

Destination Memory: Stop Me If I Told You This Already

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

Consider a common social interaction: Two people must each attend to and remember the other person's behaviour while also keeping track of their own responses. Knowledge of what one said to whom is important for subsequent interactions so that information is not repeated to the same person. Remembering what one said to others is also important in the workplace where supervisors need to remember to whom they have told specific information so that they can later assess assignment progress from the relevant employee. The processes involved in remembering the destination of information will be referred to as "destination memory" in this dissertation. Although there has been extensive research regarding the processes involved in remembering the source of information, or "source memory," there has been little to no research on destination memory. In a series of four experiments, this dissertation delineates the core features of destination memory.

In Experiment 1, a paradigm was developed to assess destination memory in the laboratory. This experiment also corroborated complaints of destination memory failures: Adults have very poor destination memory when compared to memory for the information they tell or the person to whom they tell the information. Destination memory fundamentally differs from source memory in terms of how information is transferred—"input" in the case of source memory and "output" in the case of destination memory. Attention is directed at the processes involved in transmitting information in the case of destination memory which leaves fewer attention resources for associating the information with the person one is telling it to. Therefore, it would be anticipated that destination memory would be worse than source memory.

Experiment 2 directly contrasted destination memory and source memory and confirmed that destination memory accuracy was indeed substantially lower than source memory accuracy. Because in the case of a destination event information is self-produced, attention is focused on oneself. Experiment 3 assessed whether self-focus reduces the association between the outputted information and the person that one is telling it to. When self-focus increased, so too did destination memory errors because fewer attentional resources were available to integrate the person-information pairing. This led to the prediction that, in the reverse situation where attentional resources are directed to the person-information pairing at encoding, then destination memory should improve. Experiment 4 confirmed this prediction: Destination memory was enhanced when people's attention was shifted from themselves to the person-information pairing.

This thesis has undertaken to examine a surprisingly neglected component of normal remembering—remembering who one told something to. To study this “destination memory,” a new paradigm is introduced. Across four experiments, destination memory is seen to be quite fallible, more so than source memory. An account is offered in terms of destination memory being undermined by the self-focus that it generates. This view is reinforced by two experiments that show that increasing self-focus reduces destination memory whereas increasing environment-focus improves destination memory. Like source memory, destination memory is a key component of episodic memory, the record of our personal past.

Acknowledgments

Like most young children, I was regularly posed the question of what I wanted to be when I grew up. Without hesitation, I would blurt out, "scientist," whereas my friends aspired to become firemen, astronauts, or the occasional construction truck driver. My childhood in the Caribbean nurtured my scientific curiosity. I was free to explore small ponds in rainforests, which were filled with frogs and fish in all stages of their life-cycles, and I catalogued the motley-coloured birds that visited our home. I witnessed the effects of erosion on nearby mountains and designed an experiment to demonstrate that deforestation was to blame. I carefully formed two hills out of soil from our yard and embedded one with twigs and leaves and left the other bare. While I poured a cup of water on each hill to reveal the consequences of deforested land, the fate of my seven-year-old self was sealed: I was destined to explore and investigate interesting questions using the scientific method.

Twenty years later, I am still conducting experiments, albeit mostly in a laboratory. This journey would not have been possible if not for the infinite support of my loving parents. I fondly remember the many trips to science fairs, zoos, and museums, which undoubtedly influenced my educational aspirations. I am also grateful that my younger brother, Darren, was always my willing "lab technician," who availed himself during many crazy schemes.

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Introduction

In a typical day, we engage in conversations with many different people. These social interactions place significant demands on memory both in terms of encoding and retrieval. Each person must not only attend to what the other person is saying but they must also keep track of their own responses. For example, you will want to remember that your conversational partner asked for a reprint of your article so that you can later follow up on this request, and you will also want to remember what you told her about your latest research endeavour so that you will not repeat yourself the next time you meet.

The processes involved in remembering the source of information, in particular the person who imparted information to you during a conversation, have been comprehensively studied and are referred to in the literature as *source memory* (Johnson, Hashtroudi, & Lindsay, 1993). There is so much work on source memory that it now often is assigned its own chapter or a large portion of a chapter in textbooks (e.g., Radvansky, 2006). This dissertation explores the neglected half of the story—the processes involved in remembering the destination of information, such as who one told information to during a conversation. This will be referred to, by analogy, as *destination memory*.

Source Memory

Source memory has been extensively researched over the past 30 years using a variety of paradigms that have investigated whether subjects remember such source elements as the *font* (e.g., Kausler & Puckett, 1980), *colour* (e.g., Doerkson &

Shimamura, 2001; Macken, 2002; Park & Puglisi, 1985), *origin* (e.g., Cohen & Faulkner, 1989; Craik, Morris, Morris, & Loewen, 1990; Shimamura & Squire, 1987), *location* (e.g., Cansino, Maquet, Dolan, & Rugg, 2002), *speaker* (e.g., Dodson, Holland, & Shimamura, 1998; Hicks & Marsh, 1999) and *modality* (Kausler & Puckett, 1981; Lehman & Mellinger, 1984, 1986) differently than the relevant piece of information (or *item*) itself.

These studies provide evidence that memory for the source of information is dissociable from memory for the content—the to-be-remembered item. As always, the most compelling confirmation that encoding of item and source information is dissociable comes from experiments demonstrating that a single variable benefits memory for one yet impairs memory for the other. For example, Jurica and Shimamura (1999) demonstrated that an elaborative encoding task benefitted item memory yet impaired source memory. Consequently, item memory and source memory are not inherently unified: A variable that increases item memory does not necessarily increase source memory—and in fact, may even impair source memory. This conclusion is intuitively appealing because we are well aware that we can remember vast amounts of information without remembering from where or whom we originally acquired the knowledge. We also know that we can sometimes recall a source element despite not being able to recall the item information, as when we remember where on the page a fact was but are unable to recover the fact itself (Rothkopf, 1971).

Neuropsychological evidence from brain-injured patients, neuroimaging, and aging studies also corroborate the claim that item memory and source memory are dissociable. Some amnesic patients have impaired source memory that is

disproportionately worse than their item memory performance (Schacter, Harbluk, & McLachlan, 1984; Shimamura & Squire, 1987, 1991). Researchers also have shown that patients with circumscribed frontal lobe lesions, who are not grossly amnesic, perform just as well as controls on tests of item memory. By contrast, these same patients have impaired source memory (Janowsky, Shimamura, & Squire, 1989; Johnson, O'Connor, & Cantor, 1997; Shimamura, Janowsky, & Squire, 1990); thus, providing further support that item and source memory are distinct theoretical constructs which are mediated by different brain areas.

Other scientists have not just argued for a dissociation but instead have championed the stronger view that there is a functional *double* dissociation between source and item memory. For example, Glisky and colleagues contend that item memory is more dependent on medial-temporal brain structures, whereas source memory is heavily reliant on regions in the frontal lobes (Glisky, Polster, & Routhieaux, 1995). Neuroimaging studies also support a source-item neuroanatomical distinction by demonstrating preferential frontal lobe activation during source memory tasks (Petrides, Alivisatos, & Evans, 1995; Tulving, Kapur, Craik, Moscovitch, & Houle, 1994), as do studies measuring event-related potentials in source memory tasks with healthy subjects (Johnson, Kounios, & Nolde, 1997; Senkfor & Van Petten, 1988; Van Petten, Senkfor, & Newberg, 2000).

Source memory is more sensitive to age than is item memory (for a review see Spencer & Raz, 1994). As we age, memory for context generally declines precipitously, whereas memory for facts follows a shallower decline (Brown, Jones, & Davis, 1995; Craik, 1983; Ferguson, Hashtroudi, & Johnson, 1992; Henkel, Johnson, & DeLeonardis,

1998; McIntyre & Craik, 1987). Differences in source memory performance between younger and older adults have been found under a variety of source memory paradigms. For example, in determining the source of actions (Cohen & Faulkner, 1989), words (Hashtroudi, Chrosniak, & Johnson, 1989), fame (Dywan & Jacoby, 1990), learned location of words (Chalfone & Johnson, 1996), or the speaker of information (Rahhal, May, & Hasher, 2002), older adults perform disproportionately worse on measures of source memory when compared to younger adults. Therefore, another domain of research—aging—demonstrates that item and source memory are dissociable from each other.

Many formal models of memory make a distinction between item and source memory (e.g., Batchelder & Riefer, 1990; Bayen, Murnane & Erdfelder, 1996). Specifically, researchers have proposed that source memory is episodic in nature. That is, successfully recognizing the source of information relies on our ability to recollect our past accurately, whereas recognition of item information is based on familiarity processes (e.g., Yonelinas, 1999). Therefore, item memory is less dependent on contextual information, whereas source memory is reliant on the encoding of information within a specific spatiotemporal context.

A framework also exists to explain how we monitor the source of our memories. The source monitoring framework (SMF, Johnson, 1988; Johnson, Hashtroudi, & Lindsay, 1993; Mitchell & Johnson, 2000) states that we attribute sources to our memories by inferring the perceptual, semantic, and affective content of our thoughts, images, and feelings. For example, recollecting the deep, booming voice of a particular

acquaintance, his burly appearance, the summer breeze, and your thoughts and feelings at the time will all provide clues to various aspects of the source of this recollection.

Overall, hundreds of studies have contributed to our understanding of how we remember who told us something or where we first encountered information—the source of information (see, e.g., Mitchell & Johnson, 2000, for a review). This makes sense, given the importance of remembering the source of information. For example, remembering that information was attained from a reputable television news program rather than an entertainment television show will determine how that information is used. In this situation, information learned from a news program may be shared with a colleague during an intellectual debate whereas information attained from a less reputable source may be withheld. However, the inverse situation—remembering who we told something to—is often important as well. For example, remembering what was said to a colleague is important for future interactions so that relevant information can be discussed later and that previously said information will not be repeated. Thus, it is surprising that we know very little about the processes involved in remembering the destination of information that we output, a situation that I have labelled *destination memory*.

