively. We chose the critical element with two criteria in mind: (1) that the critical element was central to any description of the event, and (2) that reasonable alternatives could be found that would maintain the credibility of the event. For instance, in an episode entitled *Had Soccer Practice*, in the baseline version of the story, for the event Tom's team *won the scrimmage*, *won* served as the critical element (inasmuch as Tom's team could have lost the scrimmage). To control for recency and primacy effects, we included two filler episodes, as the first and last episodes of the story. The story was 797 words long.

In order to allow us to assess both social contagion and RIF, different versions of the narrative were constructed. The speakers read and studied a "baseline" version of the story. We constructed three additional versions of the story for the listeners to read. Each listener read just one of these versions. In a listener's version, two-thirds (four) of the events in each episode were consistent with the baseline version read by the speaker, and one-third (two) were inconsistent (e.g., where the speaker read *a cat walked in front of them*, the listener read *a dog walked in front of them*, or, in the soccer example above, the listener version might include *lost the scrimmage*). The inconsistency was achieved by altering the critical element in the description of the events. Appendix A illustrates both the baseline and alternate versions of each critical event. The three variants were achieved by rotating which third of the events were inconsistent. As a result, all story events were inconsistent in one of the three different listener versions. The three alternate versions of the story were counterbalanced across listeners, so that each was read by one-third of the listeners.

As will be seen below, we employed the consistent critical events to test for both WI-RIF and SS-RIF. Here we contrasted speakers' and listeners' correct recall of either practiced events, related but unpracticed events, or unrelated, unpracticed events. Conversely, we employed the inconsistent events to test for social contagion. In this case, we

probed for whether listeners incorrectly described these events not according to the version of the story they read, but according to the version of the story which their partner read.

Retrieval practice. For the retrieval practice phase, we constructed, from the original "baseline" story (the one read by the speakers), *selective practice redactions.* The redactions consisted of three of the six events from three of the six episodes from the original baseline story. The three events were chosen so that two of them were consistent across the speaker's and listener's versions of the story. The third event was inconsistent, that is, the speaker's and listener's versions contained different critical elements. Following Anderson et al. (1994), we refer to the two mentioned consistent events, in each practiced episode, as *Rp+* items. The inconsistent mentioned event in each practiced episode served as "misleading" material, that, is, as a *social contagion event*. The unmentioned consistent critical events in the episodes featured in the redactions are referred to as *Rp-* items (the inconsistent unmentioned event in each practiced episode, meanwhile, was not included in the analyses). Finally, the consistent critical events in the unpracticed episodes are referred to as *Nrp* items. The "baseline" measure for the test for social contagion, which we refer to as *baseline social contagion events*, involved the inconsistent items that were associated with the unpracticed episodes. We counterbalanced which three episodes, and which three events within an episode, were redacted from the baseline story.

This design yielded, across the six episodes, six Rp+ items, six Rp- items, 12 Nrp items, three social contagion items, and six baseline social contagion items. We used these redactions to create the material the speaker and listener would see on a computer screen during the practice phase. This material would constitute the Rp+ events. It would be a fragment of an event described in the redacted story. Thus, if the redaction contained the event, *Tom said hi to Jane's mother*, from the episode *Walked to School*, participants would see on the computer screen *Walked to School—Tom said* _____ *to Ja*_____ _____. The

critical element of a critical event was always one of the elements eliminated to create the fragment, in this case, the word "mother."

Cued recall task. For the cued recall task, we constructed a booklet containing a summary heading of a critical episode on the top of each page serving as the cue. All the critical episodes were included, and they were presented in the same order in which they appeared in the story.

Design and procedure. The experiment took place over two consecutive days. On Day One, each member of the participant pair first individually read their respective version of the story. They read the story in separate rooms and were asked to read the story carefully, as their memory for it would subsequently be tested. Participants read the story on a computer screen, with the story presented one episode at a time, and each episode presented for an ample 30 seconds. Each episode began with its title presented at the top of the screen.

Following this, in the expert condition, the speakers (i.e., the participants who would eventually be asked to practice the story) were given a hard copy of the story to study overnight and were told that they would receive an additional $10.00 if they knew the story very well upon returning the next day. The listeners (i.e., the participants who would eventually observe the retrieval practice) were simply dismissed with no further opportunity to study the story. In the non-expert condition, both participants were dismissed after reading the story.

In Day Two's session, in the expert condition only, the putative expert's memory was initially tested with the cued recall task. They were given the recall booklet described above and asked to remember, under the heading for each critical episode, as much as they could remember of that episode. Putative experts were considered to be bona fide experts if, on this task, they recalled at least 90% of the critical events in the story. In cases in which the would-be expert failed to score 90% on this initial recall task, both participants were

dismissed and the experiment terminated. This procedure ensured that the expert participant would perform exceedingly well during the joint practice session, a necessary condition if the listener was to perceive the participant as an expert. Eighty-nine percent of the possible experts scored at the required 90% or above.

Following the initial test of expertise, the speaker and listener began the selective practice phase of the study. In the expert condition, the practice phase began with the experimenter telling the listener, in front of the speaker, that the speaker had had the opportunity to study the story the night before, had just been tested, and had a superior memory for the story. In the non-expert condition, the participants simply commenced with the practice phase.

During the practice phase, the speaker was asked to complete the fragments from the redactions with the relevant material from the studied story. Each fragment appeared on the screen for 12 seconds, during which time the speaker had the opportunity to complete it. The listener, meanwhile, looked on and rated their level of confidence in the accuracy of the speaker's recollection, from 1 (*not at all confident*) to 5 (*very confident*), for each recollection.

After a 20-minute distractor phase, during which both participants played Sudoku, the speaker and listener received the final cued recall test. This final test was identical to the one the expert received at the beginning of the session in the expert condition. That is, participants were given the recall booklet described above, and were asked, under the heading for each critical episode, to recall as much as they could of that episode. Lastly, as a manipulation check, we asked listeners to rate how well the speaker knew the story, relative to themselves. These ratings were on a Likert scale from 1 (*did not know the story nearly as well as I did*) to 7 (*knew the story much better than me*).

Results and Discussion

All analyses focused on the proportion of relevant events recalled in the final recall test. For Rp+, Rp-, and Nrp items, this was the proportion of each retrieval type recalled out of the total number of such items. Using these proportions, for both speaker and listener, we probed separately for the presence of a practice effect (Rp+ > Nrp), as well as the presence of RIF (Rp- < Nrp). A response in the final memory test was scored as "correct" if it captured the gist of what was said in the original story. Two coders scored the responses, with 97% agreement. Disagreements were resolved. For the RIF results, we separately analyzed the effect on speakers and the effect on listeners, inasmuch as we had no strong predictions about whether the size of the RIF effects should differ for the two, and if so, in what way.

The social contagion items only applied to the listeners. The *social contagion score* of a listener was the proportion of misleading items recalled by the listener in the final recall test out of the total number of misleading items recalled by the speaker during the practice phase. Each listener also received a *baseline social contagion score*. This score focused on the inconsistent items from the unpracticed episodes. The baseline score was the proportion of these misleading items that were subsequently incorrectly recalled by the listener, out of the total number of such items. We considered social contagion to be present if the social contagion score was significantly greater than the baseline score. Descriptive statistics for both speakers and listeners are presented in Table 1.

