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Research Article

Destination Memory

Stop Me if I've Told You This Before

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ABSTRACT—*Everyone has recounted a story or joke to someone only to experience a nagging feeling that they may already have told this person this information. Remembering to whom one has told what, an ability that we term* destination memory, *has been overlooked by researchers despite its important social ramifications. Using a novel paradigm, we demonstrate that destination memory is more fallible than* source memory*—remembering the person from whom one has received information (Experiment 1). In Experiments 2 and 3, we increased and decreased self-focus, obtaining support for a theoretical framework that explains relatively poor destination memory performance as being the result of focusing attention on oneself and on the processes required to transmit information. Along with source memory, destination memory is an important component of episodic memory that plays a critical role in social interactions.*

Everyone has had the experience of recounting a story or telling a joke to someone only to be informed that they have already told that person the story or joke—sometimes more than once. It is for this reason that people sometimes preface a story with "stop me if I've told you this before." Remembering to whom one has told things not only can help one avoid social embarrassment, but also may be critical in some situations. For example, supervisors need to remember to whom they told specific information or delegated particular responsibilities so that they may assess progress and accurately gauge employees' workloads, and liars need to keep track of the information that they have told to particular people to avoid getting caught telling incongruent stories. Remembering to whom one has told things also is necessary for facilitating everyday interactions, such as conversations with friends. People can assume a common ground and continue where they left off only if they remember what they told to different friends (cf. the given-new contract—Haviland & Clark, 1974). Consequently, in daily interactions, people need to remember not only who told them things, or the source of information, but also to whom they told things, or the destination of information.

The processes involved in remembering the source of information (e.g., in conversations, who told you something) have been comprehensively studied and are referred to as *source memory* (Johnson, Hashtroudi, & Lindsay, 1993; for a review, see, e.g., Mitchell & Johnson, 2000). Studying source memory makes sense, given the importance attached to remembering sources. For example, remembering that information was obtained from CNN rather than MTV is likely to determine how that information is used. Yet the inverse situation—remembering the people one has told something to—is often important as well. Thus, it is surprising that researchers know very little about the processes involved in remembering the destination of information that people output. We refer to these processes, by analogy, as *destination memory*.

On a theoretical level, destination memory and source memory are both part of the episodic memory system (see Tulving, 1983). Like source memory, destination memory is autobiographical because it is recollected in the context of a certain time and place with reference to oneself as a participant in the episode. However, source and destination memory are fundamentally different in terms of the direction of information transfer—*output* in the case of destination memory and *input* in the case of source memory. A fundamental question is whether the direction in which information is exchanged has consequences for memory performance and theory. Past research suggests that it does.

Previous research demonstrated that encoding of the external environment is disrupted when actions are performed by oneself rather than by someone else (e.g., Engelkamp, Zimmer, & Denis, 1989; Koriat, Ben-Zur, & Druch, 1991). For example, Koriat et al. found that when participants performed, as opposed to watched, someone else perform a set of tasks, such as raising their hands or stirring water in a cup, their memory for the context (i.e., the room in which the task was performed) was

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worse for self-performed tasks than for other-performed tasks. On this basis, Koriat et al. proposed that output events are not as well integrated with their environmental context as are input events. In the case of incoming information, rich associative links are formed between an event and its environment. In contrast, output events are less strongly integrated with their context because people perceive their own behavior as belonging more to themselves than to their environment. Consequently, for output events, people associate their behavior with their internal mental processes rather than with the environment.

In related work, Marsh and Hicks (2002) had participants receive and give virtual objects to one of two fictitious people. Unlike Koriat et al., these researchers concluded that input and output are differentially remembered only when a decision component was involved. Specifically, memory for giving someone an object was better than memory for receiving an object because giving an object involved a decision (e.g., "Do I give the object to Sally or Mary?"), whereas receiving an object did not. However, people do not typically engage in a deliberate strategy to decide with which one of two people they will share information. Therefore, we hypothesized that in everyday situations, destination memory and source memory would differ from each other, just as Koriat et al. (1991) found that memory for room context differed between output and input events. That is, destination memory should be more fallible than source memory because outgoing information is not as well integrated with its context (i.e., the person to whom one tells a fact) as is incoming information (i.e., the person from whom one learns a fact).