Destination Memory

Destination memory has been largely overlooked despite anecdotal reports that destination information may be more difficult to remember than is source information—especially among older adults. We all know stories about, and likely have personal experience with, older people telling the same story repeatedly, indicative of recurring

failure of destination memory. However, destination memory is an issue for young adults as well: Young university-aged adults perceive it as at least as problematic as source memory. In a survey that I conducted among 30 undergraduate students at the University of Waterloo, 43.3% of the respondents “agreed” or “strongly agreed” with the statement “I forget who I tell things to” (destination memory) and the same proportion of students also “agreed” or “strongly agreed” with the statement “I lose track of who tells me what” (source memory). These same students perceived their destination memory and source memory as being fallible “sometimes” to “very often.” Clearly, destination memory problems are as much a concern for younger adults as are source memory issues.

There are important social consequences of incorrectly remembering to whom one told something. In particular, there is social embarrassment in retelling a story or joke to the same person if one’s destination memory fails. Accurately remembering the destination of information is also important in the workplace. For example, supervisors need to remember to whom they told specific information or delegated specific tasks so that they may assess progress and accurately gauge their employees’ workloads. In the previously mentioned survey, 80.0% of undergraduate students reportedly repeat a story twice to the same person “sometimes” to “very often.” This aligns well with the intuition that destination memory errors are a frequent occurrence in everyday life.

Destination memory also functions to facilitate our conversations. By remembering what we told others, we can assume a *common ground* in the conversation and continue where we last left off (cf. the given-new contract, Haviland & Clark, 1974). For example, if destination memory for the previous conversation is intact, one can introduce the topic of an upcoming test to a friend on an earlier occasion and then discuss

the results of the test on a later occasion without needing to discuss the test's background again. A professor in a classroom experiences this problem when she cannot recall if she has already told her current class—as opposed to another class—about a study in the literature, or whether she has already used a particular illustration.

On a less commendable dimension, intact destination memory is also required for successful deception. For example, we can broadly classify lies into two categories: those that we tell to many people (e.g., actions that we believe are socially positive, such as that we recycle regularly when in fact we only wish we did) versus those that we tell to some people but not to others (e.g., lowering our age). It is this latter category that places a burden on destination memory because, to avoid getting caught, we need to keep track of who we tell what. Considered from this perspective, the psychopath must have, or must have cultivated, exceptional destination memory.

On a theoretical level, destination memory shares a common feature with source memory: They 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 in terms of memory performance and theory. This thesis will argue that it does.

Item Memory vs Associative Memory

On the surface, both destination memory and source memory are a type of associative memory. They both rely on remembering relations among individual items of information so that at retrieval these relations can be assembled to form the previously encoded episode. Simple examples of associative memory include remembering words that were paired together, remembering the colour of objects, and remembering the location of objects. This is contrasted with item memory, which is the remembering of individual items such as the words or objects without knowledge of other information that was associated with them at encoding. For example, item memory is remembering that one saw a chair whereas associative memory is remembering that one saw a chair near a tree.

Numerous experiments have shown differences between item and associative information. For instance, they have different time courses at retrieval (Gronlund & Ratcliff, 1989; Nobel & Shiffrin, 2001) and different forgetting rates (Hockley, 1991, 1992; Murdock & Hockley, 1989), they are differentially affected by aging (Chalfonte & Johnson, 1996; Naveh-Benjamin, 2000), and they rely on different neuroanatomical regions (Eichenbaum & Bunsey, 1995; Kirwan & Stark, 2004; Klingberg, Roland, & Kawashima, 1994; Yonelinas, Hopfinger, Buonocore, Kroll, & Baynes, 2001).

Of particular relevance for destination memory and source memory is the finding that different recognition processes contribute in different ways to item memory and associative memory. Dual-process theories of memory assume that recognition judgments are based on recollection and familiarity processes (e.g., Atkinson & Juola, 1974; Jacoby

& Dallas, 1981; Mandler, 1980; Yonelinas, 2002). Recollection is a conscious awareness of qualitative information from the study episode, whereas familiarity reflects a sense of knowing only that an item has been previously encountered without being aware of the contextual details surrounding the learning episode. Yonelinas (1997) found evidence that item memory relies on a combination of recollection and familiarity processes, whereas associative memory relies primarily on recollection. Because destination memory and source memory are a type of associative memory, then successful retrieval of destination memory and source memory is dependent on intact recollection or episodic memory.

Current Research Rationale

Performance for destination memory and source memory will be similar to the extent that recollection levels are comparable for them. Because destination and source memory are both types of associative memory, then one might naively assume that destination memory and source memory should not differ in terms of their success or their fallibility. That is, destination memory and source memory errors ought to be committed to the same extent because both are associative in nature.

Of importance, though, recollection performance critically depends on how information was encoded. For example, recollection is particularly susceptible to an increase in memory load at encoding (Yonelinas, 1994; Yonelinas & Jacoby, 1994), and is especially disrupted by divided attention during study (Craig, Govoni, Naveh-Benjamin, & Anderson, 1996). Differences in how information is transferred at encoding—outgoing versus incoming—result in a disparity in how environmental context is encoded. Past research has shown that outgoing information is not as well integrated with the

environmental context as is incoming information (Koriat, Ben-Zur, & Druch, 1991). This has consequences for episodic retrieval because recollection is aided by context (Gopie, 2005).

As an alternative to the naive account, it is proposed in this thesis that destination memory and source memory should differ in terms of their success and their fallibility. Extrapolating from Koriat et al. (1991), this is expected to occur because incoming information is better integrated with its source compared to the integration of outgoing information with its destination. The reason for better association between the person and the information in source memory compared to destination memory is a result of how conscious attention is directed at encoding. When people impart information, they are focused on the processes required to transmit information (cf. Zimmer & Engelkamp, 1989), which leaves fewer attentional resources to associate the outgoing information with the person that one is telling it to. Consequently, it is anticipated that destination memory is more fallible than source memory because context is better integrated with source memory than with destination memory.

Therefore, this thesis aims to develop a paradigm to successfully investigate destination memory in the laboratory (Experiment 1); to determine whether destination memory is more prone to errors than source memory because of the difference regarding how information is transferred at encoding (Experiment 2); and to investigate the mechanisms underlying these error differences by manipulating encoding factors that are hypothesized to influence how destination memory items are associated with each other (Experiments 3 & 4). Overall, this inaugural exploration of destination memory will highlight the significance of destination memory as a distinct component of the episodic

memory system, and will complement source memory research by furthering our understanding of the mechanisms through which episodic memories are encoded.

Experiment 1: Destination Memory Paradigm

To critically examine destination memory, a paradigm is needed to investigate the phenomenon in the laboratory. Developing such a paradigm was the primary objective of Experiment 1.

An important goal was to test memory for item and destination information using tests that are as analogous as possible, unlike the common error committed in the source memory literature of using different assessment procedures. As Chalfonte and Johnson (1996) noted, most source memory experiments employ yes/no or forced-choice recognition tests to determine whether people remember the item. By contrast, memory for source features is usually assessed with cued recall tests (e.g., Ferguson et al., 1992; Kausler & Puckett, 1981; Zelinski & Light, 1988). Observed memory differences between item and source memory may therefore be a consequence of test type. Cued recall tests are generally more difficult than recognition tests (Craik, 1977; Craik & McDowd, 1987; Light & LaVoie, 1993), likely because they put greater weight on retrieval operations and provide, in Craik's (1986) analysis, less environmental support.

Another common pitfall that occurs in source memory research consists of assessing source memory only when individuals are correct in identifying the item. For example, only after indicating that a studied word was 'old' will subjects be questioned about the word's print colour (e.g., Mulligan, 2004, Experiment 1) or location (e.g., Meiser & Bröder, 2002, Experiment 1) at the time of study trial. Consequently, to identify source features, participants must also have intact item memory performance. However, daily experience suggests that this is a very constrained view. In reality, we are

often able to remember the source (or the destination) of our memory but not remember the content of what was said. For example, we may remember speaking to a particular acquaintance a year ago but not recall the specifics of the conversation.

Both of these critical issues plaguing source memory research were addressed in Experiment 1's destination memory paradigm. First, to address the pitfalls of the common practice of using different tests to make memory comparisons, a standard recognition memory test was adopted throughout the destination memory paradigm. Second, destination memory was not assessed only after participants identified an item as being old: Instead it was assessed separately from item memory for a non-overlapping subset of studied items.

The destination memory paradigm required participants to tell various facts (e.g., "The average person falls asleep in 12 minutes") to pictures of famous people (e.g., Tom Cruise), with the fact preceding the face on a computer monitor. Each famous person was told a single unique fact. This phase is analogous to the standard encoding component in many memory experiments. Afterward, participants' memories for the facts, faces, and fact-face linkages were assessed using the same type of test—a yes/no recognition memory test for the item or for the association. The order of these two tests was counterbalanced.

In the item memory test, some previously seen and new facts and faces were individually presented on the screen and participants were asked to make a yes/no judgment to indicate whether they had said that fact or seen that face during study. Therefore, this recognition test provided independent memory judgments for what people

said and who they saw (and told facts to), which is another beneficial feature of this paradigm, because destination memory errors could be pinpointed to a specific locus (i.e., disproportionate faulty memory for the faces or for the facts or both).

The associative memory recognition test assessed the critical research question: How well do people remember who they told something to? Here, the emphasis was on the fact-face connections. Participants were shown another subset of previously seen facts and faces that did not overlap with the stimuli used on the item recognition test. However, now the computer monitor simultaneously displayed a face and fact on screen, and people made yes/no decisions about whether they had told that displayed fact to that famous person during study.

Overall, Experiment 1's destination memory paradigm allowed for an assessment of a complex memory event by independently evaluating people's memories for individual items in an episode (i.e., item memory), and by determining whether people are able to accurately relate pieces of information that were encountered together during the acquisition episode (i.e., associative memory). It is anticipated that people will be better at recognizing individual items from an episode compared to recognizing relations among items, the latter representing destination memory. This should be the case because recognition of item information relies on either familiarity or recollection processes whereas associative information is predominantly based on the more effortful of the two processes—recollection (Yonelinas, 1997).