Speakers. For the practice effect analysis, we conducted a two-way ANOVA, with one within-subject factor (practice type – Rp+ and Nrp events), and one between-subject factor (condition – expert and non-expert). We found a main effect of practice type, $F(1, 46) = 7.43$, $MSE = .02$, $p = .01$, $n_p^2 = .14$, and a main effect of condition, $F(1, 46) = 102.30$, $MSE = .04$, $p < .001$, $n_p^2 = .69$, as well as an interaction between condition and practice type, $F(1, 46) = 10.49$, $MSE = .02$, $p = .002$, $n_p^2 = .19$. The main effect for condition arose, not surprisingly, because the expert speakers recalled significantly more of the story than did

non-expert speakers. Post-hoc paired-sample *t*-tests revealed a practice effect for non-expert speakers, $t(23) = 3.13$, $p = .01$, $d = .64$, but not for expert speakers, $t(23) = .46$, $p = .40$. The lack of a practice effect for expert speakers was likely due to ceiling effects.

For the WI-RIF analysis, we conducted a similar two-way ANOVA, with one within-subject factor (retrieval type – Rp- and Nrp events) and one between-subject factor (condition – expert and non-expert). We found main effects of retrieval type, $F(1, 46) = 6.23$, $MSE = .01$, $p = .02$, $n_p^2 = .12$ and condition, $F(1, 46) = 171.76$, $MSE = .05$, $p < .001$, $n_p^2 = .79$, as well as a trend for an interaction between condition and retrieval type, $F(1, 46) = 3.42$, $MSE = .01$, $p = .07$, $n_p^2 = .07$. Post-hoc analyses revealed WI-RIF for the non-expert speakers $t(23) = 2.31$, $p = .03$, $d = .47$, but not for the expert speakers, $t(23) = .95$, $p = .35$. The lack of induced forgetting for the expert speakers may again be due to ceiling effects.

Listeners. The manipulation check – that is, listeners' ratings, at the end of the experiment, of how well the speaker knew the story relative to themselves – indicated that listeners in the expert condition rated their corresponding speaker as significantly more expert than did those in the non-expert condition, $M_{\text{expert condition}} = 5.29$ ($SD = 1.40$) to $M_{\text{non-expert condition}} = 3.29$ ($SD = 1.40$), $t(46) = 4.96$, $p < .001$, $d = 1.46$. As an additional manipulation check, we also compared the listeners' confidence ratings, taken during the retrieval practice phase, of how accurately their corresponding speaker completed each event fragment. We did so by averaging across each event fragment for each participant, yielding a mean confidence rating for each participant. We then compared these mean ratings across listeners in the expert and non-expert conditions, respectively. Consistent with the expertise ratings taken at the end of the experiment, these confidence ratings were higher in the expert condition, $M_{\text{expert condition}} = 3.92$ ($SD = .76$) to $M_{\text{non-expert condition}} = 3.04$ ($SD = .60$), $t(46) = 4.44$, $p < .001$, $d = 1.29$.

In what follows, we first examine whether the level of social contagion varied with

the perceived expertise of the speaker, and then turn to SS-RIF.

Social contagion. We first wanted to replicate the social contagion findings reported in the literature, that is, that social contagion is greater when speakers are perceived as an expert than when they are not (Brown et al., 2009; Dodd & Bradshaw, 1980; Smith & Ellsworth, 1987). The baseline level of contagion (that is, falsely recalling the alternate versions of inconsistent critical events from the episodes which went unpracticed during the retrieval practice phase) was zero in both the expert and non-expert conditions. We therefore confined our analysis to the social contagion score, and found that participants in the expert condition falsely recalled the social contagion items more often than did those in the non-expert condition, $t(46) = 2.79$, $p = .01$, $d = .80$. These results replicate those reported by others and offer additional support for the effectiveness of our expertise manipulation.

Retrieval effects. We also explored, for the first time, the effects of expertise on the extent to which selective practice influences subsequent memory. Similar to our analyses for the speakers, we separately analyzed the results for practice effect and for SS-RIF. In a 2 x 2 ANOVA probing for practice effect, we found a main effect of practice type, $F(1, 46) = 35.76$, $MSE = .03$, $p < .001$, $n_p^2 = .44$, but no interaction between practice type and condition, $F(1, 46) = .01$, $MSE = .03$, p = .92. In a 2 x 2 ANOVA probing for SS-RIF, we found a main effect of retrieval type, $F(1, 46) = 4.30$, $MSE = .03$, $p = .04$, $n_p^2 = .09$.

Although we did not find a significant interaction between retrieval type and condition, $F(1, 46) = 1.02$, $p = .32$, we followed the advice of Tybout and Sternthal (2001), who argue that simple effects can legitimately be assessed without a significant interaction. Post-hoc analyses revealed that Rp- was significantly less than Nrp when speakers were perceived as non-experts, but not when they were perceived as experts [non-expert condition,

$t(23) = 2.24$, $p = .04$, $d = .46$; expert condition, $t(23) = .73$, $p = .47$].[1]

Summary. Expertise had contrasting results on social contagion and SS-RIF. Social contagion was greater when listeners perceived the speaker as an expert than when they perceived the speaker as a non-expert. In contrast, we found significant levels of SS-RIF when listeners perceived the speaker as a non-expert, but not when they perceived the speaker as an expert. We expected that more robust findings might have been attained if we had not asked listeners to monitor for the accuracy with which the speaker recalled the material. These instructions may have encouraged listeners to co-retrieve even if their partner was an expert. In the next experiment, then, no overt instructions were given about how to monitor the speaker.

Experiment 2

In Experiment 2, we likewise investigated the effect of the speaker's perceived expertise on social contagion and SS-RIF. Here, we specifically sought a situation in which we would not need to ask listeners to monitor for accuracy. Moreover, we wanted listeners to partake in a monitoring task similar to a situation they might encounter in everyday life. With this in mind, we asked participants to listen to a lecture. In the last few years, there has been a growth of online lectures, e.g., on YouTube and on iTunes University. We sought to mimic the type of video presentations found on these media. We did not seek to assess the

[1] According to the *output interference hypothesis* (see Anderson et al., 1994), the recall of the highly accessible Rp+ items on the final memory test may, in turn, have interfered with recall for Rp- items. One possibility is that it is this interference which is responsible for the impairment of Rp- items in RIF, rather than the inhibition explanation we had posited. If the impairment we found was indeed due to output interference, then participants who tended to recall Rp+ items early in their recall sequences would demonstrate greater impairment of Rp- items than those who recalled Rp+ items at relatively later points. We tested for this possibility, following the method employed in Macrae and Roseveare (2002). However, we found no evidence that, in the present experiment, either the WI-RIF or SS-RIF we found was due to output interference.

effect of giving a lecture on the memory of the lecturer. Rather, we focused on the effect of the lecture on the memories of audience members. We were interested in whether a lecturer can induce forgetting in his audience. Any such induced forgetting would be an instance of SS-RIF in that (1) the lecturer is communicating with his audience, and (2) the audience is under no obligation to concurrently retrieve with the lecturer. Even though concurrent retrieval is not mandatory, we nevertheless expected SS-RIF to occur, at least when the speaker is not perceived as an expert. The lecture was on science-related material. In one condition, listeners were led to believe that the lecturer was an expert on the topic of the lecture; in the other condition, they were led to believe this was not the case. Given the increasing use of online media for educational purposes, the results of this experiment could be of interest to educators as well as psychologists.

As in Experiment 1, we predicted that SS-RIF should decrease when the listener considers the speaker to be an expert. At the same time, social contagion should increase.

Method

Participants. Forty-eight participants were recruited from within The New School and through Craigslist. All participants were required to be presently enrolled at an institution of higher education. None of the participants had any advanced knowledge of either botany or astronomy, which served as the subjects of the stimulus material. They were randomly assigned to either the expert or non-expert conditions. Each participant was tested individually and was compensated with either research credit or with a cash compensation of $15.

Material.