EXPERIMENT 1

The goal of Experiment 1 was to investigate whether destination memory is indeed more error prone than source memory. We accomplished this by having participants either tell facts to pictures of famous people (*destination memory episodes*) or learn facts from pictures of famous people (*source memory episodes*). Subsequent recognition tests assessed memory for individual components of these episodes and for destination memory or source memory.

Method

Participants

Sixty University of Waterloo undergraduates received bonus course credit for participating. Thirty participants were randomly assigned to the destination condition, and 30 participants were randomly assigned to the source condition.

Stimuli

Sixty interesting facts and 60 pictures of famous people (i.e., famous through television, sports, music, movies, and politics) were culled from various Internet resources. Facts were presented in 14-point lowercase white font against a black background; faces were presented in color against a black background. All stimuli were presented at the center of a computer screen.

Apparatus

A computer with a 15-in. color monitor was used for testing. The controlling program was written in E-Prime (Schneider, Eschman, & Zuccolotto, 2002).

Procedure

First, all participants completed a study phase in which they studied 50 facts that were randomly paired with 50 faces. They were not told that their memory for the facts and faces would be tested later.

Participants in the destination condition were instructed to tell the facts to the faces. Each study trial began with a 1,000-ms white fixation cross ("+") on a black background. A fact was then presented. After reading the fact silently, the participant pressed the space bar, which resulted in a 250-ms blank screen, followed by a color picture of a famous person. The participant was to tell the famous person the fact that he or she had just read and then press the space bar again. This initiated the appearance of another blank screen for 250 ms. This procedure repeated until the participant had told each of the 50 facts to a different face.

Participants in the source condition were instructed that facts would be told to them by famous people. Each study trial began with a 1,000-ms white fixation cross on a black background. A famous person's face then appeared. After viewing the famous face, the participant pressed the space bar, which resulted in a 250-ms blank screen, followed by presentation of a fact. The participant then read the fact that the depicted famous person was "telling" him or her and pressed the space bar again, which initiated the appearance of another blank screen for 250 ms. This procedure repeated until the participant was told each of the 50 facts by a different face.

Following the study phase, all participants completed two recognition memory tests, presented in counterbalanced order. To prevent cross-test contamination, these two tests used entirely nonoverlapping sets of stimuli.

For the item memory test, 20 facts and 20 faces (half of which participants had studied, and half of which they had not studied) were randomly ordered and individually presented, with facts in white font and faces in color. Each face or fact remained visible until the subject indicated whether that item had appeared during the study phase. The participant responded "yes" by pressing the "c" key on the computer keyboard and "no" by pressing the "m" key. Once a response was made, a blank screen was displayed for 250 ms, and the next test trial followed.

On the associative memory test, 40 face-fact pairs were shown in random order: Twenty pairs had been presented during the study phase, and the other 20 were random re-pairings of previously studied facts and faces. Face-fact pairs were presented one at a time, with the fact below the face. Participants reported whether they had previously told that fact to that face (destination condition) or whether that face had told them that fact (source condition). "Yes" and "no" responses were made by pressing the same keys as in the item memory test. After each response, a blank screen was displayed for 250 ms, and then the next test trial was presented.

Results

Rates of correct "yes" responses (hits) and incorrect "yes" responses (false alarms) as well as d' and β values are shown in Table 1. Figure 1 presents corrected recognition scores (proportion of hits minus proportion of false alarms) for each of the conditions.

Corrected recognition data were submitted to a 2 × 3 mixed analysis of variance (ANOVA), with study condition (destination or source) as the between-subjects factor and item type (face, fact, or face-fact pair) as the within-subjects factor. There were significant main effects of study condition, $F(1, 58) = 12.02$, $p_{rep} = .99$, $\eta_p^2 = .17$, and of item type, $F(2, 116) = 122.65$, $p_{rep} \approx 1.00$, $\eta_p^2 = .68$, as well as a significant interaction of study condition with item type, $F(2, 116) = 9.77$, $p_{rep} \approx 1.00$, $\eta_p^2 = .14$.