Method

Subjects. Twenty students from Introductory Psychology at the University of Waterloo received bonus credit in the course for taking part in the experiment. Subjects in all experiments were independent samples. All of the experiments were approved by the University of Waterloo's Office of Research Ethics, and all participants gave informed consent prior to participation.

Stimuli. The fact item pool (Appendix A) consisted of 60 interesting facts that were culled from various Internet resources. The face item pool (Appendix B) consisted of 60 pictures of famous people anticipated to be familiar to an undergraduate through television, sports, music, movies, or politics. The pictures were also gathered from various Internet resources. All stimuli were presented in 14-pt lower case white font against a black background.

From the pool of 60 facts and faces, a random 50 facts and faces were selected to be paired for study. On the associative recognition test, 40 fact-face pairings were shown in random order, with 20 fact-face pairs presented in their original pairing and the other 20 presented re-paired, as is traditionally done on associative recognition tests, to minimize participants' use of response strategies (e.g., Hockley, 1992; Naveh-Benjamin, Guez, & Marom, 2003). That is, if the pair was composed of one new item and one old item then participants only need to recognize that one member of the pair was new to respond 'new'. By contrast, participants could not adopt this strategy on a test that is composed of intact and re-paired members because all individual items were seen at study.

The remaining 10 facts and 10 faces from study, together with 10 new facts and 10 new faces, were presented individually in the item recognition test in a random order. In this way, the two tests used entirely non-overlapping sets of stimuli, preventing contamination.

Apparatus. An IBM-compatible microcomputer with a 15-inch color monitor was used for testing. The controlling program was written in E-Prime (version 1.1, Schneider, Eschman, & Zuccolotto, 2002).

Procedure. In the study phase, participants were instructed to tell facts to faces. Each trial consisted of a fact screen followed by a face screen, with subjects told to read the fact silently and then to press the spacebar to reveal the person that they would now tell the fact to aloud. Study trial presentation began with a 1000-ms white fixation cross (“+”) on a black background at the center of the screen. The fact was then presented in white font at the center of the screen. Once the subject read the fact silently, they pressed the spacebar which resulted in a black blank screen for 250-ms, followed by a colour picture of a famous person at the center of the screen. The subject was to tell the person aloud the fact that they had just read and then to press the spacebar. This initiated the appearance of another black blank screen for 250-ms. This procedure repeated until the subject had told all 50 facts to 50 separate faces.

The next two phases were the counterbalanced recognition memory tests. For the item memory test, facts and faces were randomly ordered and individually presented at the center of the screen, with facts being in white font and faces in colour. A test face or fact stayed on the screen until the subject indicated, by pressing a keyboard button for

Yes (the “c” key) or No (the “m” key), whether they had previously seen the item. Once a response was made, a black blank screen was displayed for 250-ms followed by the next test trial.

For the associative memory test, a face and a fact were presented simultaneously on the screen, with the fact appearing below the face. Participants decided whether they had told that fact to that face by pressing either the Yes (the “c” key) or No (the “m” key) button. Once a response was made, a black blank screen was displayed for 250-ms followed by the next test trial. After the recognition memory tests, participants were debriefed and thanked for their participation.

Results

Table 1 presents the recognition data expressed as proportions of hits and false alarms, accompanied by their respective standard errors in parentheses below each mean. The dependent variable calculated for each subject was a corrected recognition score (proportion hits minus proportion false alarms). Corrected recognition scores are routinely used for interpretation purposes in source memory research (e.g., Chalfonte & Johnson, 1996; Chalfonte, Verfaellie, Johnson, & Reiss, 1996; Johnson, Nolde, DeLeonardis, 1996) and recognition memory research in general (e.g., Castel & Craik, 2003; Jones & Jacoby, 2001). Corrected recognition scores and standard errors for individual face memory, individual fact memory, and destination memory (i.e., fact and fact recognition memory) are shown in Figure 1. Note that corresponding analyses on the signal detection measure d' using the formula provided by Brophy (1986) were also

conducted in all cases. Because these consistently led to the same conclusions throughout this thesis, these analyses will not be presented.

A one-way analysis of variance (ANOVA) comparing face memory, fact memory, and destination memory showed a significant overall effect, $F(2, 57) = 73.70$, $MSE = .017$, $p < .001$. To further explore the relations among face memory, fact memory, and destination memory, t-tests were conducted to compare memory for individual facts and faces to destination memory. Results indicated that memory for faces [$t(19) = 8.47$, $p < .001$] and memory for facts [$t(19) = 13.52$, $p < .001$] were both significantly better than destination memory. Subjects also had better memory for facts than faces [$t(19) = 4.41$, $p < .001$].

Pearson correlations were computed to assess the extent to which item and associative recognition memory performances were related. Neither fact memory ($r = -.18$) nor face memory ($r = .39$) was significantly correlated with destination memory (both $ps > .05$), nor were fact and face memory correlated with each other ($r = .04$, $p > .05$).

Discussion

Experiment 1 evaluated subjects' memories for complex events in which they told different facts to different famous people. Two notable results emerged. First, people were quite accurate at recognizing the faces to which they told the facts, and at recognizing the facts that they told to the faces. This is important because memory for a complex event, such as remembering what you said to someone, relies on intact memory for individual episodic features. Second, people were surprisingly poor at remembering

what they said to whom—the associative information—despite their high accuracy in remembering the faces and facts tested individually. Clearly, memories of the features of an episodic event are not unified or automatically associated with each other (e.g., Chalfonte & Johnson, 1996). Critically, this experiment demonstrated, for the first time, that destination memory is very fallible. This finding is consistent with anecdotal accounts that people have difficulties remembering what they told to whom.

Importantly for this dissertation, Experiment 1 demonstrated the utility of this novel paradigm in assessing destination memory. Confounds that are common in source memory experiments were addressed. In particular, all memory tests were consistent: Yes/no recognition tests were used throughout. This minimized performance differences that could have been caused by the task demands of the test. Moreover, this paradigm was unique because it assessed not just item memory for the facts that were said but also independently tested item memory for the person that subjects told things to. Consequently, it was possible to determine whether subjects' difficulty with destination memory was due to poor memory for components of the episode or due to poor integration of these components. Finally, destination memory was assessed independently of whether subjects remembered either piece of item information: fact or face. Therefore, the destination memory test was not contaminated because there was no prior assessment of memory for individual items that were on the destination memory test. Armed with this simple yet effective paradigm, it was now possible to investigate destination memory systematically in the laboratory.

Experiment 2: Destination Memory vs Source Memory

Experiment 1 demonstrated that people can have very good memory for the individual components of a destination episode and yet show quite poor destination memory. People were able to remember the set of facts they told and the set of faces they told facts to quite accurately. However, their destination memory—knowing what they said to whom—was substantially worse than their memory for the individual items. This laboratory outcome is consistent with people’s interactions in the real world. People know a particular piece of information and they know that they interacted with someone but are sometimes unable to recollect whether they previously told that particular person the information that they have in mind. This memory problem is not unique to destination memory; it occurs with source memory as well, and may be characteristic of associative memory more generally. Although both source memory and destination memory are fallible, are they fallible to the same extent or for the same reasons?

At the core, source memory and destination memory are different in terms of direction of information transfer. People receive information in source memory, whereas they transmit information in destination memory. To remember the source episode later, people must keep a record of the incoming stimuli from individuals who are providing them with information. By contrast, to remember the destination episode later, people must keep a record of their own actions. These different processes that record incoming and outgoing information may lead to differences in memory performance for destination memory and source memory. In particular, experiments that examine memory for output information, such as with subject-performed tasks, suggest that incoming versus outgoing information is remembered differently.

Research over the last 25 years has consistently shown that people have better memories for phrases they act out than for those they simply receive (e.g., Cohen, 1981; Engelkamp, 1990; see Engelkamp, 1998; Nilsson, 2000; or Zimmer, 2001, for reviews). For example, people remember phrases such as *break the toothpick* or *bounce a ball* better when those phrases are acted out compared to when they are simply read or listened to without acting them out. This memory advantage, or the *enactment effect*, is found on both recall tests and recognition tests. However, although enactment results in superior memory for the phrases (the items), it may not result in better memory—and may even impair memory—for other types of information during the learning episode. For example, memory for temporal order is impaired by enacting the phrase (Engelkamp & Dehn, 2000; Olofsson, 1996).

Of particular relevance is a study by Koriat, Ben-Zur, and Druch (1991) in which output events disrupted the encoding of context. Koriat et al. contrasted item memory with context memory for self-performed compared to other-performed tasks. In their second experiment, they had participants perform or watch someone else perform a set of mini-tasks, such as raising their hands or stirring water in a cup. All participants performed and watched these tasks in a particular room during phase one and were told to leave the room for a few minutes when they were done. In phase two, participants either were brought back to the same room or went to a different room where they performed and watched additional tasks. Afterward, participants were asked to classify the tasks as having been in phase one, in phase two, or in neither (“new”). All participants were tested in a room that was not used for either of the study phases.

The results of Koriat et al. (1991) indicated that people had better memory for the task when they had produced a response than when they had observed a response, as is typically found in enactment effect research. Of particular interest, however, was the finding that participants' memory for the context of self-performed tasks was worse than their context memory for other-performed tasks. On this basis, Koriat et al. (1991) proposed that output events are not as well integrated with their environmental context as are input events. They argued that this occurs because incoming sources, which are external to the person, form rich associative links between the event and its contextual, spatiotemporal environment. By contrast, Koriat et al. explained that output events are less strongly integrated with their environmental context than are input events because the person perceives their own behaviour as belonging more to themselves than to the external environment. Consequently, the person cognitively organizes their behaviour with their internal mental processes rather than with the external environment.