Scientific text. The source material covered two *content areas* (Botany and Astronomy) and was constructed from introductory textbooks on these topics (Fix, 2006; Jones & Gaudin, 1977; Starr & Taggart, 2004). For the study phase of the experiment, we

constructed sets of text-based slideshow presentations on each topic using Powerpoint. A presentation consisted of 12 separate text-based slides for Botany and 12 separate text-based slides for Astronomy. On each slide, there was a "lead-in" sentence or two, followed by a sentence or two that introduced a scientific term (the *term word),* along with contextual information that told the reader something about the term. This contextual information contained a pivotal word that captured the intent of the contextual information. We will refer to this word as the *context word*. For example, one slide read, "The ground tissue system of the plant is mainly comprised of simple-celled tissues with only one type of cell. Examples of these are parenchyma, cells that make up most of this tissue, especially those responsible for growth.*"* The term word here is *parenchyma*; the context word, *growth*. The context words were lexically and definitionally distinctive – in the sense that one context word could not be confused with another.

Some of the term and context word combinations in the Botany presentation were: *parenchyma/growth*, *lignin/stiffens*, and *mucigel/lubricate*; some of the combinations in the Astronomy presentation were: *azimuth/horizon*, *gibbous/full*, and *ziggurats/planets*. We will refer to these combinations as *term/context pairs*. We were interested in participants' ability to remember either the term word when supplied with the rest of the material on a slide, or, conversely, the context word when supplied with the rest of the material.

As in Experiment 1, in addition to the "baseline" presentation, we also constructed three variants. These variants were designed in such a way as to allow us to assess both RIF and social contagion. For each variant, two-thirds (eight) of the term/context combinations in each content area were consistent with the baseline. The other one-third (four) were inconsistent Appendix B illustrates the baseline and alternate versions of each critical item. Each variant always contained the same consistent term/context pairs. Which term/context combinations were inconsistent varied across the three variants, with appropriate

counterbalancing. Similar to Experiment 1, we used the consistent term/context combinations to test for SS-RIF, while the inconsistent term/context combinations were used to test for social contagion.

As to the inconsistent items, these could be rendered inconsistent in two ways: either the incorrect term word could be supplied, or the incorrect context word could be supplied. With this in mind, we created two separate versions for each variant. We will refer to the two versions of a variant as a *variant pair*. In order to create a variant pair, for one member of the pair, one-half (two) of the inconsistent items in each content area were assigned an alternate term word; the other half were assigned an alternate context word. In each instance, we substituted the item in the baseline with an alternate. For the second member of a pair, we flipped which term words and context words were supplied alternates. The alternate term words consisted of invented words, which were pilot-tested to ensure that they sounded like plausible botany or astronomy terms and made sense in the passage, e.g., for *parenchyma*, the alternate was *entochrym*. The alternate context words were also plausible substitutes, e.g., for *growth*, the alternate was *digestion*. Each participant read one of the six versions of the presentation, with assignment appropriately counterbalanced. Participants never saw the baseline text. The baseline served as the source of the retrieval practice lecture.

Retrieval practice lecture. For the practice phase, we created six "lecture" videos for each content area, with each lecture covering only one content area. There were two such lectures for each variant pair. In one lecture, half of the *consistent* items in a variant pair were mentioned, while the other half went unmentioned. In the second lecture, the mentioned and unmentioned items were switched. In each lecture, all of the inconsistent items were mentioned. The mentioned consistent pairs in a lecture served as Rp+ items. The unmentioned consistent pairs served as Rp- items. The mentioned inconsistent items served as social contagion items.

Thus, with each lecture, we created four Rp+ items (consistent term/context pairs that were presented in the lecture), four Rp- items (consistent term/context pairs from the relevant content area that were not presented in the lecture), and four social contagion items (the baseline term/context pairs presented in the lecture which were inconsistent with what the participant studied). Inasmuch as only one lecture was presented to a participant, and each lecture covered only one content area from the slideshow presentation, the eight consistent items in the non-lectured-upon content area served as Nrp items, and the four inconsistent items from this unpracticed content area served as baseline social contagion items.

The lecture was a recitation of the original slideshow presentation, except for the redacted parts. We videotaped a Caucasian male orally presenting the redaction. He was old enough to be perceived as either an expert or a non-expert on the topics covered by the slideshows. Every effort was made to ensure that the different versions of the video did not differ in style of presentation. The lecturer emphasized the term and context words as they were presented. All the lectures were of the same approximate length, about two-and-a-half minutes.

Final recall task. The final recall test was also presented as a slideshow. We prepared two different recall tasks for each of the six versions of the slideshow presentation. Each recall test consisted of 24 slides, corresponding to the 24 term/context pairs in the two slide presentations – 12 in the Astronomy presentation, and 12 in the Botany presentation. On each recall slide, the pertinent slide in the originally studied presentation was again presented in the center of the computer screen. Missing from the slide was either the probed-for term word or probed-for context word. For each recall test, half of the slides involving consistent term/context pairs had their context word missing; in the other half of the slides, their term word was missing. We counterbalanced which word was missing, thereby producing the two recall tests for each version of the slideshow. For the slides involving

inconsistent term/context pairs, the missing word was the inconsistent term or context word. We indicated that a word was missing by replacing it with a blank line, 10-spaces long. The order of the slides was randomly determined.

Design and procedure. The experiment took place in a single session. First, participants read the slideshow on a computer screen. They were asked to study the presented material carefully, so that they could remember it on a subsequent memory test. Each slide was presented for 25 seconds. A title slide introducing the Botany slideshow appeared first, then a brief introductory slide, followed by the 12-slide presentation on Botany, (then a 15-second rest), then a title slide for the Astronomy slideshow, a brief introductory slide, and finally the 12-slide presentation on Astronomy. This 28-slide presentation was then repeated after a 10-second break. The Botany slideshow always preceded the Astronomy slideshow.

Participants were then given a 15-minute distractor in the form of a Sudoku puzzle. Following the distractor, participants were told that they would see a brief video of a lecture reviewing the material they had just studied. They were told that the experimenter was interested in studying YouTube-type lectures as an educational tool. Participants in the expert condition were told that the lecturer was an expert on the topic and had been given a full day to review the material. Those in the non-expert condition were told that the lecturer's relation to the material was limited. They were told, by the experimenter, that the originally arranged-for lecturer, who was an expert, could not make it, and that the replacement was a graduate student majoring in visual arts, without much background knowledge of the material. Participants were further told that the replacement lecturer had the same amount of time as the participant to review the material. The participant was told that the experimenter had decided to continue with the experiment anyway. In both conditions, participants were told that "We hope and believe the lecture will be of help to you

on the test, so please pay close attention to the all the information presented." In the non-expert condition, the qualifier "Nevertheless" preceded this comment.

The video lecture followed. Half of the participants only saw a lecture on Astronomy; the other half, only on Botany. As noted above, which version of the lecture was used depended on the variant of the text that the participant read in the initial slide presentation. After a second five-minute period of Sudoku, the final memory test followed. Participants were told to write down on an answer sheet the missing term word or context word for each slide as the slides were presented, to manually advance the slides, and to enter a response for every item, inclusive of "do not know." Before leaving, as a manipulation check, participants were asked to assess their perception of the lecturer's expertise, on a Likert scale of 1 to 7, with *1* denoting *no expertise* and *7* denoting *great expertise*.

Results and Discussion

In order for a term word to be counted as correctly recalled in the final recall test, the recalled item was required to be close to the original word phonologically. For example, "albido" was an acceptable answer for the term "albedo," and "cambrium" was an acceptable answer for "cambium." In the case of context words, a response was required to have the specificity of function, and sense of meaning, as in the original text. Among the context words, "securing," for instance, would be scored as a correct rendering of "attaching," inasmuch as it aptly defines a synonymous action. Similarly, "center" would be scored as correct for the context word "inside," inasmuch as both pertain to the internal rather than external location of a particular component of the seed of a plant. The responses of half of the participants were dual-coded, with agreement across coders 99% of the time. Descriptive statistics are presented in Table 2.

