Collaborative and Autobiographical Memory in Strangers, Friends, Siblings, and Twins

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Statement of Candidate

I certify that the work in this thesis entitled “Collaborative and Autobiographical Remembering in Strangers, Friends, Siblings, and Twins” has not previously been submitted for a degree nor has it been submitted as part of the requirements for a degree to any other university or institution other than Macquarie University.

I also certify that the thesis is an original piece of research and it has been written by me. Any help and assistance that I have received in my research work and the preparation of the thesis itself have been appropriately acknowledged.

In addition, I certify that all information sources and literature used are indicated in the thesis.

The research presented in this thesis was approved by the Macquarie University Ethics Review Committee (Ethics Clearance number 5201100021).

Amanda Selwood, 42281164

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Thesis Abstract

In this thesis, I investigated how people in different kinds of non-romantic peer relationships remember together and whether this changes according to the kind of remembering they engage in. I aimed to determine whether recalling with a stranger, friend, sibling, or twin influenced the product and process of collaborative remembering, and whether intimacy and shared identity played a role in friends', siblings,' or twins' collaborative remembering. Motivated by the theories of autobiographical memory, shared identity, and transactive memory, my research highlighted the close connections between shared history, shared knowledge, shared identity, intimacy, and collaborative remembering.

Across five chapters, I conducted four experiments, one re-analysis of the four experiments, and one case study. Each experiment was designed to determine the impact of the following on the product of collaborative remembering: (1) the relationships between participants, (2) the tasks they performed, and (3) the process of their collaboration. In Chapters 2 and 3, I examined stranger, friend, and sibling dyads' collaborative recall of categorized word lists and self-generated lists of varying degrees of "sharedness". In Chapters 4 and 5, I examined stranger, friend, and sibling dyads' collaborative recall of shared and unshared autobiographical events. In Chapter 6, I aimed to answer the question: are twins special? To do so, I re-analyzed my sibling data from Chapters 2 to 5, comparing twins to other siblings, and reported a case study on a pair of twins and their brother. Across my chapters, I investigated the product and process of collaborative remembering from multiple angles and developed a coding scheme to assess the collaborative processes people used to recall together. Across my thesis, I found that recalling with someone with whom we share history, knowledge, identity, and intimacy has a considerable impact on both the product of recall and the process of collaboration.

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CHAPTER ONE

Introduction

When we recall the past together or attempt to retrieve information jointly with other people, we engage in collaborative remembering. Collaborative remembering plays a role in many social situations, from casual conversations to goal-directed activities. The people we remember with range from those we have just met to people with whom we have shared our entire lives. Collaborative remembering, then, can take a variety of forms and serve a variety of purposes. Here are two examples of collaborative remembering between people in an intimate relationship, in these cases, twins, and siblings.

The first case involves a pair of identical 18-year-old twins recounting the day they met their teen idol, Dean Geyer, who had been a contestant on Australian Idol. This quote is a particularly rich example of collaborative remembering. The twins refer to themselves as "we" throughout, illustrating their intimacy. Their storytelling flows fluently, with each twin effortlessly finishing the other's sentences, and they even end by quoting their idol in one voice. This kind of collaborative remembering, jointly recounting an event they experienced together, may reinforce their shared past and the intimacy of their relationship.

A: We realized that … to be able to meet him you had to have bought something for him to sign.

M: And we didn't have any money on us.

A: And we didn't have any money but one of our friends did.

M: And so we bought the fan book and then eventually we got to the front of the line.

A: Up close and personal with Dean Geyer. (laughs)

M: And he took it from us, and he opened it up to the poster page, and we were like, "He, he, he, he's so cute!"

A: We were dying.

M: And he was like, "Ah who should I make it out to?" kind of thing. And we were like, A: No he didn't he said, "Are you guys twins?"

M: Okay.

A: And we said, "Yep." And then he said, "Who should I make it out to?"

M: Yep.

A: And we said, "A-- and M--" and then he wrote on our poster, um (pause)

M: "To A--,"

A: Oh yeah, yeah.

A & M: "To A-- and M--. The two cutest twins I've ever seen. Dean Geyer."

The second case involves a pair of sisters, aged 18 and 20 years, attempting to recall the name of their great aunt during a task in which they listed their mutual friends and acquaintances. This quote demonstrates a different kind of collaborative remembering to the one above because instead of recounting the story of an event they experienced together, one sister uses the other as a resource to access specific memory information. A successfully probes B for information neither would have recalled without the other.

A: And, what's the other one's name? Oma's sister? You met her, the one from Haarlem.

B: (laughs)

A: (laughs) Dude that's no help!

B: (laughs)

A: Okay that's not (laughs)… I forget what her name is.

B: Umm.

A: She was really nice. The one who lived in the squishy apartment.

B: Squishy apartment?

A: Did you go to her house? She lives in Haarlem.

B: Oh!

A: She has a small little apartment.

B: Yeah, yeah Ta- Ta- Tin- Tinike!

A: Yes that's it!

These two quotes demonstrate some of the many ways that people in intimate relationships can remember together, and the different functions it can serve. My research explores how people remember together, as well as how collaborative remembering is influenced by their relationship. Remembering with other people is central to our relationships with them. It is through talking about a shared or unshared past that we maintain existing relationships or establish new ones, by building intimacy and discovering connections between ourselves and the people we converse with (Alea & Bluck, 2003). For instance, extensive research has established that the way parents discuss the past with their children has wide-reaching benefits in terms of the quality of the relationship, the children's skill in remembering the past on their own, and even the children's broader wellbeing and self-concept in adolescence (Fivush, 1994, 2011b; Fivush, Bohanek, & Marin, 2010; Fivush, Bohanek, & Zaman, 2010; Fivush, Haden, & Reese, 2006; Fivush & Nelson, 2006; Jack, MacDonald, Reese, & Hayne, 2009; Reese & Fivush, 1993, 2008; Reese, Haden, & Fivush, 1996; Reese, Jack, & White, 2010). Other research has shown that the way older and younger married couples discuss the past together has benefits in terms of how much and what they remember (Barnier et al., 2014; Harris, Barnier, Sutton, & Keil, 2014; Harris, Keil, Sutton, Barnier, & McIlwain, 2011).