Reduced environmental contextualization of self-performed tasks has been found with simpler cognitive tasks as well. In an interesting example with imagined self-performed tasks (Engelkamp, Zimmer, & Denis, 1989), participants studied pairs of action verbs and were told either to imagine performing the actions or to imagine someone else performing the actions. Participants' memory performance was equivalent for cued recall and free recall when they imagined someone else performing the actions. However, self-performed instructions resulted in worse memory for cued recall than for free recall. Therefore, the relational integration of each target word with its contextual cue was undermined as a result of self-performance encoding.

In general, the research described here suggests that 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 is telling a fact) as is incoming information. For the first time, Experiment 2 directly compared source memory and destination memory, investigating whether destination memory is more error-prone than source memory, which would also provide experimental confirmation of anecdotal reports that remembering destination memory is especially difficult. Such a finding would provide preliminary evidence of differences between source memory and destination memory at encoding. To accomplish this goal, the destination memory paradigm was adjusted, with a very simple manipulation, so that famous faces ‘told’ facts to participants in a source memory condition whereas, as in Experiment 1, participants told facts to faces in the destination memory condition. A between-subjects design was used to eliminate any confusion among participants regarding the transmission of information in the case of a mixed within-participants design and to eliminate order effects in the case of a blocked within-participants design.

Method

Subjects. Fifty-two students from Introductory Psychology at the University of Waterloo received bonus credit in the course for taking part in the experiment. None had taken part in Experiment 1. Participants were randomly assigned to each study instruction condition, with 22 in the destination instruction condition and 30 in the source instruction condition.

Stimuli and Apparatus. The stimuli and apparatus were identical to those in Experiment 1.

Procedure. The procedure for the destination instruction condition was also identical to Experiment 1. For the source instruction condition, the procedure was subtly modified. Participants in this condition were instructed that facts would be told to them by famous people. This was accomplished by having the famous person precede the fact for each person-fact pairing. Participants pressed the spacebar to read a fact on the screen after they viewed the famous person. All subsequent instructions and timings were identical to Experiment 1 for both groups of participants except for the associative memory test. The source instruction participants decided whether a person told them a fact whereas the destination instruction group, as in Experiment 1, decided whether they told a fact to a person. After the experiment was completed, participants were debriefed and thanked for their participation.

Results

Table 2A presents the source instruction condition recognition data and Table 2B presents the destination instruction condition recognition data expressed as proportions of hits and false alarms, accompanied by their respective standard errors in parentheses below each mean. As in Experiment 1, the dependent variable calculated for each subject was a corrected recognition score (proportion hits minus proportion false alarms). Corrected recognition scores and standard errors for individual face memory, individual fact memory, source memory, and destination memory are shown in Figure 2.

Corrected recognition data were submitted to a 2 X 3 mixed analysis of variance (ANOVA), with study condition (destination or source) as the between-subjects factor and test condition (face, fact, face and fact) as the within-subject factors. There were significant main effects for study condition, $F(1,50) = 10.05$, $MSE = .035$, $p < .01$, and test condition, $F(2,50) = 104.12$, $MSE = .020$, $p < .01$, as well as a significant interaction of study condition with test condition, $F(2,50) = 8.27$, $MSE = .020$, $p < .01$.

To further explore this interaction, one-way ANOVAs compared the effect of study instruction on each of the test conditions. Results indicated that participants in the source instruction condition had better face recognition than those in the destination instruction condition, $F(1,50) = 17.10$, $MSE = .027$, $p < .001$, and that fact recognition performance was equivalent for the source instruction and destination instruction groups, $F(1,50) = 0.88$, $MSE = .013$, $p > .05$. Critically, source memory performance was better than destination memory performance, $F(1,50) = 6.03$, $MSE = .035$, $p < .02$.

Pearson correlations were computed to assess the extent to which item and associative recognition memory performances were related. Neither fact memory ($r = -.02$) nor face memory ($r = .10$) was significantly correlated with source memory (both $ps > .05$) nor were they correlated with each other ($r = -.21$, $p > .05$). In the destination memory condition, face memory was correlated with fact memory ($r = .65$, $p < .01$) and the reason that this was the only significant correlation across all four experiments is unknown. However, neither fact memory ($r = .29$, $p > .05$) nor face memory ($r = .24$, $p > .05$) was significantly correlated with destination memory.

Discussion

Research previously examined how memory for source information is affected by performing motor actions or interacting with objects to determine the role of action on later memory. The current experiment did not use objects or have people perform different actions, nor was it limited to investigating only source memory. Experiment 2, for the first time, directly compared destination memory and source memory using the same stimuli and procedure except for one key manipulation: In the destination procedure, participants told facts to famous people whereas in the source procedure, participants were told facts by famous people. Of particular importance in the development of a new paradigm, the destination group replicated the results from Experiment 1, thereby providing support for the reliability of the destination paradigm in experimental research.

In terms of memory for individual item information, people were once again quite good under both the destination instruction and the source instruction conditions. Overall, recognition performance was relatively good for individual items and faces for both conditions. It is also fascinating that individual recognition of facts and faces was non-predictive of destination memory or source memory performance. Destination memory and source memory performances were substantially poorer than the worst individual item memory performance. Therefore, details of a contextualized episodic event—at least for those assessed here—are not automatically encoded as a unified memory trace nor are they automatically associated with each other.

Although the result of the important comparison between destination memory and source memory was consistent with prediction, it was nonetheless rather surprising. The difference between destination memory and source memory was quite large: Destination memory accuracy was about 12% lower than source memory accuracy. On a fundamental level, people were doing something very similar in both the destination and source conditions: forming an episodic memory by relating fact and person information to each other in a spatiotemporal context. However, the similarities end here: These results indicate that outgoing information is less integrated with its environmental context (i.e., the person) compared to incoming information. Moreover, compared to previous research (e.g., Koriat et al., 1991), the current experiment demonstrated that output is not just disruptive when it comes to associating the item with the physical environmental context (e.g., laboratory room) but also disrupts the associative memory between separate items within the environment. That is, transmitting information—in this case, telling facts—disrupts the associative processes by which independent items (i.e., facts and faces) are related to each other within a spatiotemporal context. In the present experiment, when information is transmitted, the fact-face association is accomplished less efficiently than when information is received. What causes reduced associative memory in the destination memory condition compared to the source memory condition?

The processes involved in association or binding of information are poorly understood, but it has been proposed that associative memory relies on conscious attentional processes (Moscovitch, 2000). Support for associative memory relying on the individual's conscious control come from research on normal aging and divided attention studies.

Normal aging is accompanied by a reduction in attentional resources (Craik, 1983; Craik & Byrd, 1982; Craik & Simon, 1980), which leaves even fewer resources available to consciously associate independent information from an episode together. Consequently, older adults are less able to integrate items with their contexts of occurrence (Chalfonte & Johnson, 1996). Naveh-Benjamin (2000) has even proposed that older adults' memory problems are due to a deficiency in creating and retrieving associations between individual items of information (i.e., associative deficit hypothesis). Similarly, when younger adults' attention is divided at encoding, they should also have impairments with associative memory for the learning episode because their conscious attentional resources are compromised by the distracting task. This is precisely what is found: Younger adults' memory performance is worse under divided-attention conditions compared to full-attention conditions, with the deficit in associative memory being greater than the deficit in item memory (Castel & Craik, 2003; Craik, Govoni, Naveh-Benjamin, & Anderson, 1996). Therefore, there is strong support that conscious attention at encoding is necessary for intact associative memory.

The proposal for why destination memory is worse than source memory also relates to the amount of conscious attentional resources devoted to the fact-face pairing at encoding because both destination memory and source memory are instances of associative memory. When participants tell facts to people, their attention is focused on the processes required to transmit information (cf. Zimmer & Engelkamp, 1989). Because destination actions are self-generated, the person's focus is on themselves, which leaves fewer attentional resources available to associate the fact to the person that one is telling it to. This reduction of conscious attentional processes results in relatively weaker fact-

person integration for destination events. By contrast, incoming information establishes rich associative linkages between the information and its environment because incoming information is thought to be psychologically construed as part of the environment (Koriat et al., 1991). That is, when attention is directed to the incoming information it is also directed to the person who is providing the information. Attention to both the fact and person will benefit the association of the fact-face pairing. Therefore, as was confirmed in Experiment 2, associative memory for the fact-face pairing is worse for destination memory compared to source memory.

Based on the idea that destination memory errors are committed more often than source memory errors because attentional resources are more self-focused in the case of destination, it should be possible to impair or improve destination memory by manipulating factors that influence how people direct their attention. In particular, destination memory should worsen as self-focus increases because fewer attentional resources are available to adequately form associative linkages between the fact and face. This was investigated in Experiment 3. An interesting and socially valuable situation, in terms of practical application, arises if we can improve destination memory. Specifically, if attentional resources are directed to the fact-face pairing at encoding, then destination memory should improve. This was investigated in Experiment 4.

Experiment 3: Impairing Destination Memory

Remembering a complex episode depends on the successful retrieval of independent items and the associations between these independent items within that experience. Therefore, situations which detract from establishing associative linkages between independent items within an event will result in impoverished memory for that prior occurrence. For example, the source memory literature provides abundant evidence indicating that impoverished encoding situations result in deficits in episodic memory retrieval. Thus, stress or divided attention (e.g., Troyer, Winocur, Craik, & Moscovitch, 1999), aging (e.g., McIntyre & Craik, 1987), and brain injury (e.g., Schacter, Harbluk, & McLachlan, 1984) all interfere with associative processes during encoding of an episode.