The manipulation check indicated that listeners in the expert condition rated the lecturer as significantly more expert than did those in the non-expert condition, $M_{\text{expert condition}}$

= 4.48 (*SD* = 1.49) to $M_{\text{non-expert condition}}$ = 3.08 (*SD* = 1.59), *t*(46) = 3.15, *p* = .003, *d* = .91.

Social contagion. As previously demonstrated, in both Experiment 1 and the prior literature (Brown et al., 2009; Dodd & Bradshaw, 1980; Smith & Ellsworth, 1987), social contagion was greater when the lecturer was perceived as an expert than when he was perceived as a non-expert. As in Experiment 1, scores for the baseline social contagion items were zero for both the expert and non-expert conditions. As a result, following the procedure in Experiment 1, we simply contrasted social contagion scores. Participants who listened to the putative expert lecturer falsely recalled the social contagion items more often than those who listened to the presumably non-expert lecturer, *t*(46) = 2.32, *p* = .03, *d* = .67.

Retrieval effects. Again, the new findings here concern retrieval effects. In a 2 x 2 ANOVA probing for practice effect, with practice type (Rp+ and Nrp items) as a within-subject factor and expertise condition as a between-subject factor, we found only trends toward a main effect of practice type, *F*(1, 46) = 2.94, *MSE* = .04, *p* = .09, n_p^2 = .06, and an interaction between practice type and condition, *F*(1, 46) = 3.20, *MSE* = .04, *p* = .08, n_p^2 = .07. These results suggest that there was at best a minimal practice effect overall, with the practice effect marginally stronger when the lecturer was viewed as an expert than when the lecturer was viewed as a non-expert.

As other RIF studies have also failed to find a practice effect (Storm, Bjork, Bjork, & Nestojko, 2006), this negative result should not preclude finding RIF. After all, the two involve different mechanisms, the former, reinforcement, for instance; the latter, inhibition. Indeed, in a 2 x 2 ANOVA probing for SS-RIF, we found a trend toward a main effect of retrieval type, *F*(1, 46) = 3.17, *MSE* = .05, *p* = .08, n_p^2 = .06, and, critically, a significant interaction between retrieval type and condition, *F*(1, 46) = 5.43, *MSE* = .05, *p* = .02, n_p^2 = .11. Post-hoc analyses revealed that Rp- was significantly less than Nrp when the lecturer was perceived as a non-expert, *t*(23) = 3.17, *p* = .001, *d* = .86. Conversely, when the lecturer

was perceived as an expert, Rp- was not significantly less than Nrp, $t(23) = .36$, $p = .72$.

Summary. The results produced a pattern similar to that found in Experiment 1: When listeners viewed the speaker, in this case a science lecturer, as an expert, social contagion increased while SS-RIF decreased, relative to instances in which the lecturer was viewed as a non-expert. These results not only confirm the findings of Experiment 1, but demonstrate that such a pattern of social influence on memory occurs even in such ecologically valid circumstances as listening to a YouTube-like lecture.[2]

Experiment 3

In the Introduction, we suggested that contrasting effects on social contagion and SS-RIF might arise not just when the expertise of the speaker varies, but also as a function of the listener's degree of mnemonic trust in the speaker. The less listeners trust the reliability of the speaker's memory, the greater the SS-RIF and the lower the level of social contagion. In Experiment 3, we tested this claim by embedding the selective remembering within a free-flowing conversation between two participants. The conversation concerned a joint recounting of a narrative story they had each read individually, similar to the narrative story employed in Experiment 1. One participant was warned that her partner may have read a different version of the story from themselves, while the other participant received no such warning. Remembering within a conversation is almost always selective (Rajaram & Pereira-Pasarin, 2010). We chose to examine free-flowing conversations, rather than an artificial one with a confederate guiding it, because we wanted to make the setting as ecologically valid as possible.

Method

[2] Inasmuch as the order of the recall in the final test was carefully controlled in this experiment, there was no need to test for output interference.

Participants. Forty-two participants were recruited from The New School student body and through Craigslist. They were run in pairs, for a total of 21 participant pairs. Each participant was compensated with $15 or offered research participation credit. Half were randomly assigned to serve as *warned* participants, the other half as *non-warned* participants.

Material.

Story. The story we employed as source material was adapted from the story used in Experiment 1. Here, we expanded the number of critical episodes, so as to increase the likelihood that, in their recounting of the story, participants would neglect to mention at least one episode. Consequently, the story used in this experiment contained eight critical episodes, each containing six critical events. There were no filler episodes. The story was 820 words long. As in Experiment 1, there was a baseline story and three variants: For each episode in a variant, four of the events were consistent with those in the baseline story, and two differed from their counterparts in the baseline story. Appendix C illustrates the baseline and alternate versions of each critical event. The three variants were again produced by counterbalancing, across the variants, the consistent and inconsistent events. Also as in Experiment 1, in each pair, one participant read the baseline story, and the other participant read one of the variants. Assignment of the three variants was counterbalanced across pairs, so that each variant was read in one-third of the pairs. Similar to Experiments 1 and 2, the consistent items were employed to test for both WI-RIF and SS-RIF, while the inconsistent items were employed to test for social contagion.

Cued recall task. The cued recall task was similar to that employed in Experiment 1, except that it included eight, not six episodes as cues. As in Experiment 1, it consisted of a booklet containing a summary heading of a critical episode on the top of each page.

Design and procedure. First, each member of the participant pair read their respective version of the story, in separate rooms. They were instructed to pay close attention

to the story because they would have to discuss it later with their fellow participant, as well as take a final memory test for the story. One participant was randomly assigned the baseline story to study; the other participant, one of the variants. As in Experiment 1, each story was presented on a computer screen, one episode at a time, at a rate of 30 seconds per episode. Also as in Experiment 1, each episode began with its title presented at the top of the screen.

After participants had read the story once, they watched, as a distractor task, a recorded video segment from the History Channel for 30 minutes. At the completion of the film segment, participants were given a questionnaire and asked to express various feelings and opinions concerning the film. They were given 12 minutes to complete the questionnaire. After completing it, participants were told that they would convene with their partner in a common room and discuss the story they initially read. The warned participants were then given an explicit pre-warning right before they entered in the room. On a single sheet of paper, the warning read: "The story you have read before watching the film may have been slightly different from your partner's version. You are the only one who knows about this possible discrepancy, so do not let your partner become aware of it. Remember any memory test that you may later partake in will examine your memory for YOUR story, not YOUR PARTNER'S version." The warned-against participants (i.e., the non-warned participants) had no knowledge that their respective partners received a warning, nor did they receive any warning themselves about their partners.

Once set up in the common room, the two participants were instructed to jointly recount as much as they could from the originally studied story in the next four minutes. They were instructed to keep the conversation evenly distributed so that both participants could have equal opportunity to share their recollection of the story. After four minutes, we stopped the conversation without warning, in order to increase the probability that some

episodes from the story would not be recounted. The conversations were recorded using the computer software *Garageband*, with participants' awareness.

At the end of the conversation, the participants were again seated in individual rooms. After a five-minute delay, they were then administered a 20-minute distractor task: a questionnaire assessing their feelings and opinions about different events from their life (e.g., the prior New Year's Eve). The experimenter then administered the final recall task, in which participants were given the recall booklet described above and instructed, as participants were in Experiment 1, to write down, under the appropriate episode heading, as much as they could remember from that episode.