In this program of research, I aimed to extend the literature on collaborative remembering to friends, siblings, and twins. People in these relationships may recall the past together differently from parents and children or married couples because their relationships are between peers and lack the romantic elements of a marriage. In addition, there may be qualities unique to each relationship that shape the way friends, siblings, and twins remember together. Siblings and twins share a family environment that friends do not, and family environment is even more similar for twins because they are the same age. Friendships are usually voluntary and have the potential to end (Ueno & Adams, 2006), unlike sibling and twin relationships. These special qualities may impact the way friends, siblings, and twins remember the past together. Additionally, remembering the past together may play an important role in establishing and maintaining these relationships. I also contrasted the way friends, siblings, and twins remember together with the way strangers remember together. By definition, strangers have no prior relationship or shared history, and the processes and outcomes of recalling together may be quite different to already acquainted groups.

Autobiographical Memory and Peer Relationships

Autobiographical Memory

Both of the cases presented at the beginning of this chapter are examples of autobiographical memory, which is memory for our own lives (Conway & Pleydell-Pearce, 2000; Fivush, 2011a; Habermas & de Silveira, 2008). Autobiographical memory includes both episodic memories and personal semantic memory (Haslam, Jetten, Haslam, Pugliese, & Tonks, 2011). Episodic memory is memory for events we have experienced, which involves spatial-temporal information and a feeling of reliving the past (Tulving, 2002). Personal semantic memory is knowledge about our lives and our sense of self, and may include autobiographical facts, self-knowledge, repeated events, and autobiographically significant concepts in general semantic memory (Grilli & Verfaellie, 2014; Renoult, Davidson, Palombo, Moscovitch, & Levine, 2012). Although personal semantic memories are not linked to a particular time and place like episodic memories, it is more experience-near and personally relevant than general semantic memory, placing it between episodic and semantic memory (Grilli & Verfaellie, 2014; Renoult, Davidson, Palombo, Moscovitch, & Levine, 2012). Therefore, memory is not only a store of information about the world and events we have experienced, autobiographical memory is fundamentally related to our concepts of ourselves. In his influential framework, the Self-Memory System, Conway (2005) used the term autobiographical knowledge to refer to personal semantics, including our life stories and semantic knowledge related to our lives, as well as related episodic memories.

Autobiographical knowledge, according to Conway (2005), is linked to the working self, which organizes our goals by prioritizing those that are most relevant to our current situation. The working self manipulates the accessibility of autobiographical knowledge and events to ensure those that are the most closely related to our current goals are the most accessible. In this way, Conway argued, the working self strives to maintain coherence or a stable self-concept. Information that opposes or undermines the goals of the working self threatens coherence, so is rendered less accessible. Although the need for coherence is powerful, it is balanced by the need for correspondence between our memory for the event and what actually occurred (Conway, Singer, & Tagini, 2004). In this way, we maintain an accurate representation of the past without violating knowledge about ourselves. On this view, autobiographical memory is a distinct memory system that involves both semantic knowledge and episodic memories. It is the goal-driven nature of autobiographical memory that sets it apart from semantic and episodic memory as a whole.

Another aspect of autobiographical memory that separates it from simple episodic or semantic memory is our ability to engage in autobiographical reasoning. Autobiographical reasoning is the ability to connect events to other events from different time points in our lives and to our personality (Habermas, 2011; Habermas & de Silveira, 2008). This ability appears to develop in adolescence and is essential for the development of the life story. From this perspective, autobiographical memory is consequently more than a simple amalgamation of events and knowledge about our lives; it is goal-driven and interpreted in light of our current situation.

Evidence for the goal-driven nature of autobiographical memory comes from studies examining the close connections between current beliefs about ourselves and autobiographical memory. In one study, participants were able to generate more memories for more strongly endorsed “I am” statements than for those that were less endorsed (Rathbone & Moulin, 2014). The researchers explained this finding in terms of Conway’s model; our most salient aspects of self are associated with our most accessible autobiographical memories. Other studies found that episodic memories cued by certain “I am” statements came from the time when participants first identified with the statement (Rathbone, Moulin, & Conway, 2008; Rathbone & Steel, 2014). Individuals can apply autobiographical reasoning to past events in order to link them to their current goals and explain how they came to be the person they are today (McLean, 2008; McLean, Breen, & Fournier, 2010; McLean & Fournier, 2008; McLean & Pasupathi, 2011; Pasupathi & Mansour, 2006; Pasupathi, Mansour, & Brubaker, 2007). This literature shows that autobiographical memories can be interpreted in light of the goal to explain who we are now. The extensive literature on self-defining memories (Blagov & Singer, 2004; Singer, Blagov, Berry, & Oost, 2013; Singer & Salovey, 1993) also illustrates how deeply connected our current goals are to certain autobiographical memories, as self-defining memories are used to explain how we became who we are. Finally, we appear to update our perception of ourselves as we were in the past to match how we see ourselves now. This work suggests current beliefs about ourselves and autobiographical memories are bi-directionally linked (Conway, 2005; Ross, 1989; Wilson & Ross, 2003). These studies from various literatures show that engaging in autobiographical memory is not simply a matter of recalling episodic events from our past. Instead, our memories and knowledge about our lives appear to be closely intertwined with our goals and the way we see ourselves in the present.