Experiment 3 was designed to further examine the hypothesis that transmitting information disrupts integrative processes that link independent units of information (i.e., the face and fact) from a destination episode. This occurs because, when we output information, attentional resources are directed at the processes involved in transmitting information. In the case of destination memory, the focus is unavoidably on oneself because the information that is being transferred is self-produced, which leaves fewer encoding resources available to associate the outputted information with its target. In their analysis of “working-with-memory” tasks, Moscovitch and Winocur (1992) support the view that associative memory requires a greater expenditure of resources compared to individual item information. Moreover, Hockley and Cristi (1996) showed that item memory was unimpaired when associative information was emphasized at encoding, whereas associative memory was impaired when attention was directed to the encoding of item information. This result coupled with the previously mentioned research that

demonstrated associative memory was impaired when attention was divided (Troyer, Winocur, Craik, & Moscovitch, 1999) provide evidence that associative memory requires more attention than item memory. Therefore, if the transmission of information increases one's self-focus, then there should also be an increase in destination memory errors because fewer attention resources will be available to associate the fact with the person one is telling it to.

Therefore, the objective of Experiment 3 was to determine whether self-focus diverts attention away from associating a particular fact with the person to whom one is speaking. Past studies increased self-focus by having participants focus on their own emotional states (e.g., Johnson, Nolde, & De Leonardis, 1996). In this study, to increase self-focus while keeping the paradigm similar to the one used in Experiments 1 and 2, participants simply told personal facts about themselves, rather than arbitrary facts, to famous faces. If self-focus is responsible for destination memory errors, then destination memory should be impaired compared to Experiment 1, in which people told non-personal facts to famous faces.

Method

Subjects. Twenty students from Introductory Psychology at the University of Waterloo received bonus credit in the course for taking part in the experiment. None had taken part in any other related experiments.

Stimuli. The fact item pool (Appendix C) consisted of 60 fact cues, each with a blank portion at the end for participants to fill in their personal answer. An example of a personal fact cue would be “My zodiac sign is...” The face item pool was exactly the

same as in the previous experiments. All fact stimuli were presented in 14-pt lower case white font against a black background.

Apparatus. The apparatus was identical to that used in the prior experiments.

Procedure. The procedure was virtually identical to the destination memory condition used in Experiment 1 and Experiment 2 with one modification that was made during the encoding phase. Participants were told that they would see the beginning of a fact—a fact cue—which they were instructed to silently read and fill in with their personalized answer. It was emphasized to participants that they should have their personal fact in mind before they pressed the spacebar to display a face. This was done to avoid having a generation component during the fact-face association because the effect of generation on associative information is not entirely clear (e.g., see Mulligan, 2004 and Marsh, Edelman, & Bower, 2001 for conflicting results).

Study trial presentation began with a 1000-ms white fixation cross (“+”) on a black background at the center of screen. The fact cue was presented in white font at the center of the screen. Once the participant read and generated the answer to the fact silently, they pressed the spacebar which resulted in a black blank screen for 250-ms followed by a picture of a famous person at the center of the screen. The participant was to tell the person aloud the entire personal fact (e.g., “My zodiac sign is *Pisces*”) and then to press the spacebar. This initiated the appearance of another black blank screen for 250-ms. This procedure repeated until the participant had told all 50 personal facts to 50 faces.

The remainder of the procedure was the same as in Experiments 1 and 2, with the fact cue (e.g., “My zodiac sign is...”) being displayed instead of the full fact during both

the item and associate recognition tests. This was another way that the influence of generation on recognition memory was controlled because the generated portion of the personal fact was never tested; instead, only the fact cue was tested on the recognition tests.

For the item memory test, fact cues and faces were randomly ordered and individually presented at the center of the screen, with fact cues being in white font and faces in colour. A test face or fact cue stayed on the screen until the subject indicated, by pressing a keyboard button for Yes (the “c” key) or No (the “m” key), whether they had previously seen it. Once a response was made, a black blank screen was displayed for 250-ms followed by the next test trial.

For the associative memory test, a face and a fact cue were presented simultaneously on the screen, with the fact cue appearing below the face. Participants decided whether they had told that fact to that face by pressing either the Yes (the “c” key) or No (the “m” key) button. Once a response was made, a black blank screen was displayed for 250-ms followed by the next test trial. After the recognition memory tests, participants were debriefed and thanked for their participation.

Results

Table 3 presents the increased self-focus recognition data expressed as proportions of hits and false alarms, accompanied by their respective standard errors in parentheses below each mean. As in prior experiments, the dependent variable calculated for each subject was a corrected recognition score (proportion hits minus proportion false alarms). The pattern of results for Experiment 1 was replicated in Experiment 2.

Therefore, Experiment 1 was treated as the between-subjects control condition in Experiment 3. Corrected recognition scores and standard errors for individual face memory and individual fact memory are shown in Figure 3.

Corrected recognition data were submitted to a 2 X 3 mixed analysis of variance (ANOVA), with self-focus (high or low) as the between-subjects factor and test condition (face, fact, face and fact) as the within-subject factors. There were significant main effects of self-focus, $F(1,38) = 11.46$, $MSE = .027$, $p < .01$, and test condition, $F(2,76) = 165.04$, $MSE = .022$, $p < .001$, as well as a significant interaction of self-focus with test condition, $F(2,76) = 7.07$, $MSE = .022$, $p < .01$.

To further explore this interaction, one-way ANOVAs compared the effect of self-focus separately on each of the test conditions. Results indicated that participants performed similarly on individual face recognition, $F(1,38) = .028$, $MSE = .036$, $p > .05$, but participants in the low self-focus group (from Experiment 1) performed slightly better on individual fact recognition than those in the high self-focus group, $F(1,38) = 6.95$, $MSE = .008$, $p < .05$. Critically, high self-focus was associated with increased destination memory errors (destination memory $M = .21$, $SE = .04$) over that seen for low self-focus (in Experiment 1; destination memory $M = .45$, $SE = .03$), $F(1,38) = 20.43$, $MSE = .028$, $p < .001$.

Pearson correlations were computed to assess the extent to which item and associative recognition memory performances were related. In the low self-focus condition, neither fact memory ($r = -.18$) nor face memory ($r = .39$) was significantly correlated with destination memory (both $ps > .05$), nor were they significantly correlated

with each other ($r = .04, p > .05$). Similarly, in the high self-focus memory condition, face memory was not correlated with fact memory ($r = -.05, p > .05$), and neither fact memory ($r = -.25, p > .05$) nor face memory ($r = .17, p > .05$) was significantly correlated with destination memory.

Discussion

Results from Experiment 3 support the hypothesis that self-focus is detrimental to destination memory. When people's self-focus was increased by telling personal facts to faces, their destination memory performance suffered quite dramatically, despite individual item information being unaffected. This is consistent with Hockley and Cristi's (1996) finding that associative memory is more attention-demanding 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 you said and who you said it to—together from the destination episode.

Self-focus has been previously manipulated in psychological experiments using external objects, such as mirrors, video cameras, or voice recordings (e.g., Walter, 2007; Wicklund & Duval, 1971), and by having participants focus on their affective states (e.g., Cryder, Lerner, Gross, & Dahl, 2008; Johnson et al., 1996; Zimring, 1985; Zimring & Katz, 1988). In the study by Johnson et al. (1996), for example, they found that when people were focused on their own emotions, their memory for identifying which of two speakers told them a statement (e.g., “The President of the United States is the most powerful man in the world”) was poorer compared to the condition in which they were

focused on how the speaker felt. Therefore, focusing on one's own emotions led to increased source misattributions.

Those results coupled with the results from the current experiment are suggestive of a more general theory: Self-focus, 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 together. Johnson and colleagues did concede that they were not against the idea that other manipulations would impair (or promote) the association of features to form complex memories but they would probably be surprised that a very common task, such as telling someone facts, would have such a negative effect on associating separate features from a memory episode. They might be even more surprised that, when those facts heighten self-focus, there is even further impairment to destination memory.

Experiment 4: Improving Destination Memory

Destination memory is more fallible than source memory. Retrieval of destination memory and source memory associations is dependent on the quality of the events that were initially recorded. Situations which detract from establishing or forming associative linkages between independent events of an episode will necessarily result in reduced associative memory performance. Destination memory is especially error-prone compared to source memory because of weak integration of the fact and person pairing at encoding. This is due to attention being focused on the internal processes involved in outputting information in the case of the destination episode, emphasizing the internal context—oneself—instead of the external context—the other person to whom you were transmitting the information.

Based on this framework, it should be possible to improve destination memory by shifting the focus of attention away from oneself and more toward the fact-face pairing. The objective of Experiment 4 was to improve destination memory by directing participants' attention outward toward the person to whom they tell a fact. By shifting attention away from oneself and toward the face while telling the fact to the face, the associative linkage between fact and face should be enhanced. This shift in attention was accomplished by having participants in one experimental group say the name of the famous person before they told them the fact (e.g., "Oprah Winfrey, the United States postal service handles 40% of the world's mail volume"), thereby shifting the focus of attention from themselves to the person that they are telling things to. The control group did not say the name of the famous person and simply told them the fact.

Method

Subjects. Forty-two students from Introductory Psychology at the University of Waterloo received bonus credit in the course for taking part in the experiment. None had taken part in any other related experiments. Participants were randomly assigned to study condition, with 19 in the refocus memory condition and 23 in the control destination memory condition. A new control group was used because there was an additional phase to the normal procedure, which is described below.

Stimuli and Apparatus. The stimuli and apparatus were identical to those in Experiment 1.

Procedure. To accomplish the shift of attention, participants in the refocus group were required to say the famous person's name aloud before telling the fact to that person. This required that people know the names of all of the famous faces, which was accomplished in a separate first phase where participants from the experimental and control groups were told the names of the famous people as their pictures were presented on the screen in random order. After this initial phase, the procedure was exactly the same as that of Experiment 1 except for one change for the refocus condition participants: During the fact-telling phase, refocus condition participants were required to say the famous person's name aloud before telling them the fact. All subsequent instructions and timings were identical to Experiment 1 for both groups of participants.

Results

Table 4A presents the refocus recognition data and Table 4B presents the control recognition data expressed as proportions of hits and false alarms, accompanied by their

respective standard errors in parentheses below each mean. As in the prior experiments, the dependent variable calculated for each subject was a corrected recognition score (proportion hits minus proportion false alarms). Corrected recognition scores and standard errors for individual face memory and individual fact memory are shown in Figure 4.