Lastly, as a manipulation check, participants were asked to rate, on a 1-7 Likert scale, how trustworthy and reliable they found their partner's recollection of the story, with *1* indicating *no trust* and *7* indicating *substantial trust*. The pair was then debriefed and thanked for their participation.

Coding. We built on a coding procedure developed by Cuc et al. (2007). The recorded conversations were transcribed. Coders then identified the pre-determined critical events from both versions of the original story (see the Material section of Experiment 1 for a discussion of critical events). They also identified who recalled the material. Using this coding, coders then classified each critical event from the original story as Rp+, Rp-, or Nrp when the critical event served as a probe for RIF. That is, this coding focused only on the consistent events, not the inconsistent events, inasmuch as, in these instances, the critical element was the same in the versions read by the two participants. Items classified as Rp+ were those mentioned in the recounting. If a participant mentioned the item, it was classified as Rp+/Speaker for that participant. If a participant simply listened to the other participant mention it, it was classified as Rp+/Listener for that participant. If both participants mentioned it, it was classified as Rp+/Speaker for both participants. Nrp items referred to

events from episodes that went entirely unmentioned in the recounting. Nrp/Speaker and Nrp/Listener always had the same value.

Rp- items were coded as such when a specific event within an episode went unmentioned, but other events from the same episode were mentioned. For each participant, an item was coded as a Rp-/Speaker event only if the participant, in the conversational recounting, mentioned an event from the same episode. An item was coded as an Rp-/Listener event only if the participant did not mention any of the events from the episode herself, but her partner did. For instance, if a speaker recalled event *A* but not event *B* from an episode, and the listener did not recall any events from the episode, we classified, for the listener, event *B* as an Rp-/Listener event, because the related event *A* had been recalled only by the speaker.

As for social contagion, the coders focused on the critical events that differed across the versions of the story read by each participant. The coders identified the inconsistent events recalled in the conversation. The event was treated as a potential source of social contagion for the participant listening to the recall. When an inconsistent event was not mentioned in the conversation at all, it was treated as a baseline social contagion event. All conversations and test results were dual-coded, with 98% agreement. Discrepancies were resolved.

Results and Discussion

A substantial advantage of using free-flowing conversations as the means of retrieval practice is that we can approximate a type of retrieval practice often found in the world outside the psychology laboratory. On the other hand, we lose some control, in that we are not guaranteed to find examples of every retrieval type in every conversation. In the present experiment, of our 42 participants, 10 (24%) failed to have any items classified as Rp-/Listener. Four of these had been warned that the speaker was untrustworthy. This failure

rate is not surprising, in that in order for an item to be classified as Rp-/Listener for a particular participant, this participant could not recall any events from the relevant episode, even though her partner did. The number of participants producing Rp-/Listener events was nonetheless large enough to complete the analyses. As for the social contagion items, three (7%) participants' partners never mentioned a misleading critical item, and for 33% of the participants, their partner mentioned only one misleading critical item. When "missing cells" occurred, we treated them as such in the data analysis. As a consequence, degrees of freedom varied from analysis to analysis. Descriptive statistics for both speakers and listeners are presented in Table 3.

Speakers. As before, we carried out separate repeated-measures ANOVAs to probe for a practice effect (Rp+ > Nrp) and WI-RIF (Rp- < Nrp), with, in both cases, the status of the speaker (warned or non-warned) as a between-subject factor. The ANOVA probing for a practice effect found a significant main effect of practice type, $F(1, 35) = 177.78$, $MSE = .03$, $p < .001$, $n_p^2 = .84$, indicating a practice effect, and no other significant results. As for the ANOVA assessing WI-RIF, we likewise found a main effect of retrieval type, $F(1, 35) = 3.96$, $MSE = .05$, $p = .05$, $n_p^2 = .12$, and no other significant results. Thus, we found both a practice effect and WI-RIF, neither of which varied as a function of warning.

Listeners. The manipulation check indicated that warned participants rated their partner as significantly less trustworthy than did non-warned participants, $M_{\text{warned participants}} = 3.67$ ($SD = .73$) to $M_{\text{non-warned participants}} = 5.05$ ($SD = .74$), $t(40) = -6.09$, $p < .001$, $d = 1.88$.

Social contagion. We sought to replicate the extant findings on the effects of warnings on social contagion (e.g., Chambers & Zaragoza, 2001; Echterhoff et al., 2005; Ecker et al., 2010). Inasmuch as the baseline (falsely recalling the alternate variants of inconsistent critical events which went unmentioned in the conversational recounting) was again zero for both the warned and non-warned participants, we again limited ourselves to

comparing social contagion scores, that is, the proportion of misleading recollections offered by a speaker and recalled by a listener in her final memory test, out of the total number of misleading recollections offered by the speaker. Consistent with previous research, we observed a difference between the warned and non-warned listeners in the expected direction, although it did not reach significance, t(37) = 1.17, p = .25. When we eliminated those non-warned listeners who rated their speaker at or below a *4* on the 7-point scale on trustworthiness, thereby removing the non-warned listeners who might have been suspicious of the speaker even without an explicit warning, we found a marginally significant difference [$M_{\text{warned listeners}}$ = .15 (*SD* =.28) to $M_{\text{non-warned listeners}}$= .38 (*SD* =.42), *t*(34) = -1.97, *p* = .057, *d* = .60].

We also performed a linear regression between participants' rating of perceived trustworthiness on the manipulation check (as the independent variable) and levels of social contagion (as the dependent variable). This analysis likewise yielded a marginally significant effect, standardized *ß* = .31, R^2 = .09, *F*(1, 37) = 3.83, *p* = .058. Taken together, the results are consistent with the previous work establishing that more trustworthy speakers are more effective in producing social contagion in their listeners.

Retrieval effects. As to the findings that are novel to the present experiment – that is, retrieval effects – we first probed for a practice effect through the repeated-measures ANOVA, finding a main effect of retrieval type, *F*(1, 33) = 5.57, *MSE* = .06, *p* = .02, n_p^2 = .14. As for SS-RIF, in the repeated-measures ANOVA probing for SS-RIF, we attained a significant main effect of retrieval type, *F*(1, 28) = 13.66, *MSE* = .05, *p* = .001, n_p^2 = .33, as well as a significant interaction between retrieval type and condition, *F*(1, 28) = 5.00, *MSE* = .05, *p* = .03, n_p^2 = .15. Post-hoc analyses found SS-RIF (Rp- < Nrp for listeners) for warned listeners, *t*(14) = 4.78, *p* < .001, *d* = 1.23. The difference between Rp- and Nrp for non-warned listeners did not reach significance, *t*(14) = .93, *p* = .37. It may be that the presence

of a warned participant affected the way the non-warned listeners mnemonically processed the material. What is critical, however, is that SS-RIF was more likely to be found for the warned listeners than the non-warned listeners.[3]

General Discussion

As we noted in the Introduction, retrieval is mandatory in studies of WI-RIF, as well as for a speaker in a conversation about the past. On the other hand, listeners do not have to concurrently retrieve with speakers, thereby making SS-RIF conditional on the occurrence of this co-retrieval. The question that occupied this paper has been: When are listeners motivated to make the effort to concurrently retrieve? We explored here the claim that it is worth the effort when the social relationship between speaker and listener is such that questions about the accuracy of what the speaker is recalling might be raised.

The findings of Cuc et al. (2007) indicated that instructions about whether or not to monitor for the accuracy of a speaker's recollection can influence the extent to which listeners concurrently retrieve. In Cuc et al., however, the different kinds of monitoring did not grow spontaneously out of the social relationship between speaker and listener, specifically, about attributions the listener might make about the reliability of the speaker's

[3] As in Experiment 1, we tested for the possibility of output interference. Again, we found no support for the prospect that output interference was responsible for either the WI-RIF or SS-RIF we attained.