These strong connections between how we see ourselves and autobiographical memory mean that the product (what is recalled) and process (how it is recalled) of autobiographical remembering provides insight into our current goals and self-concepts. In other words, if the context in which we recall autobiographical events makes certain goals more salient, it may influence how and what we recall. Two potential factors that may shape autobiographical remembering are the people with whom we recall these events and the purpose of remembering in that context.

Functions of autobiographical memory. Autobiographical memory's goal-driven nature means it can be used to serve a variety of functions. These functions are most commonly proposed to be self, social, and directive (Bluck, Alea, Habermas, & Rubin, 2005). The self function is believed to be the use of autobiographical memory to maintain self-continuity, and is the main function of Conway's Self-Memory System. Harris, Rasmussen, and Berntsen (2014) suggested that there are two separate self functions: reflective (positive aspects of the self) and ruminative (negative aspects of the self). The directive function is believed to be the use of autobiographical memory to direct present and future behavior by learning from the past.

My research, however, is primarily concerned with the social function, which suggests that autobiographical memory may be used to develop and maintain relationships and facilitate conversation (Bluck & Alea, 2011; Bluck et al., 2005; Harris, Rasmussen, et al., 2014). Strangers may talk about autobiographical events and information to establish a new relationship, however superficial or temporary, and to find something to talk about when they have little knowledge about one another. People who have already established relationships, such as friends, siblings, and twins may talk about shared autobiographical events and information to enhance their existing relationships. For instance, they may reminisce about funny moments they have shared to induce a shared feeling of happiness. They also may talk about unshared autobiographical events and information to "catch up" on each other's lives. In this way, remembering with others is an important ingredient of our social lives.

The importance of the social function of autobiographical memory has been supported by several empirical studies. For instance, Alea and Bluck (2007) reported that when romantic partners recalled memories relevant to their relationships they experienced increased feelings of warmth towards their partners, especially when they recalled events that were personally significant. This study was the first to provide evidence for the use of autobiographical memories to maintain relationships. In another study, Alea and Vick (2010) found that couples with higher marital satisfaction rated their relationship-defining memories (memories of how their relationship began) as more vivid, positive and emotionally intense than couples with lower marital satisfaction. The more they had rehearsed these memories, the higher their marital satisfaction. Thus, autobiographical memories shared with close others appear to be a vital element of relationships. Indeed, in a study on the self-reported use of autobiographical memory, participants rated using autobiographical memories for social functions more often than for self functions (Bluck & Alea, 2009).

Thus, Conway's model and a range of empirical studies suggest not only that individual identity and autobiographical memory are tightly linked, but also that remembering with others serves social functions such as maintaining intimate relationships. It may be possible that just as there is a link between individual identity and remembering, there is a similar link between shared (or 'we') identity and shared remembering. In the next section, I describe literature on how identity can be shared between people in close relationships, and then describe literature on the processes and consequences of memory sharing in groups.

Shared Identity and Collaborative Memory

Shared identity. In a shared identity, the boundaries of an individual's perceived self are extended to include a significant other. Whereas individual identity can be seen as an 'I' identity, shared identity can be seen as a 'we' identity. Much of the research on group identity and group interactions does not distinguish between shared identity between two people in an intimate relationship and broader kinds of group identification (e.g. Gallotti & Frith's review of 'we' identification, 2013). However, I focus on one aspect of shared identity – relational self, or 'we' identity within intimate interpersonal relationships such as couples, friends, and families – rather than 'we' identities among broader social groups like societies or cultures. The 'we' identification I describe may apply to both dyadic relationships (such as a pair of siblings) and small groups built on interpersonal relationships (such as families or friendship groups). However I primarily focus on shared identity between two individuals. This concept of 'we' identity is analogous to Brewer's (2007; Brewer & Gardner, 1996) relational self, which is based on interpersonal interaction. It is separate from the individual self and is specific to the significant other. An individual can have as many shared identities as significant others (Andersen & Chen, 2002), but due to the privileged nature of the relational self, an individual is considered to have a maximum of fifteen close interpersonal relationships (Brewer, 2007). The relational self is characterized by bonding and attachment (Brewer, 2007; Sedikides, Gaertner, Luke, O'Mara, & Gebauer, 2013), demonstrating its centrality to intimate relationships.

Closely related to Brewer's relational self is the self-expansion model of shared identity (Aron, 2003; Aron & Aron, 1986, 1996a; Aron, Aron, & Smollen, 1992; Aron, Aron, Tudor, & Nelson, 1992; Aron, Mashek, & Aron, 2004). According to the self-expansion model, an individual perceives oneself and a significant other's selves as overlapping. The degree of self-other overlap reveals the degree to which the individual "perceive[s] the self as including resources, perspectives, and characteristics of the other" (Aron, Aron, & Smollen, 1992, p. 598). Self-expansion is a feeling of closeness to another person motivated by the need to be connected to others. Brewer's relational self and Aron and Aron's self-expansion model both assert that the expansion of the boundaries of the self is a basic motivation of close relationships where perceived overlap between the self and the other is a critical element of shared identity.