Corrected recognition data were submitted to a 2 X 3 mixed analysis of variance (ANOVA), with focus (refocus or control) as the between-subjects factor and test condition (face, fact, face and fact) as the within-subject factors. There were significant main effects of focus, $F(1,40) = 8.86$, $MSE = .017$, $p < .01$, and test condition, $F(2,80) = 160.14$, $MSE = .017$, $p < .001$, as well as a marginally significant interaction of focus with test condition, $F(2,80) = 2.82$, $MSE = .017$, $p = .065$.

To further explore this interaction, one-way ANOVAs were used to compare the effect of refocus on test conditions. Results indicated that participants in both groups performed similarly on individual face recognition, $F(1,40) = 0.14$, $MSE = .018$, $p > .05$, and on individual fact recognition, $F(1,40) = 2.67$, $MSE = .009$, $p > .05$. Importantly, however, the refocus group had significantly better destination memory performance compared to the control group, $F(1,40) = 8.81$, $MSE = .025$, $p < .01$.

Pearson correlations were computed to assess the extent to which item and associative recognition memory performances were related. In the control condition, neither fact memory ($r = .30$) nor face memory ($r = -.27$) was significantly correlated with destination memory (both $ps > .05$), nor were they correlated with each other ($r = -.05$, $p > .05$). Similarly, in the refocus condition, face memory was not correlated with

fact memory ($r = .33, p > .05$), and neither fact memory ($r = -.23, p > .05$) nor face memory ($r = -.13, p > .05$) was significantly correlated with destination memory.

Discussion

The results of Experiment 4 are consistent with the explanation of why destination memory is relatively more error-prone than source memory. When people output information, the focus of attention is on oneself versus the focus being more on the external context when information is being received. Interestingly, Experiment 4 demonstrated that it is possible to reduce destination memory errors by shifting the focus of attention—at least partly—from oneself to the person one is speaking to. This simple manipulation significantly improved destination memory performance.

Methods to improve source memory are very rarely researched despite numerous manipulations (e.g., *divided attention*, Troyer, Winocur, Craik, & Moscovitch, 1999; *increasing retention interval*, Schmolck, Buffalo, & Squire, 2000) and pseudo-manipulations (e.g., *aging*, Rahhal, May, & Hasher, 2002; *frontal lobe patients*, Janowsky, Shimamura, & Squire, 1989) that are reported to impair source memory. However, an experiment in a recent study by Davidson, McFarland, and Glisky (2006, Experiment 3) demonstrated that emotion can improve source memory. These researchers had people focus on the emotional tone of speakers who told them various negative or emotional messages. Using logic similar to the present Experiment 4, Davidson and colleagues expected that paying attention to the emotional tone of the speaker would draw attention to the voice-sentence pairing, leading to better integration of item and source information, which would then result in better source memory. Their findings

supported their hypothesis: Source memory benefited when the speaker's voice was emotional.

These results from Davidson et al. (2006) and from the current experiment could have broad implications. When people's attention is drawn to the person with whom they are interacting, both source memory and destination memory improves. This improvement occurs because attention is directed at the person-fact pairing, which strengthens the association at encoding. Therefore, destination memory and source memory rely on similar associative processes. A factor that promotes the establishment of associative linkages between independent items of an episode will benefit associative memory performance, regardless of whether the associative memory type is destination memory or source memory. However, the overall performance of destination memory and source memory will be different because, as was the case in Experiment 2, destination memory is initially at a lower performance level relative to source memory. Consequently, to the extent that conditions which improve associative memory do so to a similar degree, then overall destination memory will still be worse than overall source memory performance.

The view that destination memory is undermined by the self-focus that it generates was reinforced by Experiments 3 and 4. Increasing self-focus reduces destination memory whereas directing attention from oneself to the person one is telling information to improves destination memory.

General Discussion

As Rosenbaum (1991) wrote, “Most of the work...about the information processing system has been concerned with information intake rather than information output” (p. 101). Similarly, memory research is traditionally concerned with how people remember incoming or provided information. The majority of investigators research how people remember words that they read or hear, while others examine how people remember pictures or video clips that they previously saw. Thus, there has been extensive research on memory for source (see Johnson et al., 1993, for a review). Few researchers have, however, sought to understand people’s memory for their own actions. In particular, until now, no one has investigated how people remember what they told to whom, or destination memory.

Destination memory is unique when compared to other conventional memory tasks. Typical laboratory testing consigns participants to the role of passive observer; they must remember only what the experimenter exposes them to. By contrast, everyday memory situations, in which destination memory is included, can be characterized by at least three aspects that are distinct from traditional memory research. First, as outlined by Zimmer and Cohen (2001), everyday memories are usually those from situations in which people played an active role. In most contexts, people are not passive observers. Second, the encoding of these memory traces is mostly unintentional or incidental. People rarely consciously attempt to remember situations as they are happening. Finally, everyday memory is a record of the bidirectional interaction between people and their environment; it is a result of input elements, output elements, and their interaction. Consequently, memory for complex events includes both source memory and destination memory. As

such, it is remarkable that source memory has received intense research attention whereas destination memory has been largely overlooked.

Destination memory is used daily, although people likely only become aware of the importance of destination memory when it fails. One does not have to reflect for too long before being able to generate numerous examples of retelling a joke or a story to the same friend or colleague. Another example in which a failure of destination memory may cause pronounced embarrassment (among other things) is not just when one repeats information to the same person but when one tells new conflicting information to the same person. This can occur unintentionally, as when a well-meaning father inadvertently provides two very different (and both incorrect!) parallel parking methods to his son during driving lessons. But, as described at the outset of this dissertation, it can also occur intentionally, when an individual lies. Successful deception clearly relies on intact destination memory. To avoid getting caught, the person lying must remember who they told what to.

It is also the case that destination memory is important for following up with tasks that we assign others. This is significant for a workplace supervisor who needs to remember to whom she delegated a particular task so that she can later discuss the project's progress with the appropriate employee. Similarly, knowing what we told others is also important for establishing common ground (Haviland & Clark, 1974). In particular, we do not need to restate background information if we remember already having told that information to the person we are conversing with. In this way, destination memory facilitates our social interaction by saving time to say nothing of reducing boredom for those who have already heard us tell the same story.

Destination memory paradigm

Of course, understanding destination memory is also informative more generally for theories of memory. At the very least, the scope of the domain that theories must encompass becomes more apparent. The paradigm that was used in this research is an attempt to better understand how we recollect our personal past, keeping track of the information that we exchange, and to arouse interest in a fundamental component of episodic memory: destination memory. As Johnson (2005) proclaimed, “New tasks sometimes provide new purchase on old problems (or revive interest, if nothing else), or new tasks may highlight previously unexplored aspects of problems” (p. 530).

The destination memory paradigm was designed to provide a coherent framework, avoiding as many confounds as possible. By using a yes/no recognition test consistently throughout each experiment, performance differences that could have been caused by test task demands were minimized. Of particular importance, the paradigm also allowed for an independent assessment of whether individual items were encoded in the destination episode. This is critical to discern because successful retrieval of a complex memory event relies on intact memory for individual items within the episode. Knowledge of whether the encoding of a particular item (i.e., fact or face) is less than optimal is important to determine because poor destination memory could have been the result of the weak encoding of individual item information. Finally, the destination memory paradigm allowed for an assessment of whether the fact and face were associated with each other within a spatiotemporal context by using a fact and face associative recognition test. Comparing individual item memory and associative memory allowed for an assessment of what participants had difficulty retrieving.

Deconstructing destination memory

Memory stores a vast wealth of information that we typically effortlessly retrieve. Under the proceduralist view, we are able to remember episodes by recapitulating the processes that were active when the event was initially encoded (Kolers & Roediger, 1984; Roediger, 2000). Therefore, to recollect the lunch date we had last week, we access various memory attributes that were engaged during the previous episode. For example, we may remember the perceptual attributes (e.g., what our friend was wearing), spatial attributes (e.g., where we sat relative to the restaurant's entrance), temporal attributes (e.g., the time and day of the week), as well as information regarding our thoughts and emotions that were experienced during our lunch date. Therefore, the success and quality of retrieval for our past episodes depend on information that was initially encoded (Johnson, 1983; Johnson et al., 1993; Johnson & Hirst, 1991; Johnson & Multhaup, 1992). Consequently, the quantity and quality of the attributes belonging to the event that were initially recorded have ramifications for memory. It is important that the encoding situation facilitates both the consolidation of individual units of information of the episode and the integration of these units into a cohesive experience because they are not automatically unified or associated with one another. It seems very likely that controlled attentional processes are needed to associate independent units of information (Moscovitch, 2000).

Because elements in an episode are not automatically related to each other, destination memory, like source memory, is not an all-or-none concept. In particular, it is not the case that destination memory retrieval is binary such that it either occurs or does not occur. Instead, destination memory attributions may occur at qualitatively different

degrees of specificity. Participants in these studies could remember the full episode (i.e., what they told to whom) or could remember details from the episode (i.e., remembering what they told but not to whom, or remembering who they told but not what they told them). This is analogous to what occurs outside the research laboratory. For example, at a very high degree of specificity, you may remember what you said to James, the location of the conversation, and the time at which it occurred. Alternatively, you may just remember what you said to James and not remember when or where you told him the information. At a low degree of specificity, if your destination memory fails, you may simply remember having told someone a particular bit of information but not recollect that it was to James that you told this information.

How does the formation of an episode compare between destination memory and source memory? The findings from the experiments presented here suggest that for destination memory, in which information is outgoing, individual units of information within a memory episode are not as well integrated with one another as when information is incoming, the situation in source memory. This occurs because when participants tell facts to people their attention is focused on the processes required to transmit information (cf. Zimmer & Engelkamp, 1989). The processes involved in the transmission of facts are internally-based, which causes participants to focus on themselves. This self-focus reduces the controlled attentional processes that are available to associate the fact to the person that one is telling information. Therefore, destination memory is more fallible than source memory.