To explore this interaction further, we conducted a separate one-way ANOVA for each item type. Participants in the source condition had better face recognition than did those in the destination condition, $F(1, 58) = 16.56$, $p_{rep} \approx 1.00$, $\eta^2 = .94$, whereas fact recognition was equivalent in the source and destination conditions, $F(1, 58) = 1.37$, $p_{rep} = .69$, $\eta^2 = .58$. Critically, memory for face-fact pairs was significantly better in the source condition ($M = .60$) than in the destination condition ($M = .44$), $F(1, 58) = 9.14$, $p_{rep} = .97$, $\eta^2 = .90$. Put simply, source memory was significantly better than destination memory.

Discussion

Although the outcome of the key comparison between destination memory and source memory was consistent with our pre-

TABLE 1

Memory Performance as a Function of Condition and Item Type in Experiments 1, 2, and 3

Condition and item type	Hits	False alarms	d'	β
		Experiment 1		
Destination condition				
Face	.81 (.03)	.07 (.03)	—	—
Fact	.95 (.02)	.02 (.01)	—	—
Face-fact pair	.74 (.03)	.30 (.02)	1.31 (0.14)	−.18 (.08)
Source condition				
Face	.95 (.01)	.03 (.01)	—	—
Fact	.91 (.02)	.01 (.01)	—	—
Face-fact pair	.80 (.02)	.20 (.01)	1.82 (0.14)	−.13 (.08)
		Experiment 2		
High-self-focus condition				
Face	.86 (.04)	.08 (.02)	—	—
Fact	.89 (.02)	.02 (.01)	—	—
Face-fact pair	.64 (.03)	.43 (.03)	0.57 (0.12)	−.03 (.04)
Low-self-focus condition				
Face	.86 (.03)	.09 (.03)	—	—
Fact	.95 (.02)	.00 (.00)	—	—
Face-fact pair	.75 (.03)	.30 (.02)	1.30 (0.11)	−.20 (.12)
		Experiment 3		
Refocus condition				
Face	.91 (.04)	.11 (.03)	—	—
Fact	.97 (.02)	.01 (.01)	—	—
Face-fact pair	.76 (.03)	.26 (.03)	1.48 (0.12)	−.13 (.15)
Control condition				
Face	.90 (.02)	.08 (.02)	—	—
Fact	.93 (.02)	.01 (.01)	—	—
Face-fact pair	.69 (.02)	.33 (.03)	1.02 (0.12)	.05 (.08)

Note. Values for d' and β were calculated only for the face-fact pairs because hit rates of 1 and false alarm rates of 0 were quite common for face and fact memory. Standard errors are shown in parentheses.

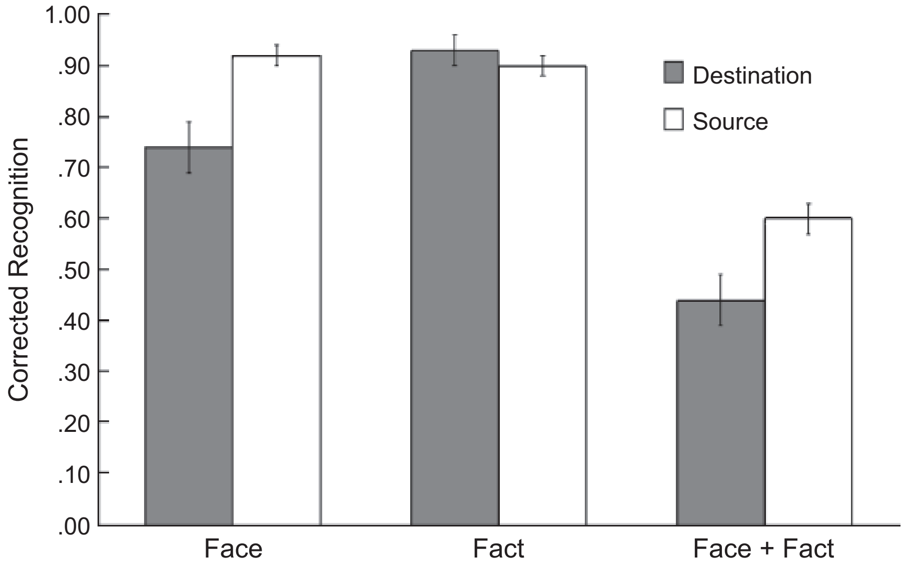

Fig. 1. Results from Experiment 1: mean corrected recognition scores for individual-face memory, individual-fact memory, and associative memory (face-fact pairs) in the destination and source conditions. Error bars represent standard errors of the mean.