Shared identity may be more important in some situations than in others. Although it has been argued that individual identity ordinarily has primacy over shared identity (Sedikides et al., 2013), in certain contexts the shared identity becomes salient. The salience of shared identity versus individual identity is motivated by the need to achieve optimal distinctiveness. Optimal distinctiveness is the ideal balance between the need to be 'me' and the need to be 'us' in the context of each personal relationship (Brewer, 2007; Brewer & Pickett, 2002). Individuals’ need for autonomy motivates identification with the individual self, whereas individuals’ need for intimacy and interdependence with a significant other motivates identification with the relational self (Brewer, 2007; Brewer & Pickett, 2002). Optimal distinctiveness is thus achieved when the tension between the individual and relational selves is balanced. This balance is dynamic and may differ according to the relationship and the current context, as well as each individual’s personality, needs, and motivations. For instance, one individual may have a greater need for autonomy than another due to differences in personality, and this need for autonomy might be different within each close relationship, and fluctuate according to their current situation. The importance of shared identity, therefore, changes depending on the needs and goals of a particular individual in a particular relationship in a particular context.

Shared autobiographical memory and shared identity. When people engage in remembering with significant others, they may develop shared autobiographical memory. Just as individual autobiographical memory appears to involve past episodic memories and semantic knowledge about our selves and our lives, shared autobiographical memory also is likely to involve past episodic memories shared with a significant other, and semantic knowledge about this significant other and our relationship with them. Given the strong links between individual identity and autobiographical memory, shared autobiographical memory may have strong links with shared identity. Fleshing out these links requires extending Conway's (2005) Self-Memory System in a way that has not been done before.

The key to extending Conway's (2005) model to link shared autobiographical memory and shared identity may be the working self. The working self forms part of the self-concept and contains a hierarchy of goals related to the self. When a current goal is active, Conway proposed that the working self increases the accessibility of memories related to its current goals. Contexts in which the relational self is more salient may make memories relevant to the relational self more accessible. As stated in the previous section, the salience of shared versus individual identity is governed by the need for optimal distinctiveness (Brewer, 1991, 2003, 2007; Leonardelli, Pickett, & Brewer, 2010; Slotter, Duffy, & Gardner, 2014). Talking about the past with a significant other may motivate identification with the relational self we share with them. This identification would thus be a goal of the working self. The working self would then make autobiographical memories related to the identity we share with them more accessible. Thus, maintaining optimal distinctiveness may be a goal of the working self. In this way, the working self may create links between shared autobiographical memories and a shared identity.

Family memory and identity. One particular kind of shared identity that demonstrates its relationship to shared autobiographical memory is family identity. Families can create a family identity in the way that they interact when they talk about the past together (Bietti, 2010). Families with adolescent children talk about the past together from three different perspectives: coordinated, individual, and imposed (Bohanek, Marin, Fivush, & Duke, 2006). A coordinated perspective means that all family members contribute equally, with the story being told by the group as a whole as each member provides small pieces of information to build the story. The quote between the twins that opened this chapter is a good example of a coordinated perspective, albeit one that only involved two family members. A coordinated perspective may foster family identity because the aim of a coordinated perspective is to create a shared family story. An individual perspective means that each family member contributes his or her perspective on the event in a turn-taking manner or as a series of cues and responses, without attempting to create a shared meaning of the event or to tell the story together. This perspective highlights differences between family members' experiences and, emphasizes family members' individual identities over a shared family identity. An imposed perspective means that one family member dominates recall of the event, and other family members' perspectives on the event are rejected. This perspective fosters neither a shared family identity nor each family member's individual identity, and may create a silencing environment (Bohanek et al., 2006; Pasupathi & McLean, 2010).

Indeed, family recounting in which the narration is shared between family members appears to result in a more "shared rendering" of the events being recounted. On the other hand, when one family member dominates the narration, it is told from the perspective of the dominant narrator (Hirst, Manier, & Apetroaia, 1997; Hirst, Manier, & Cuc, 2003). Kellas (2005) reported that families who integrated each other's perspectives about an event, whose members were more engaged in the storytelling, and who recalled events by taking many turns that were equally distributed among family members, valued the family over individuals. Sharing the narration using a coordinated perspective therefore cultivates a shared representation of the family's past. Families can create a sense of interconnectedness and shared family identity by recalling together past events in certain ways.

Transactive memory. People may come to share memory by developing a shared system of remembering. Transactive memory theory proposes that people in intimate relationships are cognitively interdependent, which means that they share encoding, storage, and retrieval of knowledge and memories (Wegner, 1987; Wegner, Erber, & Raymond, 1991; Wegner, Giuliano, & Hertel, 1985). A transactive memory system involves both differentiated and integrated knowledge. Differentiated knowledge is known by one or only some members of a group: integrated knowledge is shared by the group as a whole. Yet whatever the distribution of first-order knowledge, each person also has second-order knowledge, which is knowledge of the kind of information each member knows. According to Wegner, this second-order knowledge means that when group members are together, they can use each other as a memory resource and cue the appropriate group member for the information they require. Hence, people in close relationships can use communicative processes to remember more information when they are together than when they are apart. The second quote at the beginning of this chapter, in which one sister eventually successfully cued her sister for their great-aunt's name demonstrates how this process may occur.

Transactive memory can apply to dyads and groups recalling all kinds of information, not only shared autobiographical memories. For instance, it can apply to recalling a shopping list or information related to a shared project. Due to the broad scope of shared tasks that transactive memory systems can support, there has been an extensive literature on transactive memory in workplace and other non-intimate groups (for reviews see Peltokorpi, 2008; Ren & Argote, 2011). However, Wegner's original conception of transactive memory was as a feature of intimate relationships. It remains to be seen whether transactive memory can apply equally to intimate and non-intimate dyads and groups.

Researchers have attempted to measure transactive memory. Lewis (2003) developed the Transactive Memory System Scale, which he designed to be given to participants after the completion of a group task in organizational settings. It has three subscales: specialization (the differentiation of knowledge or tasks), credibility (trust in other group members' knowledge) and coordination (how smoothly the group completed the task). A higher score on each of the three subscales indicates a more efficient transactive memory system. However, the scale ignores the important role that integration of knowledge plays in a transactive memory system and is, therefore, an inadequate measure of transactive memory. More importantly it is unclear that people can self-report on transactive memory systems, especially if they develop over a long period and their operation is subtle.