We also examined whether the pattern of recall in the final memory test reflected how memorable the material was. That is, inasmuch as we could not govern what was said in the conversation, it might be that Rp+ items were simply those that were the most memorable, whereas Rp- items were harder to remember. This difference alone might have produced RIF, rather than any effect the selective remembering in the conversation may have had. We investigated this possibility, following the procedure employed in Cuc et al. (2007), by probing for whether the Nrp items were more memorable than the Rp- items (i.e., were mentioned in a greater proportion of the conversations between participants). We found no significant difference in the memorability of each type of item.

recollections. In the present experiments, therefore, we varied the attributions of the listener. In Experiments 1 and 2, listeners differed in their perception of the speaker as an expert; in Experiment 3, listeners differed in the extent to which they trusted the speaker's memory.

The results reported here indicate that SS-RIF is sensitive to both perceived expertise and perceived mnemonic trustworthiness. Both of these factors could affect the degree to which listeners are motivated to concurrently retrieve along with the speaker, and hence, both should affect the level of SS-RIF. When the motivation to concurrently retrieve is low, as it presumably is when a listener views a speaker as an expert, SS-RIF should, and did, decrease. When the motivation is high, as when a listener does not trust a speaker's recollection, SS-RIF should, and did, increase.

Although previous work had established that perceived expertise and mnemonic trustworthiness also affect social contagion, the pattern we found for SS-RIF is the opposite of what the established literature reports for social contagion: in the latter case, perceived expertise increases the level of social contagion, whereas social contagion decreases as trust in the speaker's memory decreases (see, for instance, Chambers & Zaragoza, 2001; Dodd & Bradshaw, 1980; Echterhoff et al., 2005; Ecker et al., 2010; Smith & Ellsworth, 1987). The experiments reported here confirmed these results by replicating the social contagion findings in a within-subjects design, allowing us to observe the effects of perceived expertise and trustworthiness on SS-RIF and social contagion in the same participants.

We want to emphasize that how listeners address their concerns about the accuracy of a speaker's recollection can lead to a variety of different activities: an increase in the level of source monitoring (Johnson et al., 1993), a rejection of speaker's utterances' validity as faith in the speaker's credibility decreases (Allan et al., 2012; French et al., 2011; Wright & Schwartz, 2010), and an increase in the level of concurrent retrieval (Cuc et al., 2007). Listeners are motivated to make the effort to undertake these distinctive processes because of

their concerns about the reliability of the speaker's recollections. The distinctive effects on social contagion and SS-RIF are consequences of this motivation and the activities it engenders.

Although the consequences of these motives and resultant activities are, in the end, best understood in cognitive terms, the motives and activities themselves have a social basis in that they arise out of concerns about an actual, imagined, or implied other (Allport, 1954). To be sure, concurrent retrieval might come into play for reasons that have little to do with either the social situation itself, the relationship between speaker and listener, or the attributions the listener makes about the speaker, as in Cuc et al.'s (2007) experiment involving monitoring instructions. However, the current findings demonstrate that the social relationship between speaker and listener serves as one factor which influences the extent to which a listener will co-retrieve with a speaker, and, subsequently, the extent to which the speaker induces SS-RIF in the listener.

It is also worth considering whether our findings regarding trust in Experiment 3 would hold across different manipulations of trust. Here, we manipulated trust by informing one member of a dyad that her partner had a *knowledge bias* (Eagly, Wood, & Chaiken, 1978), that is, that the partner may have read a different version of the story that served as the experiment's stimulus material. An alternative means of manipulating trust would have been to inform one participant that her partner had a *reporting bias* (Eagly et al., 1978), that is, that the partner was inherently untrustworthy (for manipulations of trust which focus on reporting biases, see, for example, Echterhoff et al., 2005; Schul, Mayo, & Burnstein, 2004). However, the reasoning underlying Experiment 3 would suggest that the specific reason why an individual is trusted should have scant bearing on their ability to induce either social contagion or SS-RIF.

Conversational Remembering and Persuasion

Persuasion involves an attempt to influence belief, attitudes, intentions, and behaviors through communication (Bohner, Erb, & Siebler, 2008). Even though memories can be viewed as beliefs about the personal past (James, 1890), the persuasion literature rarely considers changes in memory. This neglect may reflect the treatment of memory, until lately, as individual acts of encoding and retrieval, rather than an act of communication, wherein what a speaker remembers depends on the listener, and what is subsequently remembered by speaker and listener depends on their previous communications (for further discussion of this point, see D. Coman, Coman, & Hirst, 2013; Hirst & Echterhoff, 2012). It may also reflect that, even in the communicative settings we considered here, speakers may influence listeners' memories without necessarily intending to do so. Finally, the present framework is specifically tied to well-defined processes that bear directly on memory performance, rather than beliefs in general. That is, it confines itself to specific predictions both about the processing consequences of being motivated by questions about the mnemonic credibility of a speaker, as well as the resultant changes in mnemonic beliefs. That being said, the relation between the theoretical perspective presented here, which we consider to be a type of dual processing framework, and the dual processing perspective present in two well-regarded theories of persuasion is worth considering.

We characterize the present framework in terms of dual processing because we distinguished between instances in which listeners are motivated to source monitor or concurrently retrieve with situations in which they are not motivated to make this effort. In a similar way, both Chaiken's heuristic-systematic model (Chaiken, Liberman, & Eagly, 1989) and Petty and Cacioppo's elaboration likelihood model (Petty & Cacioppo, 1986) consider the motivations of listeners to undertake effortful processing. In all instances, speakers viewed as experts would elicit less effortful processing: a peripheral route in the elaboration likelihood model, heuristic processing in the heuristic-systematic model, and minimal source

monitoring and concurrent retrieval in the framework presented here. On the other hand, questions about the credibility of a source might elicit more elaborate or systematic processing, or, in the present framework, greater source monitoring and concurrent retrieval.

Implications for Collective Memory

Hirst and his colleagues have argued that both social contagion and SS-RIF have adaptive value (Hirst, 2010; Hirst & Echterhoff, 2012; Stone, Coman, et al., 2012; Stone et al., 2010). On the surface, both might be viewed as weaknesses of human memory, in that they have the potential to reduce memory's reliability. According to Hirst and colleagues, however, this putative weakness is also an advantage, in that it promotes the formation of collective memories, which, in turn, facilitate human sociality (Hirst & Brown, 2011; Olick, Vinitzky-Seroussi, & Levy, 2011). Hirst and colleagues argue that this effect on sociality is an advantage, given the essential social nature of humans.

How do social contagion and SS-RIF promote the formation of collective memories? We follow Hirst and Manier (2008) here and treat collective memories as individual memories shared across members of a community that bear on the identity of that community. As such, communities as small as a couple or as large as a nation can possess collective memories, an observation made by the father of the study of collective memory, Maurice Halbwachs (1992/1925). The present work bears on how memories become shared. Social contagion, for instance, allows for the implantation of a new memory across a group of conversing individuals and, as a result, the group, as a whole, shares this "new" memory. Socially shared retrieval-induced forgetting promotes the formation of a collective memory because the selective remembering of a speaker can potentially induce forgetting in both speakers and listeners. As a result, a group of conversing individuals can converge on a slimmed-down rendering of the past. After all, collective forgetting is as critical to the formation of a collective memory as collective remembering (Connerton, 2008).