The finding of poor destination memory performance compared to source memory performance (Experiment 2) is interesting when considering that past research

(e.g., Cohen, 1981; Engelkamp, 1990; Koriat, Ben-Zur, Druch, 1991) has demonstrated that outputting information typically boosts memory performance. For example, our laboratory has shown that saying a word aloud results in better explicit memory for the word than does simply reading the word silently (the production effect; MacLeod, Gopie, Hourihan, & Neary, submitted), a finding that corresponds nicely with the generation effect (Slamecka & Graf, 1978) and the enactment effect (Cohen, 1981; Engelkamp & Krumnacker, 1980). By contrast, results from these experiments indicate that outputting information does not benefit memory for all aspects of the learning episode, as outlined in the introduction. Instead, the memory benefit appears to be limited to the information that is said.

Does the memory benefit for the transmitted information come at a cost for other information within the episode? Similar questions have been explored regarding resource allocation and selective attention (e.g., Baddeley, 1986; Kahneman, 1973; Norman & Shallice, 1986). For example, the generation effect—the finding that generating words in response to cues (e.g., what is the opposite of ‘hot’ that begins with the letter ‘c’?) results in considerably better memory for those words than when they are simply read (Slamecka & Graf, 1978; see Bertsch, Pesta, Wiscott, & McDaniel, 2007, for a review and meta-analysis)—has been subjected to an encoding trade-off account. Specifically, Jurica and Shimamura (1999) reported that generation improves item memory but impairs memory for context (i.e., for context information, there is a negative generation effect). These researchers proposed that because of participants’ limited resources, the task demands involved in generation cause participants to pay attention to the item, which benefits the encoding of item-specific information, but at a cost to the encoding of associations

between the item and other elements in the environment. Similar evidence was described concerning the enactment effect (Cohen, 1981; Engelkamp, 1990) in the introduction.

Evidence that a benefit to item memory comes at a cost to associative memory is, however, not conclusive. First, Mulligan (2004) found that generation disrupted contextual memory for the colour of a target word but did not negatively affect context memory for location or background colour, which undermines a general item-context trade-off. Even more damaging for the trade-off hypothesis and conflicting with Mulligan is the finding that generation improves memory for both the item and contextual details (e.g., colour and location; Marsh, Edelman, & Bower, 2001). Although further research is needed to clarify the item-context trade-off hypothesis for the generation effect, these experiments provide various resource-allocation accounts that will be considered for destination memory below.

An extreme item-context trade-off interpretation would predict that a memory benefit for item information would ordinarily come at a cost to other information in the encoding episode, whereas a more moderate view would allow that memory costs may occur for only particular aspects of the learning episode. Experiments 1 to 3 indicate that transmitting information does not undermine the encoding of the person to whom one is telling information. Moreover, even when destination memory suffers because of increased self-focus (Experiment 3), memory for the people that one speaks to still is not negatively affected. Therefore, the extreme item-context trade-off view is not supported for destination memory.

Instead, these results support a more moderate view that the integration of individual items within a destination episode is relatively impaired. When people transmit information, the association of independent items within a spatiotemporal context is disturbed because attentional resources are directed at the processes involved in producing the information which reduces the available resources that are needed to integrate independent items together. In other words, associative memory is more disrupted in a destination episode compared to a source episode. Consequently, people commit more destination memory errors than they do source memory errors. Overall, the memory benefit for produced information does not come at a general memory cost for other items in the learning episode; it is associative memory or the association of unrelated items within a spatiotemporal context that is impaired.

In addition, Experiment 3 demonstrated that when people focus on themselves, destination memory errors increase markedly. The results of Experiment 3 are of particular interest when compared to the finding of Johnson et al. (1996) that focusing on one's own emotions increases source misattributions. It appears that self-focus, irrespective of emotional content, negatively affects the establishment of connections among independent features from a complex memory episode. When the linkages between independent items of an episode are not well-established, then associative memory performance is compromised. However, the degree of associative memory impairment may be more devastating in the case of destination memory when compared to source memory because, as was found in Experiment 2, the fact-face pairing within the destination episode is less strongly integrated than the fact-face pairing within the source episode.

Of significance, it is also possible to improve destination memory based on the framework that has been proposed. That is, features of an episode can be better integrated with each other if attention is directed to their association. Experiment 4 improved fact-person integration by highlighting the person that one was telling a fact to at the outset (e.g., “Oprah Winfrey, the United States postal service handles 40% of the world’s mail volume”). By the present account, other manipulations which emphasize the fact-person association should also have a positive effect on destination memory. Further, results from Experiment 4 have broader applications. Davidson et al. (2006) demonstrated that people are better able to remember who told them a fact if they paid attention to the emotional tone of the speaker. Together, Experiment 4 and Davidson et al.’s results suggest that destination memory and source memory may be improved by drawing attention to one’s conversational partner. 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).

Destination Memory and the Law

Applied memory research over the past 30 years has clearly shown that memory plays an integral role in the legal domain. Much of this research has been focused on source memory and eyewitness testimony (e.g., Loftus, 1979; Wells & Loftus, 1984). Because memory is a reconstruction of past experiences instead of a retrieval of events recorded precisely as they occurred (e.g., Bartlett, 1932/1995; Bransford & Johnson, 1973; Carmichael, Hogan, & Walter, 1932), determining the veracity of what is recollected is important. Specifically, knowing the conditions and the likelihood under

which witnesses are susceptible to misleading information is significant in legal cases. This is especially important because people often are not aware of the integrity of their memories. For example, it is worrisome that people are sometimes quite confident that their inaccurate memories are correct (Bothwell, Deffenbacher, & Brigham, 1987; Wells, Small, Penrod, Malpass, Fulero & Brimacombe, 1998).

In the typical eyewitness misinformation paradigm (e.g., Loftus, 1992), participants are exposed to an event (e.g., a movie clip of a crime) followed by a verbal account of the incident. Critically, half of the participants are exposed to an account that reflects an accurate depiction of the crime (i.e., control participants) whereas the other half are exposed to information that was not part of the original event (i.e., misled participants). Afterward, participants are questioned about the incident. Numerous studies confirm that misled participants are more likely than control participants to incorporate the misinformation as part of the original event—the *misinformation effect* (e.g., Belli, 1989; Christiaansen & Ochalek, 1983; Lindsay, 1990; Loftus, 1992; Zaragoza & Lane, 1994). Fortunately, using the source-monitoring framework, conditions can be specified that reduce suggestibility. In particular, encouraging participants to use relatively strict decision criteria by changing test format can eliminate the suggestibility effect (Lindsay & Johnson, 1989).

Clearly, knowing the factors that influence source memory in legal proceedings is important. However, witnesses, plaintiffs, and defendants are usually questioned about what they did or what they said to whom during the relevant incident(s). The answers to these questions rely not on source memory but on destination memory. Therefore, understanding the boundary conditions and variables that influence destination memory

has important ramifications for testimony. This is crucial because the encoding conditions during crimes are less than optimal (e.g., situations are stressful, exposures are sometimes brief, there is sometimes a long delay between the event and being asked about it, and the test procedures are not generally conducive to effective retrieval strategies; Deffenbacher, 1980). Consequently, examining how encoding factors influence destination memory is important and its consideration is essential in the legal realm for judges and juries to become aware of conditions that reduce destination memory.

Understanding the factors that undermine the veracity of destination memory is important, but so too is researching the factors that may improve the reliability of destination memory. This is critical because encoding has already occurred by the time testimony or evidence is procured; therefore, retrieval is particularly significant. Reducing destination memory errors at retrieval may be accomplished by encouraging participants to use strict decision criteria as is done to reduce source memory suggestibility errors (Lindsay & Johnson, 1989). In particular, it is hypothesized that destination memory errors will be reduced by encouraging participants to use recollection processes instead of familiarity heuristics. Promoting recollection-based processes will reduce destination memory errors because it will induce people to retrieve the specific context of the learning episode instead of them basing memory judgments on feelings of familiarity that are not context-specific. That is, it is not sufficient to have feelings of familiarity for a joke one told or a person one knows; destination memory relies on recollecting the specific context in which one told a particular joke to a friend. Consequently, encouraging people to use recollection processes will improve destination memory.

Also significant, but often overlooked in memory research, is knowing what one did not say to whom. For example, there are well known on-going civil and criminal lawsuits in which Peter Paul is suing former American president, Bill Clinton, and his wife Hillary Clinton for \$41.9 million in damages. Mr. Paul alleges that Hillary Clinton had discussions with him regarding arrangements whereby he would support her campaign for the United States Senate in exchange for a pardon by then-President Clinton for his previous criminal convictions. As part of a declaration for the trial (Case No. BC 304174), Hillary Clinton acknowledged meeting with the plaintiff at various events but was not able to “remember any of the statements” that she made to Mr. Paul. Interestingly, Hillary Clinton strongly believes in the integrity of her destination memory as evidenced by the following statement in her declaration: “I do not believe that I made any such statement [regarding support for my campaign in exchange for a pardon to Mr. Paul] because I believe I would remember such a discussion if it had occurred.” Consequently, it is possible for people to know—or at least to believe with conviction—that they did not say something to a particular person. How this decision is achieved is unknown but it certainly is an interesting topic for future research on destination memory.

Destination memory is special

Researchers may be sceptical about further dividing episodic memory into source memory and destination memory, and within each exploring empirical observations and theoretical propositions. However, as Tulving (1972) wrote regarding divisions in memory, “Such dichotomies are among useful heuristic devices for furthering our understanding of mental processes. Almost all of them increment the signal-to-noise ratio in the literature, many of them suggest new experimental questions, and quite a few of

them hold the promise of becoming important entries in more permanent taxonomies of cognitive processes” (p. 383). At the heart of this dissertation is the belief that destination memory and source memory warrant independent—and joint—study.