diction, it is nonetheless surprising. The difference was large: Destination memory accuracy was 16% lower than source memory accuracy. At a fundamental level, participants were doing something very similar in the destination and source conditions: forming an episodic memory by associating fact and person information in a spatiotemporal context. However, the similarity ends there: Our results indicate that outgoing information was less integrated with its environmental context (i.e., the person) than was incoming information. Moreover, Experiment 1 extended previous research (e.g., Koriat et al., 1991), in which participants who transmitted information showed impairments in the formation of associations between items and their physical environment (e.g., laboratory room). Specifically, participants in our destination condition exhibited a disruption in formation of an association between separate items within the environment. That is, transmitting information disrupted the associative processes by which independent items (i.e., facts and faces) were integrated.

Poor destination memory performance may be related to the amount of attentional resources devoted to face-fact pairings at encoding. When one tells a fact to someone else, one's attention is focused on the processes required to transmit information (cf. Zimmer & Engelkamp, 1989). Because such actions are self-produced, one's focus is on oneself, which leaves fewer attentional resources available to associate the fact with the person one is telling the fact to. As a result, fact-person integration is weak. By contrast, incoming information is perceived as belonging to the environment (Koriat et al., 1991). Thus, when attention is directed to incoming information, it is also directed to the person providing the information, and the fact being transmitted is associated with the face of the person transmitting it. Consequently, destination memory is worse than source memory.

EXPERIMENT 2

Is this self-focus component of destination memory responsible for the poorer integration between independent items of information in destination memory episodes compared with source memory episodes? To address this question, in Experiment 2 we manipulated the degree of self-focus during the encoding phase. To keep the paradigm similar to that of Experiment 1, we asked participants to tell the famous faces either personal facts about themselves (*high-self-focus condition*) or arbitrary facts, like those in Experiment 1 (*low-self-focus condition*). High-self-focus participants used personal pronouns ("I" and "my") during their fact telling, and such language has been shown to promote self-focus (cf. Gardner, Gabriel, & Lee, 1999). Hypothesizing that self-focus is responsible for destination memory errors, we predicted that destination memory would be poorer among participants in the high-self-focus condition than among participants in the low-self-focus condition.

Method

Participants

Forty University of Waterloo undergraduates received bonus course credit for participating. Half of the participants were randomly assigned to the low-self-focus condition and half to the high-self-focus condition. None had participated in Experiment 1.

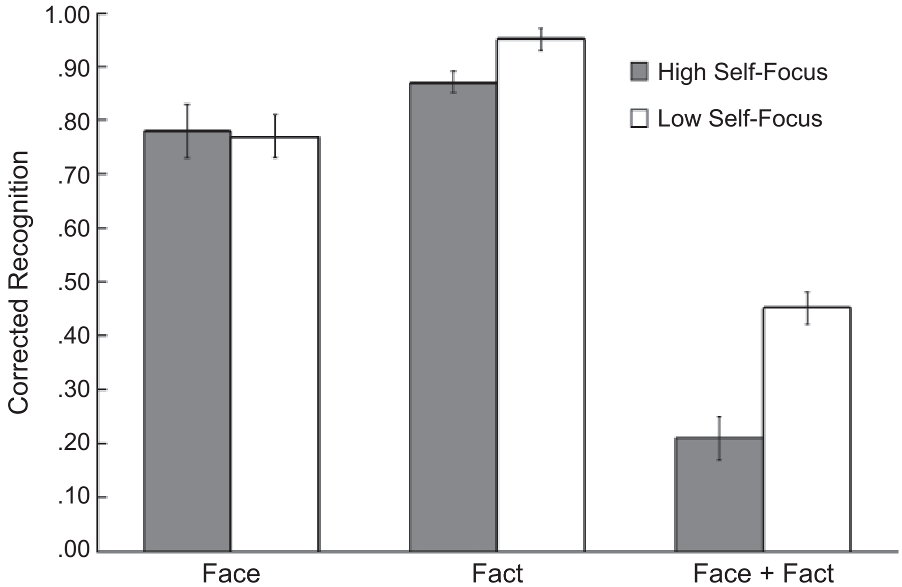

Fig. 2. Results from Experiment 2: mean corrected recognition scores for individual-face memory, individual-fact memory, and destination memory (face-fact pairs) in the high-self-focus and low-self-focus conditions. Error bars represent standard errors of the mean.