To be sure, we did not explicitly test whether SS-RIF can lead to a similar patterns of forgetting in speaker and listener. This has been tested elsewhere (Stone et al., 2010; A. Coman & Hirst, 2012). What we examined are the social factors that could potentially affect this convergence. Moreover, although we have focused here on small groups, specifically, pairs of individuals, SS-RIF has been found to lead to collective forgetting in large groups as well. For instance, Stone, Luminet, Klein, Licata, and Hirst (2013) found that French-speaking Belgians who listened to a speech given by the King of Belgium were more likely to have trouble accessing information related to what was discussed by the King than were those who did not listen to the speech. Finally, although we have not examined information that might be considered critical to a group's identity, thereby potentially limiting the applicability of our findings to discussion of collective memory, others have. For instance, Stone, Barnier, et al. (2012) found both WI-RIF and SS-RIF for autobiographical memories shared by intimate couples. In addition, one might surmise from the present results employing scientific material that SS-RIF could also hold for historical material learned in educational and other settings. Both autobiographical memories and historical memories clearly bear on identity formation.

When SS-RIF and social contagion are viewed as adaptive mechanisms, it is reasonable to wonder why the two are affected by the same factors in different ways. The pattern of influence governing social contagion is understandable: People want to promote the formation of collective memories, and thereby sociability, among those they trust. But why would collective forgetting occur more often when a mistrusted, rather than a trusted, person selectively remembers? We suspect that it depends on the level of mistrust. It may be advantageous to bring the listener closer to the rendering of the speaker if there is a mild level of mistrust. In this way, one might build group cohesion even among those with some level of mistrust of each other. Although speakers may not be able to implant memories when they

are mistrusted, nonetheless, as long as the level of mistrust is relatively slight, they may be able to induce a listener to forget what they intentionally or unintentionally fail to remember (Stone, Coman, et al., 2012).

On the other hand, a person may not want to become part of a strongly mistrusted speaker's social group. In this case, mistrust should not lead to SS-RIF. A. Coman and Hirst's (2012) findings are consistent with this possibility. They found SS-RIF when a listener did not agree with the viewpoint of a speaker, but only when the disagreement was mild. In addition, Stone et al. (2013) reported that Flemish Belgians, who view the King as more affiliated with French speakers than Flemish speakers, did not show the same SS-RIF as the French-speakers. Socially shared retrieval-induced forgetting may not be present when the listeners have strong countervailing attitudes.

Conclusions

Remembering often occurs in a social setting. Human memory appears to be structured so that it is difficult to escape the influence of others in such settings. The results we report here suggest that both expertise and trust have a strong bearing on how the social setting will influence memory. When listeners view a speaker as an expert, in essence, they are confident that the speaker will recall the information accurately. As a result, they are open to having memories implanted, but not to the possibility of forgetting, as induced by the speaker. Similarly, when listeners hold one speaker to be trustworthy, while another speaker is mistrusted, they are likewise more open to mnemonic implantation through the trustworthy speaker, while the less trustworthy speaker is more likely to induce forgetting. The expertise we perceive in others, or the trust we place in them, can open up our memories to the influence of others, but in complex ways.

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Appendix A

Critical Items for the Stimulus Material in Experiment 1

Baseline Version		Alternate Version	
Critical Episodes	Critical Events	Critical Episodes	Critical Events
Walked to School	1. Tom picked up Jane at her house.	Walked to School	1. Tom picked up Jane at the street corner.
	2. He said hi to Jane's mother.		2. He said hi to Jane's sister.
	3. They quizzed each other on their upcoming Spanish test.		3. They quizzed each other on their upcoming math test.
	4. Jane was better prepared for the test than Tom.		4. Tom and Jane were about equally well prepared for the test.
	5. A cat walked in front of them.		5. A dog walked in front of them.
	6. Jane remarked that was good luck for the test.		6. Jane remarked that was bad luck for the test.
At Lunch	1. Tom ate a sandwich.	At Lunch	1. Tom ate pizza.
	2. He drank a Sprite.		2. He drank a 7-Up.
	3. He traded his apple for his friend Jimmy's orange.		3. He traded his apple for his friend Jimmy's banana.
	4. He and Jimmy made fun of the short legs of their teacher, Mr. Gardner.		4. He and Jimmy made fun of the big head of their teacher, Mr. Gardner.
	5. Mr. Gardner came walking by.		5. Mr. Gardner was sitting right behind them.
	6. Fortunately, he didn't hear anything.		6. Unfortunately, he heard everything they said.
Had His Test	1. The teacher passed out the tests.	Had His Test	1. The students collected the tests from the front of the room.
	2. She told the class they could not refer to their notes for the test.		2. She told the class they could refer to their notes for the test.
	3. Tom and Jane wished each other good luck.		3. Tom and Jane smiled at each other.

	4. Tom became nervous as he looked over the exam.		4. Tom became excited as he looked over the exam.
	5. He was surprised at how slowly time seemed to move.		5. He was surprised at how quickly time seemed to move.
	6. He tried to cheat off of the kid next to him.		6. He tried to cheat off of notes on his hand.
Went to Soccer Practice	1. The team ran laps around the field.	Went to Soccer Practice	1. The team ran wind sprints.
	2. They practiced penalty kicks.		2. They practiced passing.
	3. They scrimmaged against another team.		3. They scrimmaged against each other.
	4. Tom scored a goal.		4. Tom did not score a goal.
	5. His team won the scrimmage.		5. His team lost the scrimmage.
	6. The losing team had to do push-ups.		6. The losing team had to do extra running.
Ate Dinner	1. Tom's family ate meatloaf.	Ate Dinner	1. Tom's family ate steak.
	2. Tom's father complained about his favorite baseball team.		2. Tom's father complained about his favorite football team.
	3. Tom asked if he could go to Hawaii with Jane's family over spring break.		3. Tom asked if he could go to Florida with Jane's family over spring break.
	4. His parents said yes.		4. His parents said no.
	5. Tom's parents asked about his test earlier in the day.		5. Tom's parents asked about his soccer practice earlier in the day.
	6. He said it went really badly.		6. He said it went really well.
Watched TV	1. Tom watched *Survivor* with his brother and sister.	Watched TV	1. Tom watched *American Idol* with his brother and sister.
	2. He watched it from the couch.		2. He watched it from the floor.
	3. Tom didn't like the show very much.		3. Tom liked the show a lot.

	4. Then a commercial for Nextel came on.	4. Then a commercial for Verizon came on.
	5. Tom's sister changed the channel.	5. Tom's brother changed the channel.
	6. They also turned the volume up.	6. They also turned the volume down.

Appendix B

Critical Items for the Stimulus Material in Experiment 2

Baseline Version				Alternate Version			
Content Area				Content Area			
Botany		Astronomy		Botany		Astronomy	
Term Words	Context Words	Term Words	Context Words	Term Words	Context Words	Term Words	Context Words
1. Parenchyma	1. Growth	1. Ziggurats	1. Planets	1. Entochrym	1. Digestion	1. Heptazags	1. Continents
2. Xylem	2. Water	2. Albedo	2. Reflected	2. Sestume	2. Cellulose	2. Lumida	2. Absorbed
3. Stomata	3. Oxygen	3. Azimuth	3. Horizon	3. Phytroma	3. Pollen	3. Altidome	3. Sun
4. Glycocalyx	4. Attaching	4. Scalar	4. Increase	4. Capregaxyl	4. Protecting	4. Mascon	4. Decrease
5. Mucigel	5. Lubricate	5. Synodic	5. 29.5	5. Lipimose	5. Thicken	5. Lunaptic	5. 53.8
6. Lignin	6. Stiffens	6. Gibbous	6. Full	6. Eptrol	6. Softens	6. Aspherous	6. New
7. Carpels	7. Female	7. Saros	7. Lunar	7. Apicals	7. Male	7. Noctral	7. Solar
8. Cotyledon	8. Leaves	8. Rilles	8. Tributaries	8. Embricote	8. Roots	8. Venules	8. Canyons
9. Scutellum	9. Inside	9. Lenticulae	9. Jupiter’s	9. Dentrigume	9. Outside	9. Plenicombs	9. Saturn’s
10. Integuments	10. Seeds	10. Chondrules	10. Meteors	10. Nigestigams	10. Petals	10. Hydronumes	10. Stars
11. Anthocyanins	11. Blue	11. Spicules	11. Gas	11. Thalcinyolides	11. Yellow	11. Helispumes	11. Magma
12. Cambium	12. Diameter	12. Paterae	12. 1,600	12. Agricam	12. Height	12. Steptra	12. 2,800