Much of transactive memory research has focused on applying transactive memory to the workplace, but there have been some non-workplace related findings to support Wegner's claims. Transactive memory systems have been shown to rely on communication. Romantic couples only perform better than stranger dyads on a knowledge pooling task when they communicate face-to-face, indicating the role of non-verbal and paralinguistic communication (Hollingshead, 1998b). When romantic couples and stranger dyads encode and recall words in the same communication condition (with or without communication), they perform better than when they change communication condition from encoding to recall, for example if they communicate at encoding but not at recall, or vice versa (Hollingshead, 1998a). Thus, communication is necessary for transactive memory.

The distribution of knowledge is crucial to how effectively groups work together. When the integration versus differentiation of information within groups is manipulated, groups with more integrated knowledge perform better than groups with more differentiated knowledge on a knowledge-based task. Groups with integrated knowledge report more helping behavior, working together, and error correction than those with differentiated knowledge (Gupta & Hollingshead, 2010). Therefore, the way knowledge is distributed influences the processes by which group members collaborate on certain tasks as well as influences their likely success (Gigone & Hastie, 1993).

A good example of a transactive memory system between people in a close relationship comes from a study by Davies (2010). In this study, three unmarried sisters aged between sixty and eighty who lived together for their entire lives. Each sister had her own role in the family dynamic. The oldest sister acted as the “parent” of the three, and the youngest was responsible for remembering the details of their shared experiences, and indeed appeared to provide the bulk of information in their collaborative remembering. Thus, expertise was allocated, and the information differentiated across the sisters, alongside integrated information they undoubtedly shared after so many decades living together. However, these sisters are unlikely to be representative of the majority of sibling relationships, given the length of time they lived together and the fact that all three remained unmarried. Nevertheless, their relationship demonstrates that transactive memory systems can develop among siblings.

Although people in close relationships seem likely to share identity and develop transactive memory systems to share and distribute knowledge among them, the nature of the relationship itself is crucial. It is only in certain kinds of relationships that the expansion of the self in shared identity is likely to be sufficient to influence shared remembering. In a similar way, it only may be in certain kinds of relationships that people develop transactive memory systems. In the next section, I examine the nature of non-romantic peer relationships in general. I then describe sibling, twin, and friend relationships, and how strangers may differ from these intimate relationships.

Non-Romantic Peer Relationships

A large number of the relationships we have in our lives are non-romantic relationships with our peers. In my research, I focus on three particular kinds of non-romantic peer relationships: friends, siblings, and twins. However, there are many other kinds, such as co-workers, classmates, cousins, and sports teammates. Each kind of non-romantic peer relationship may have its own unique qualities, which I describe below. First, however, I describe some aspects of non-romantic relationships that are common to all kinds of relationships.

Nature of relationships. There are two aspects of relationship quality in non-romantic peer relationships relevant to shared remembering: shared identity and intimacy. In the previous section, I introduced the concept of shared identity; that is, the expansion of the boundaries of the self to include close others. As Brewer (2007) stressed, shared identity is not something we can have with every person in our lives. We may only have a shared identity with a small number of people: those with whom we are the most intimate.

Intimacy research has focused primarily on romantic couples, particularly married couples, but other kinds of close relationships also can be intimate. Intimacy is difficult to define, and the definitions provided by the literature have suggested that intimacy is a diverse concept. Nevertheless, intimacy has been suggested to involve commitment, communion, or closeness with another person; feelings of love and caring; and shared experiences and openness to self-disclosure (Bauminger, Finzi-Dottan, Chason, & Har-Even, 2008; Cox, 2006; Helm, 2010; Pittman, Keiley, Kerpelman, & Vaughn, 2011; Schaefer & Olson, 1981).

Schaefer and Olson highlighted five dimensions of intimacy: emotional intimacy, social intimacy, intellectual intimacy, sexual intimacy, and recreational intimacy. Emotional intimacy is the feeling of closeness and caring for the significant other. Social intimacy is the integration of each partner's social circles and the tendency to spend time together with mutual friends. Intellectual intimacy is the ability to share one's opinions and thoughts freely with one another without judgement. Sexual intimacy is the extent to which one's sexual needs are met by a romantic relationship. Finally, recreational intimacy is the tendency to engage in shared recreational activities and interests.

In a related approach, Theriault (1998) highlighted three dimensions of intimacy between friends and romantic partners: positive intimacy, negative intimacy, and social intimacy. Both kinds of relationships were characterized by positive intimacy (sharing ideas and opinions, understanding and listening to each other) and negative intimacy (emotional distance, feelings of inferiority or disapproval, not sharing ideas and opinions). However, only friendships were characterized by social intimacy (having common friends), and only romantic partners were characterized by sexual intimacy. Thus, close relationships involve shared identity, the maintenance of optimal distinctiveness to ensure we do not lose our individual selves under the shared identity, and various forms of intimacy and closeness. According to these approaches, people can be intimate in different ways, which can change depending on the kind of intimate relationship people are in and the unique characteristics of that relationship.