Stimuli and Apparatus

The item pools for the high-self-focus condition consisted of 60 cues, each with a blank at the end for participants to fill in their personal answer (e.g., "My zodiac sign is ______"), and the 60 faces from Experiment 1. The stimuli for the low-self-focus condition were the 60 facts and 60 faces used in Experiment 1. The apparatus was identical to that used in Experiment 1.

Procedure

The procedure for low-self-focus participants was identical to the destination memory procedure used in Experiment 1. These participants were presented with face-fact pairs from the original item pools during the study phase and completed the same recognition memory tests as in Experiment 1.

Instead of seeing an item from the original fact pool during the study phase, the high-self-focus participants saw a personal-fact cue. They were instructed to read the cue silently and then fill in their personalized answer. Trial presentation began with a 1,000-ms white fixation cross ("+") on a black background, followed by presentation of the fact cue. Once the participant had silently read the cue and generated an answer, he or she pressed the space bar. After a 250-ms blank screen, a picture of a famous person was presented. The participant told the person the entire personal fact (e.g., "My zodiac sign is Pisces") and then pressed the space bar, initiating the appearance of another blank screen for 250 ms. This procedure repeated until the participant had told each of 50 personal facts to a different face. The testing procedure was the same as in the destination condition in Experiment 1, except that the fact cue, rather than the full fact, was displayed during both recognition memory tests.

Results

Hit and false alarm rates as well as d' and β values are shown in Table 1. Figure 2 presents corrected recognition scores for individual faces, individual facts, and destination memory, separately for the low- and high-self-focus conditions.

Corrected recognition data were analyzed using a mixed ANOVA, with self-focus (high or low) as the between-subjects factor and item type (face, fact, face-fact pair) as the within-subjects factor. There were significant main effects of self-focus, $F(1, 38) = 11.46$, $p_{rep} = .98$, $\eta_p^2 = .23$, and of item type, $F(2, 76) = 165.04$, $p_{rep} \approx 1.00$, $\eta_p^2 = .81$, as well as a significant interaction of self-focus with item type, $F(2, 76) = 7.07$, $p_{rep} = .98$, $\eta_p^2 = .16$.

To explore this interaction further, we conducted a separate one-way ANOVA for each item type. Participants in the low- and high-self-focus conditions performed similarly on individual-face recognition, $F(1, 39) = 0.028$, $p_{rep} = .22$, $\eta^2 = .03$, but participants in the low-self-focus condition were slightly better at recognizing individual facts than were those in the high-self-focus condition, $F(1, 39) = 6.95$, $p_{rep} = .94$, $\eta^2 = .87$. Critically, destination memory accuracy was markedly lower in the high-self-focus condition ($M = .21$) than in the low-self-focus condition ($M = .45$), $F(1, 39) = 20.43$, $p_{rep} \approx 1.00$, $\eta^2 = .95$.

Discussion

These results support the hypothesis that self-focus is what makes destination memory less accurate than source memory. When people's self-focus was increased by having them tell personal facts to faces, their destination memory performance suffered dramatically, despite memory for individual items being largely unaffected. This result is consistent with Hockley and Cristi's (1996) finding that associative memory demands more attention than item memory. When people focus on themselves, more destination memory errors are made, possibly because fewer encoding resources are available to associate independent pieces of information—such as what one said and to whom one said it.

Johnson, Nolde, and De Leonardis (1996) found that people's source memory improved when they focused on how the speaker felt rather than on their own emotions. The results of Experiment 2, coupled with the findings from Johnson et al., suggest a more general perspective. The present research supports the idea that self-focus, apparently irrespective of emotional content, detracts from establishing connections among independent features from a complex memory episode because fewer attentional resources are available to integrate the independent features.