As illustrated previously, there are circumstances involving destination memory that we do not yet fully understand, such as knowing how we keep track of what we tell to whom or knowing how we are able to determine that we did not tell something to a particular person. This is part of a larger issue regarding how our memory influences the decisions that we make in our daily lives. A thorough investigation of destination memory will help address important issues and inspire new questions. Consider, for example, the following question: What are the processes that underlie decisions regarding whether people tell others a particular piece of information?

On the surface this may appear as a simple question of knowing whether one has already told that information to the person; however, this is a complex issue because multiple factors must be taken into account. Some of these factors include knowing whether one has previously told the person the information, whether we believe that the person already knows certain aspects of the information that we are about to impart, and whether it is certain information that should be withheld from that particular person. These are fundamental factors that need to be considered for new research that explores destination monitoring and destination memory in general.

In their review of the 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 is equally critical, given that it serves as an

important component in our social interaction. The claim in this dissertation is not that destination memory and source memory operate independently of each other. On the contrary, they must interact with each other during regular conversational turn-taking, and their processes may rely on similar heuristics and systematic processes. However, as this dissertation demonstrates, compared to the association between the person and their information in source memory, destination memory is characterized by a weaker integration between information that is transferred and the person who is the destination of the information. Moreover, destination memory is unique in terms of the decision processes that are engaged during encoding. Only in destination memory are decisions made regarding to whom to tell information and from whom information will be withheld. Research is needed to examine how these decisions will affect later retrieval. Importantly, conceptualizing episodic memory as involving two important components—destination memory and source memory—will bolster our understanding of how people remember complex events.

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Appendix A: Facts used in Experiments 1, 2, & 4

93% of all greeting cards are purchased by women
A dime has 118 ridges around the edge
A person uses 57 sheets of toilet paper each day
An office desk has 400 times more bacteria than a toilet
Chopsticks originated from China 4,000 years ago
It costs 3 cents to make a \$1 bill in the United States
A disposable diaper can hold up to 7 pounds of liquid
The life span of a dollar bill is 1 and 1/2 years
1 billion Valentine's Day cards are sent each year in North America
The average North American car contains 300 pounds of plastics
There are 200 parts in a typical telephone
18% of a person's income is spent on transportation
In 1962, the first Wal-Mart opened in Rogers, Arkansas
McDonald's restaurant has over 1.5 million employees all over the world
The United States Postal Service handles 40% of the world's mail volume
25% of kids in the USA are overweight
A blink lasts 0.3 seconds
15% of the population is left-handed
Each day 14 people die from asthma in North America
From all the oxygen that a human breathes, 20% goes to the brain
It takes 3 hours for food to be broken down in the human stomach
A shrimp's heart is in its head.
People spend 33% of their life sleeping
The average person falls asleep in 12 minutes
American models are skinnier than 98% of American women
The stomach of an adult can hold 1.5 litres of material
Women live 7 years longer than men do
It takes 5 seconds for light to get from the sun to earth
Roses need 6 hours of sunlight per day to grow properly
90 people have been frozen after their death
25% of injuries by athletes involve the wrist and hand
38% of Americans eat breakfast everyday
An average American eats 60 hot dogs per year
Heinz first started making ketchup in 1876
In a year, an American kid eats 46 slices of pizza
80% of households have oatmeal in their kitchen
90% of Pumpkins sold are for decoration
The Snickers chocolate bar was invented in 1930
A crocodile can run up to a speed of 16 kilometres per hour
A leech has 1 brain
A female mouse can produce up to 100 babies a year
Rats can survive up to 14 days without any food
Alaska has 2 times as many caribou as people
31% of employees skip lunch entirely
25% of Americans don't know that the sun is a star
85% of weddings are held in a synagogue or church
96% of candles that are purchased are purchased by women
Women spend 55 minutes per day getting showered and dressed
40% of the states in the U.S. have severe, or extreme pollution problems
5% of the people who use personal ads for dating are already married
33% of accidental deaths occur in the home
93% of children go out trick or treating for Halloween
8% of men are color blind
Only 4% of babies are born on their actual due date
50% of lottery players go back to work after winning the jackpot
30% of the human population reside in deserts
40% of people end up marrying their first love
In the United States, 33% of land is covered by forests
12 men have landed on and explored the moon
Hitler was voted Time Magazine's man of the year in 1938

Appendix B: Names of the famous people used in Experiments 1-4

Albert Einstein	Jean Chretien
Arnold Schwarzenegger	Jennifer Lopez
Audrey Hepburn	Jim Carrey
Barbara Streisand	John Travolta
Barbara Walters	Julia Roberts
Bill Clinton	Larry King
Bill Cosby	Madonna
Bill Gates	Mahatma Gandhi
Bob Barker	Marilyn Monroe
Brad Pitt	Michael Jackson
Britney Spears	Mother Theresa
Cameron Diaz	Oprah Winfrey
Celine Dion	Pamela Anderson
Cher	Paris Hilton
Clint Eastwood	Paula Abdul
David Hasselhoff	Pope John Paul
David Letterman	Prince Charles
Donald Trump	Princess Diana
Dr. Phil	Queen Elizabeth II
Drew Barrymore	Rosie O'Donnell
Dustin Hoffman	Samuel L Jackson
Eddie Murphy	Sharon Stone
Elizabeth Taylor	Steve Martin
Ellen Degeneres	Steven Spielberg
Elvis Presley	Tiger Woods
George Clooney	Tina Turner
George W Bush	Tom Cruise
Howie Mandel	Tom Hanks
Jackie Chan	Wayne Gretzky
Jay Leno	Whitney Houston

Appendix C: Personal fact cues used in Experiment 3

My favourite sport is...
My favourite animal to see at the zoo is...
My favourite radio station is...
If I had to choose between Coke or Pepsi I would pick...
My favourite pet animal is...
The class I look forward to the most is...
My favourite junk food is...
My favourite thing to do in Waterloo is...
My hometown is...
I get to campus by...
The last time I did my laundry was...
The weather today is...
The length of time it usually takes me to get to campus is...
My favourite high school teacher was...
If I could befriend any celebrity it would be with...
My birthday is...
My favourite possession is...
The street that I live on is...
The best gift that I have received was...
For breakfast I like eating...
My shoe size is...
The movie I most enjoy is...
This weekend I will...
The last time I read the newspaper was...
The city I was born in was...
My favourite thing to do on a Friday night is...
The website I go to most often is...
The last movie I saw was...
The number of pets that I had as a child was...
The last friend I saw was...
The number of siblings I have is...
I like my peanut butter with...
My favourite drink is...
My friends and I like to...
My eye colour is...
I love shopping at...
The next class that I will attend is...
The car I would love to buy is...
My favourite dessert is...
The TV show I enjoy watching is...
On Sunday mornings I like to...
The program that I am studying at UW is...
I love eating...
My favourite colour is...
My high school's name was...
The season I most like is...
I'd love to travel to...
The fast-food place I like eating at is...
My favourite pizza toppings are...
My dream job is...
My last vacation was to...
The number of shoe pairs I own is about...
My favourite day of the week is...
My age is...
My funniest friend is...
The city I'd like to live in is...
My best friend's name is...
My favourite holiday is...
The last book I read was...
My favourite singer is...

Table 1

Experiment 1, Within Subject: Hits and False Alarms as a Function of Test Condition

	Face	Fact	Face & Fact
<i>Hits</i>	.860 (.031)	.950 (.017)	.753 (.030)
<i>False Alarms</i>	.090 (.030)	.000 (.000)	.303 (.022)

Note. Standard errors are shown in parentheses below the respective means.

Table 2A

Experiment 2: Hits and False Alarms as a Function of Test Condition for the Source

Instruction Group

	Face	Fact	Face & Fact
Hit Rates	.952	.903	.787
	(.013)	(.019)	(.025)
<i>False Alarms</i>	.026	.006	.206
	(.014)	(.004)	(.014)

Note. Standard errors are shown in parentheses below the respective means.

Table 2B

Experiment 2: Hits and False Alarms as a Function of Test Condition for the Destination

Instruction Group

	Face	Fact	Face & Fact
<i>Hits</i>	.818	.945	.741
	(.034)	(.019)	(.030)
<i>False Alarms</i>	.086	.018	.280
	(.045)	(.018)	(.023)

Note. Standard errors are shown in parentheses below the respective means.

Table 3

Experiment 3: Hits and False Alarms as a Function of Test Condition for the Increased Self-Focus Group

	Face	Fact	Face & Fact
<i>Hits</i>	.860 (.035)	.890 (.023)	.640 (.027)
<i>False Alarms</i>	.080 (.024)	.015 (.008)	.428 (.033)

Note. Standard errors are shown in parentheses below the respective means.

Table 4A

Experiment 4: Hits and False Alarms as a Function of Test Condition for the Refocus

Group

	Face	Fact	Face & Fact
<i>Hits</i>	.932 (.027)	.979 (.016)	.768 (.028)
<i>False Alarms</i>	.095 (.024)	.011 (.007)	.242 (.026)

Note. Standard errors are shown in parentheses below the respective means.

Table 4B

Experiment 4: Hits and False Alarms as a Function of Test Condition for the Refocus

Control Group

	Face	Fact	Face & Fact
<i>Hits</i>	.900	.930	.696
	(.022)	(.021)	(.022)
<i>False Alarms</i>	.078	.009	.315
	(.018)	(.006)	(.029)

Note. Standard errors are shown in parentheses below the respective means.

Figure Captions

Figure 1. Corrected recognition scores and standard errors for individual face memory, individual fact memory, and destination memory.

Figure 2. Corrected recognition scores and standard errors for individual face memory, individual fact memory, and associative memory for the source memory group and the destination memory group.

Figure 3. Corrected recognition scores and standard errors for individual face memory, individual fact memory, and destination memory for the high self-focus group and the low self-focus group.

Figure 4. Corrected recognition scores and standard errors for individual face memory, individual fact memory, and destination memory for the refocus group and the control group.