Evidence for shared identity with those with whom people are most intimate comes from various studies. Brown, Young, and McConnell (2009) asked individuals to complete a self-complexity trait-sorting task in reference to themselves and their closest other. They found that participants perceived their closest others with the same complexity as they saw themselves. This study suggested that people in close relationships have shared identity. Similarly, Myers and Hodges (2011) assessed self-other overlap in close friends and acquaintances. They found three dimensions: perceived closeness, overlapping representations, and behaving close. The first factor included perceived similarity, “we”-ness, and the inclusion of other in the self, all of which are markers of shared identity. This factor correlated with liking, caring, and desire to spend time with close friends. Thus, these two studies showed that shared identity is a feature of intimate relationships. It is important to note, however, that while these two forms of “closeness” are often connected, shared identity and intimacy are separate concepts. It is possible to have a shared identity without intimacy. Indeed, in pilot interviews I conducted with a pair of identical female twins aged 59 years, I found evidence of shared identity without intimacy (see Chapter 7 for a more detailed discussion). Similarly, we can have intimate relationships with others even if we may not identify with them as a ‘we’.

Siblings. Sibling relationships are unique, complex, and flexible. Cicirelli (1995) identified five characteristics that make sibling relationships unique: (1) their duration; (2) their involuntary nature; (3) their tendency to change due to external life events such as the shift away from the family in early adulthood; (4) their peer status within the family; and (5) the manner in which the accumulation of shared and unshared experiences in childhood fosters individuals’ identities as separate or similar to their siblings. The longevity and involuntary nature of sibling relationships are important contributors to the unique qualities of sibling relationships. Sibling relationships begin when the youngest is born and end only in death. Although the maintenance of sibling relationships in adulthood is voluntary (Goetting, 1986), even estrangement does not dissolve sibling status (Cicirelli, 1995). Thus, our relationships with our siblings typically last longer than our relationships with our parents, friends, romantic partners and children (Bank & Kahn, 1997; Fowler, 2009; Kluger, 2011; Lamb, 1982; Noller, 2005; Rocca, Martin, & Dunleavy, 2010; Ross & Milgram, 1982).

The longevity and involuntary nature means that instead of dissolving sibling relationships, external life events can cause sibling relationships to change. The shift away from the family in early adulthood, and the concomitant physical separation and decline in intimacy between siblings is well documented (Cicirelli, 1995; Conger & Little, 2010; Goetting, 1986). Contact between siblings appears to decrease with age across adulthood (White & Riedmann, 1992), although feelings of warmth towards siblings may increase in middle to late adulthood (Bank & Kahn, 1997). Marriage often weakens sibling relationships, whereas the death of a parent in older age often strengthens sibling relationships (Bank & Kahn, 1997; Ross & Milgram, 1982). Siblings' peer status is influenced by factors such as birth order and the resulting differences in age, as well as gender, parental treatment, and sibling rivalry (Cicirelli, 1995). Young adult siblings are more likely to view their relationships as friendship- or peer-like than older adult siblings, who view their relationships as based on family ties (Ross & Milgram, 1982). Thus, sibling relationships fluctuate in terms of intimacy and contact across adulthood.

The fifth unique characteristic of siblings that Cicirelli (1995) identified is the influence that shared and unshared experiences in siblings' childhoods has on their similarities and differences. In growing up alongside siblings, children learn to define themselves both in terms of how they are different from, as well as how they are similar to or identify with their siblings. These two opposing processes are known as the need for differentiation and the need for identification (Whiteman, McHale, & Crouter, 2007; Wong, Branje, VanderValk, Hawk, & Meeus, 2010). Differentiation is strongest in older siblings, whereas identification is stronger in younger siblings and often seen in their imitation of older siblings. Having two older siblings has been shown to increase young children's self-awareness, which in turn increases children's social understanding (Taumoepeau & Reese, 2014). Differentiation and identification can be seen as the forces of optimal distinctiveness that are particularly important to sibling relationships (Brewer, 1991, 2003; Brewer & Pickett, 2002). Differentiation is particularly important for sibling relationships. As Bank and Kahn (1997, p. xxii) explained, "Difference – like similarity – helps to make lively our connections [with our siblings] even when these connections are upsetting or uncomfortable. Being different makes the bond work." In other words, siblings' optimal distinctiveness requires a higher level of differentiation than other intimate relationships might. On the other hand, identification is also essential to sibling relationships. The quality of older adolescents' relationships with their younger siblings positively influences their identity formation (Dekovic, 2005) and younger siblings' identity formation becomes more similar to that of their older siblings over time (Wong et al., 2010). Thus, siblings' relationships are among the most developmentally important of our lives because they help shape our identity.

Growing up in the same family means that siblings have a long history of shared experiences, but they also have many unshared experiences due to their different ages, peer groups, gender, parental treatment, and other factors (Cicirelli, 1995; Reiss et al., 1994). These shared and non-shared experiences may impact the extent to which siblings differentiate from or identify with one another.

Siblings as different from couples. Most previous research on the role of intimacy in collaborative remembering (of which there is a limited amount) has focused on romantic couples (Barnier et al., 2014; Harris, Barnier, et al., 2014; Harris et al., 2011). I expected the product and process of siblings' collaborative remembering to be somewhat different from romantic couples' collaborative remembering because sibling relationships differ from couples' relationships in important ways. First, unlike in romantic relationships, frequent contact and self-disclosure are not required for adult sibling relationships. Instead, siblings report having "a general warmth based on a fuzzy sense of the sibling's 'just being there'" (Bank & Kahn, 1997, p. xxiv) if they need support from one another, regardless of their frequency of contact.