Appendix C

Critical Items for the Stimulus Material in Experiment 3

Baseline Version		Alternate Version	
Critical Episodes	Critical Events	Critical Episodes	Critical Events
Got Ready for School	1. Tom woke up at a quarter past eight.	Got Ready for School	1. Tom woke up at a quarter to eight.
	2. He took a shower.		2. He washed his face.
	3. He threw on a sweatshirt.		3. He threw on a fleece.
	4. He had a cup of coffee.		4. He had a cup of tea.
	5. He picked up a copy of the *New York Post*.		5. He picked up a copy of the *New York Daily News*.
	6. The weather report said it would be foggy that day.		6. The weather report said it would be hazy that day.
Walked to School	1. Tom met Jane at a street corner by her house.	Walked to School	1. Tom met Jane at a stop light by her house.
	2. He told her he was up all night with a horrible headache.		2. He told her he was up all night with a horrible stomachache.
	3. They quizzed each other on their upcoming Spanish test.		3. They quizzed each other on their upcoming math test.
	4. Jane was better prepared for the test than Tom.		4. Tom was better prepared for the test than Jane.
	5. Tom wiped the sweat from his forehead using his sleeve.		5. Tom wiped the sweat from his forehead using his handkerchief.
	6. Jane reminded Tom of her piano recital on Friday night.		6. Jane reminded Tom of her band recital on Friday night.
At Lunch	1. Tom ate pizza while Jane ate a sandwich.	At Lunch	1. Jane ate pizza while Tom ate a sandwich.
	2. Tom drank two pints of chocolate milk		2. Tom drank two pints of milk.
	3. Jane also traded Tom a banana for his pear.		3. Jane also traded Tom a pear for his banana.

	4. Their friend Jimmy joined them, having just finished a math test.		4. Their friend Jimmy joined them, having just finished a Spanish test.
	5. Their gym teacher walked by with large sweat stains on his back.		5. Their gym teacher walked by with large sweat stains under his armpits.
	6. Tom stopped by his locker to grab his notes.		6. Tom stopped by his locker to grab his books.
Had His Test	1. Their teacher handed out the tests from the front of the room.	Had His Test	1. The students collected the tests from the back of the room.
	2. The teacher informed the class that the test would be open-book.		2. The teacher informed the class that the test would not be open-book.
	3. Tom nervously tapped his pencil as he glanced over the test.		3. Tom nervously bit his fingernails as he glanced over the test.
	4. He kept staring at the clock.		4. He kept staring at his watch.
	5. Jane glared at Tom as she thought about the questions.		5. Jane glared at the teacher as she thought about the questions.
	6. When time was up, Jane frantically tried to answer the last question, but was unable to complete the test.		6. When time was up, Tom frantically tried to answer the last question, but was able to complete the test.
Went to Baseball Practice	1. Tom stretched and ran wind sprints.	Went to Baseball Practice	1. Tom stretched and ran base sprints.
	2. He took batting practice.		2. He took fielding practice.
	3. During a scrimmage, Tom hit into a double play.		3. During a scrimmage, Tom fielded a double play.
	4. He hurt his shoulder trying to throw a curveball.		4. He hurt his shoulder trying to throw a screwball.
	5. He iced his shoulder from the dugout.		5. He iced his shoulder from the trainer's room.
	6. His injury would keep him out of baseball for the next week.		6. His injury would keep him out of baseball for the next month.

Ate Dinner	1. Tom sat down to eat with his mother, father, and siblings. 2. They were having his grandmother's famous lasagna recipe. 3. He asked his parents if he could go away to Palm Beach for spring break. 4. His parents told him it would depend on his final grade in math. 5. His parents asked how his test went that day. 6. He said he wasn't sure, since he was feeling nauseous.	Ate Dinner	1. Tom sat down to eat with his grandparents. 2. They were having his grandmother's famous pasta recipe. 3. He asked his parents if he could go away to Palm Springs for spring break. 4. His parents told him it would depend on his final grade in Spanish. 5. His parents asked how practice went that day. 6. He said he wasn't sure, since he was feeling so tired.
Watched TV	1. After dinner, Tom watched *SportsCenter* with his father. 2. He ate chocolate ice cream as he watched TV. 3. He was disappointed that the Mets lost. 4. Tom dreamed of playing first base some day for a Major League team. 5. A commercial for the new iPod came on. 6. Tom asked his father if he'd consider splitting the cost of one for Christmas.	Watched TV	1. After dinner, Tom watched *Baseball Tonight* with his father. 2. He ate vanilla ice cream as he watched TV. 3. He was disappointed that the Nets lost. 4. Tom dreamed of playing third base some day for a Major League team. 5. A commercial for the new iPad came on. 6. Tom asked his father if he'd consider splitting the cost of one for his birthday.
Got Ready for Bed	1. Tom brushed his teeth. 2. His mother asked him if he wouldn't mind walking the dog before bed. 3. As Tom packed his bag for school, he remembered to pack the CD that Jimmy let him borrow.	Got Ready for Bed	1. Tom washed his face. 2. His mother asked him if he wouldn't mind feeding the dog before bed. 3. As Tom packed his bag for school, he remembered to pack the DVD that Jimmy let him borrow.

	4. He set his alarm clock for the next morning, so he would have time to bike before school.	4. He set his alarm clock for the next morning, so he would have time to jog before school.
	5. He said goodnight to his parents and went to bed.	5. He said goodnight to his siblings and went to bed.
	6. He read a few articles in *Sports Illustrated* and fell asleep easily.	6. He read a few articles in *ESPN The Magazine* and fell asleep easily.

Table 1

Mean Proportion of Events Recalled, Experiment 1

	Speaker		Listener	
	As		attending to	
	Expert	Non-Expert	Expert	Non-Expert
Rp+	.97 (.08)	.63 (.23)	.72 (.19)	.74 (.23)
Rp-	.97 (.08)	.37 (.20)	.48 (.26)	.42 (.24)
Nrp	.99 (.04)	.46 (.25)	.51 (.24)	.52 (.23)
Social Contagion Events	N/A	N/A	.28 (.27)	.08 (.20)

Note. Standard deviations are in parentheses.

Table 2

Mean Proportion of Term and Context Words Recalled, Experiment 2

	Listener Attending to Expert	Listener Attending to Non-Expert
Rp+	.55 (.28)	.51 (.31)
Rp-	.44 (.32)	.33 (.26)
Nrp	.41 (.27)	.51 (.22)
Social Contagion Items	.19 (.17)	.08 (.14)

Note. Standard deviations are in parentheses.

Table 3

Mean Proportion of Events Recalled, Experiment 3

	Speaker as		Listener attending to	
	Neutral Speaker	Untrustworthy Speaker	Neutral Speaker	Untrustworthy Speaker
Rp+	.87 (.13)	.89 (.17)	.51 (.35)	.50 (.30)
Rp-	.20 (.21)	.39 (.28)	.18 (.30)	.09 (.13)
Nrp	.30 (.22)	.42 (.22)	.30 (.22)	.42 (.22)
Social Contagion Events	N/A	N/A	.32 (.40)	.19 (.29)

Note. Standard deviations are in parentheses.