EXPERIMENT 3

Experiment 1 demonstrated that destination memory is more error prone than source memory, and Experiment 2 suggested that this is because attention is focused on outputting information during a destination episode, thereby emphasizing the internal context (oneself) instead of the external context (the other person). The objective of Experiment 3 was essentially the opposite of that of Experiment 2: to improve destination memory by shifting the focus of attention away from the participant's self and toward the face-fact pairing, thereby enhancing the associative linkage between the fact and the face. This shift in attention was accomplished by having participants in one condition (the refocus group) say the famous person's name before telling him or her the fact (e.g., "Oprah Winfrey, the United States Postal Service handles 40% of the world's mail volume"). Saying a person's name prior to telling that person something should shift the emphasis away from the self and toward the destination person. The control group simply told the famous person the fact without saying the famous person's name.

Method

Participants, Stimuli, and Apparatus

Forty-eight University of Waterloo undergraduates received bonus course credit for participating. Half were randomly assigned to the refocus condition and half to the control condition. None had taken part in related experiments. The stimuli and apparatus were the same as those used in the destination memory condition in Experiment 1.

Procedure

Refocus and control participants were exposed to a familiarization phase in which they were shown individual pictures of all 60 famous people and told their names. The rest of the procedure was exactly the same as in the destination memory condition of Experiment 1 except that, during study, refocus-condition participants were required to say the famous person's name aloud before telling him or her the fact.

Results

Hit and false alarm rates as well as d' and β values are shown in Table 1. Figure 3 presents corrected recognition scores for in-

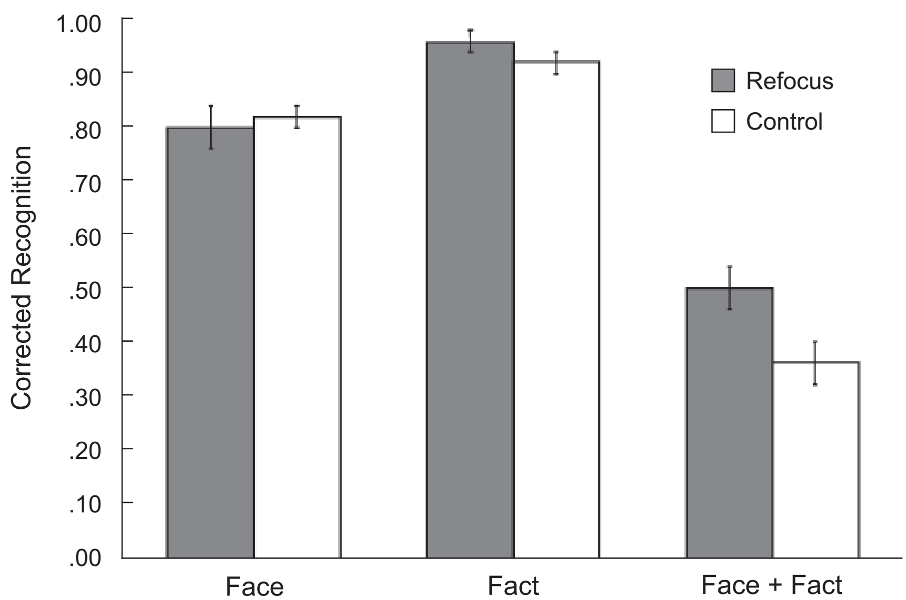

Fig. 3. Results from Experiment 3: mean corrected recognition scores for individual-face memory, individual-fact memory, and destination memory (face-fact pairs) in the refocus and control conditions. Error bars represent standard errors of the mean.

dividual faces, individual facts, and destination memory separately for the control and refocus conditions.

Corrected recognition data were analyzed using a mixed ANOVA, with focus (refocus or control) as the between-subjects factor and item type (face, fact, face-fact pair) as the within-subjects factor. There were significant main effects of focus, $F(1, 46) = 5.00$, $p_{\text{rep}} = .91$, $\eta_p^2 = .10$, and of item type, $F(2, 92) = 157.90$, $p_{\text{rep}} \approx 1.00$, $\eta_p^2 = .77$, as well as a significant interaction of focus with item type, $F(2, 92) = 3.38$, $p_{\text{rep}} = .90$, $\eta_p^2 = .07$.

To further explore this interaction, we conducted a separate one-way ANOVA for each item type. Participants in the two conditions performed similarly on individual-face recognition, $F(1, 47) = 0.24$, $p_{\text{rep}} = .41$, $\eta^2 = .19$, and on individual-fact recognition, $F(1, 47) = 2.31$, $p_{\text{rep}} = .78$, $\eta^2 = .70$. However, the refocus group had significantly better destination memory ($M = .50$) than the control group ($M = .36$), $F(1, 47) = 6.99$, $p_{\text{rep}} = .95$, $\eta^2 = .87$.