Second, romantic and sibling relationships differ in terms of both the origin and intended future of the relationship. Sibling relationships typically begin when the youngest is born, whereas romantic couples' relationships typically begin in adulthood. This difference means that siblings' relationships are more developmentally important than couples' relationships, as explained above. Although sibling relationships tend to last a lifetime, their lives and identities begin to diverge in adolescence and young adulthood. As they progress through life, siblings become less invested in their sibling relationships (Watzlawik & Clodius, 2011). As young adults, they begin to make connections beyond their immediate family, as they leave home, finish their education and enter the workforce, enter into romantic relationships, and start their own families (Conger & Little, 2010). At this point in life, siblings may be perceived as part of one's past or childhood, whereas a romantic partner may be perceived as part of one's future or adult life. In contrast to siblings, couples tend to become more committed to the relationship over time (Sassler, 2004) and in doing so, become more invested in creating and maintaining a shared identity with their partner in order to create a long-standing relationship (Agnew, Lange, Rusbult, & Langton, 1998; Aron & Aron, 1996b; Arriaga & Agnew, 2001). Thus, broadly speaking, sibling and romantic relationships have opposing trajectories: divergent in siblings and convergent in romantic couples. These opposing trajectories may play an important role in the way people in sibling versus romantic relationships remember together. For instance, young adult siblings may tolerate more conflict in their memories of shared events than couples because they are more motivated than couples to differentiate themselves from each other.

Twins. There have been many claims that twins, especially those who are identical, share a special bond that is different to the bond between siblings (Segal, 1999). This special bond is characterized by strong interdependence and shared identity, which has been called 'the couple effect' (Bryan, 1992) or 'the twinning bond' (Bank & Kahn, 1997; Klein, 2003). Many twins have described themselves as being two halves of one whole, and report seeing the co-twin as an extension of oneself (Pogrebin, 2009). However, empirical studies comparing twins' and siblings' identity formation in adolescence suggest that twins may not necessarily be more similar than non-twin siblings (Watzlawik, 2009; Watzlawik & Clodius, 2011). Bank and Kahn (1997) suggested that twins are simply examples of extremely 'high-access' siblings, meaning that they have had a high degree of shared history, shared space, shared social circles, and shared possessions. If twins are merely at one end of this dimension, they can be used to study the identification processes that occur in all siblings.

The differences between twins and non-twin siblings may vary depending on whether the twins are identical or non-identical. Behavioural geneticist and leading twin researcher, Nancy Segal, found that identical twins showed more coordinated and less role-differentiated behaviour in joint tasks than non-identical twins, at least as children (Segal, 1999, 2002; Segal, McGuire, Miller, & Havlena, 2008). Non-identical twins are as genetically similar as non-twin siblings. She believed that this difference in behaviour was at least partly caused by the tendency to behave more altruistically towards people with whom we share more DNA. However, she also argued that because identical twins tend to be more similar in personality and interests, even in childhood their lives are more "intimately entwined" than the lives of non-identical twins (Segal, 1999, p. 101). In other words, by her account, identical twins have a stronger shared identity than non-identical twins. Nevertheless, the differences between identical and non-identical twins, and between twins and non-twin siblings, may simply be a matter of degree, rather than quality. In my research, I sought to clarify whether twins differ qualitatively or quantitatively in their remembering from other siblings.

Friends. Friends arguably are the most pervasive of peer relationships; some people have no siblings, but most people have at least one friend. Friendships undergo transition during young adulthood. In adolescence, friends engage in shared recreational activities, but in young adulthood, work colleagues become friends and shared recreational activities are less central to the relationship (Hartup & Stevens, 1999). In a similar manner to sibling relationships, adults become less involved in their friendships, have fewer friends and see their friends less frequently as they establish solid romantic relationships and start their own families (Doherty & Feeney, 2004; Kalmijn, 2003; Ueno & Adams, 2006). At all life stages, however, friendships are characterized by a sense of equality (Ueno & Adams, 2006) and people choose friends who are similar to themselves (Thorpe & Gardner, 2006).

Communication and conversation are important in young adult friendships, and friends' conversations have been shown to differ from non-friends' conversations in important ways. For instance, friends' conversations involve more self-disclosure, opinions, arguments, assumed mutual knowledge, free-flowing topics, 'we' pronouns to refer to the speakers, and references to the shared past and shared future than acquaintances' conversations. Acquaintances' conversations, on the other hand, involve more politeness, fillers, stories, superficial information, hesitation, pursuit of agreement, and the need to make a good impression than friends' conversations (Planalp & Benson, 1992). Friends' conversations reflect their greater intimacy and shared history, while acquaintances' conversations are more akin to conversations between strangers, which I describe below. Thus, friendships involve intimacy and shared history, and are true peer relationships.

Friends compared to siblings. Friends and siblings differ in terms of the amount of genetic relatedness, group membership and shared history they involve, as well as in terms of the quality of their relationships and the amount and type of intimacy they have. Friends often have much shorter shared histories than siblings, and unlike siblings, belong to different families, are not genetically related, and do not share a childhood home environment. Unlike sibling relationships, friendships can and sometimes do end due to their voluntary nature (Rose & Serafica, 1986; Sias, Heath, Perry, Silva, & Fix, 2004; Ueno & Adams, 2006). Nevertheless, both sibling relationships and friendships tend to be peer relationships within the same generation. Thus, although these two peer relationships are both characterized by intimacy, shared history and are peer relationships, they also are quite different. This means that sibling dyads may remember together differently to friend dyads, both in terms of the product and the process of memory collaboration.

Strangers. Strangers, by definition, have neither a shared history nor an intimate relationship. When they interact, they tend to rely on conventional conversational practices and engage in fewer and less intimate topics (Berger & Calabrese, 1975; Hornstein, 1985). That is not to say that strangers' interactions are necessarily stilted and formal. In some cases, strangers' interactions can be the beginning of friendships. By interacting in certain ways, for example through self-disclosure, strangers can build rapport and even a fleeting sense of closeness or shared identity (Aron, Melinat, Aron, Vallone, & Bator, 1997; Vacharkulksemsuk & Fredrickson, 2012). However, strangers do not have intimate relationships with each other in the same way as friends and siblings, due to their lack of shared experiences, knowledge about each other, and enduring sense of intimacy. Strangers must provide more contextual information and explain themselves more than those who have an intimate relationship. Thus, when strangers recall the past together, they are likely to do so in a markedly different way in terms of both the product and process of collaboration to those in non-romantic peer relationships such as friends, siblings, and twins.