Discussion

We have argued that the focus of attention when people output information is ordinarily on themselves rather than on the external context. Notably, Experiment 3 demonstrated that it is possible to reduce destination memory errors by shifting attention from oneself to the person to whom one is speaking.

Methods to improve source memory are rarely researched despite the numerous manipulations (e.g., divided attention—Troyer, Winocur, Craik, & Moscovitch, 1999; increasing retention interval—Schmolck, Buffalo, & Squire, 2000) and pseudomanipulations (e.g., aging—Rahhal, May, & Hasher, 2002; frontal lobe patients—Janowsky, Shimamura, & Squire, 1989) reported to impair source memory. However, Davidson, McFarland, and Glisky (2006) reported that focusing on the emotional tone of speakers who told messages improved source memory.

Together, Experiment 3 and the study by Davidson et al. (2006) have broad implications. When people's attention is drawn to the person with whom they are interacting, the association between the person and the information being communicated is strengthened at encoding, and both source memory and destination memory are improved. However, overall performance differs for destination memory and source memory: As Experiment 1 demonstrated, destination memory is normally less accurate than source memory. Consequently, although conditions that improve associative memory may do so to a similar degree for both destination and source memory, destination memory will still be worse than source memory.

The hypothesis that destination memory is impaired by its associated self-focus was supported by Experiments 2 and 3: Increasing self-focus impaired destination memory, whereas decreasing self-focus by directing attention to the person participants told information to improved destination memory.

GENERAL DISCUSSION

Everyday memory is a record of the bidirectional interaction between people and their environment; therefore, memory for complex events includes both source memory and destination memory. It therefore is remarkable that source memory has received intense research attention, whereas destination memory has been almost entirely overlooked.

How does the formation of a memory episode differ between destination memory and source memory? Our findings suggest that individual units of information within a memory episode are not as well integrated with one another in destination memory (involving outgoing information) as in source memory (involving incoming information). This occurs because when speakers output information to other people, they focus their attention on the processes required to transmit information (cf. Zimmer & Engelkamp, 1989), and therefore on themselves. This self-focus reduces the attention available to associate facts with the people to whom speakers tell them. Therefore, destination memory is more fallible than source memory.

That destination memory is less accurate than source memory is interesting on another level, given that past research has demonstrated that output typically boosts memory performance. For example, enacting a phrase (the enactment effect; Cohen, 1981; Engelkamp & Krumnacker, 1980), generating a word from a cue (the generation effect; Slamecka & Graf, 1978), or even just producing a word aloud (the production effect; MacLeod, Gopie, Hourihan, Neary, & Ozubko, in press) all have been shown to improve memory for the respective word or phrase. However, our research on destination memory suggests that this item-memory benefit may come at a cost to associative memory (see Mulligan, Lozito, & Rosner, 2006).

The present research indicates that transmitting information does not undermine the encoding of the individual components within an episode; the associative memory, or the integration of items within a spatiotemporal context, is what is impaired. This impairment occurs because attentional resources are directed at the processes (and the individual) involved in producing the information, so that the resources available to integrate independent items are reduced. Consequently, associative memory is more disrupted in a destination episode than in a source episode.

Experiment 3 clearly demonstrated that individual components of an episode can be better integrated if attention is directed to their association. Exploring the boundary conditions of this memory improvement will be a fruitful enterprise for theory (e.g., identifying encoding factors that determine the degree to which one later recollects a complex memory episode) and application (e.g., memory rehabilitation).

In their review of source memory research, Johnson et al. (1993) asserted that knowledge of source is a "critical everyday memory function" (p. 21). As source memory's sibling, destination memory plays an equally critical role in social interaction. We are not claiming that destination memory and source memory operate independently. On the contrary, they must interact with each other as people take turns speaking during conversation, and their processes should generally rely on similar heuristics and systematic processes. However, compared with the association between a person and received information in source memory, the association between a person and provided information in destination memory is weaker. Conceptualizing episodic memory as including both destination memory and source memory will bolster understanding of how people remember the complex context surrounding the information that they acquire and convey.

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