Autobiographical Memory in Non-Romantic Peer Relationships

Despite the significant role that non-romantic peer relationships play in our lives, few studies have investigated autobiographical memory in friends, siblings, and twins. The majority of studies on sibling influence on memory can be found in the false memory literature. One study found that when adult siblings discussed true and false childhood events online, they adopted information given by each other that they had not previously recalled individually (French, Sutherland, & Garry, 2006). This study demonstrated one mechanism by which autobiographical memories can become shared between siblings.

Twins, and to a lesser extent, siblings close in age and same-sex friends, can have disputed memories. These memories are contested in terms of who was the protagonist in the event, even though most of the details of the event are agreed upon (Ikier, Tekcan, Gulgoz, & Kuntay, 2003; Kuntay, Gulgoz, & Tekcan, 2004; Sheen, 2002; Sheen, Kemp, & Rubin, 2001, 2006). The disputed events tend to be mundane childhood events, but are recalled with a greater sense of reliving, sensory imagery, and emotionality than non-disputed memories. Sheen et al. (2001) suggested that disputed memories may be most common in twins because twins assimilate their personalities more than people in other kinds of relationships, and are in the habit of sharing things, including, potentially, memories. These studies highlight the importance of shared history in shared autobiographical memories. However, in my research I was less concerned about conflicts and disputes in the memories of people in non-romantic peer relationships than about the way that people in these relationships go about remembering shared autobiographical events and information together and thus the success of their remembering.

There have been other studies investigating autobiographical memory in non-romantic peer relationships outside of the false memory literature. For instance, McLean and Thorne (2003) found that amongst a sample of college students, two-thirds reported self-defining memories that concerned their relationships with others; of those memories, nearly twice as many memories related to peers than related to parents, although ‘peers’ included romantic partners, as well as friends and siblings. Peer memories were more likely to concern closeness and less likely to concern conflict than parent memories. Thus, peers play an important role in young adults’ autobiographical memory.

My Research Questions

In light of the concepts, theory, and research I have described above, my primary research question was whether recalling with a stranger, friend, sibling or twin influences collaborative remembering and the outcomes of collaboration. I was interested in examining whether the product and process of collaborative recall differed for strangers compared to friends and siblings, friends compared to siblings, and non-twin siblings compared to twins. In addition, I was interested in whether intimacy and shared identity were linked to and were evident in the product and process of friends and siblings remembering together. Therefore, I sought to discover whether strangers', friends' and siblings' communication during recall showed evidence of transactive memory and whether the kind of relationship they had influenced this communication. I aimed to determine whether recalling with someone with whom we share a non-romantic peer relationship would influence both the product and process of collaboration, in a way that indicates collaborative success.

Testing My Research Questions

The Collaborative Recall Paradigm

In order to test my research questions outlined above, I used the collaborative recall paradigm. Collaborative recall experiments typically involve participants learning a set of stimuli, such as a word list, which they then recall either individually or collaboratively in small groups, typically triads or dyads. Instead of comparing collaborative groups with individuals, researchers create nominal groups. Nominal groups are composed of the same number of participants as collaborative groups, but their members recall individually. The product of nominal group recall is, therefore, the combined output of its individual members, with any overlapping items only counted once. This method means that collaborative groups' recall output can be compared with their hypothetical potential (Pereira-Pasarin & Rajaram, 2011). This comparison with nominal groups is the strength of the collaborative recall paradigm because each type of group has the same number of individuals recalling and the only difference is whether or not they collaborate.

The usual finding in collaborative recall studies is collaborative inhibition; collaborative groups typically recall fewer items than nominal groups (for review see Rajaram, 2010, 2011). The opposite outcome, when collaborative groups recall more items than nominal groups, is known as collaborative facilitation, but has only very rarely been found (for a unique example, see Meade, Nokes, & Morrow, 2009). Thus, collaborative inhibition is a robust effect, especially in groups of three or more, and occurs more often than not in dyads (Rajaram & Pereira-Pasarin, 2010). Due to the robustness of collaborative inhibition, and the comparison of the nominal group, I used the collaborative recall paradigm to test my research questions.

The leading explanation for collaborative inhibition is retrieval disruption, proposed by Basden, Basden, Bryner, and Thomas (1997). According to this explanation, individuals impose their own structure when encoding a list of items and then use their own strategies based on these structures to retrieve the information at recall. These individual strategies are interrupted during collaboration when individuals hear their partner recall items (Barber, Rajaram, & Aron, 2010; Congleton & Rajaram, 2014; Rajaram, 2011). Interrupting each other’s retrieval strategies means that individual members of collaborative groups are unable to recall all of the items they would have recalled on their own.

Collaborative recall experiments typically test stranger dyads or triads, which may contribute to the robustness of collaborative inhibition. Strangers have the task of negotiating collaboration with an unfamiliar person on top of recalling the material, which may magnify collaborative inhibition. Some studies have focused on exploring the explanatory power of retrieval disruption by focusing on how items are organized, both within and between individuals. In collaborative groups, the structure and organization of recalled information become more similar over time, and the amount of shared information and structure correlate with the strength of collaborative inhibition (Congleton & Rajaram, 2014). This shared structure may come about because of unshared information that is lost in collaborative inhibition (Meade & Gigone, 2011). Manipulating collaborative groups’ retrieval strategies to be more similar has been shown to reduce collaborative inhibition (Finlay, Hitch, & Meudell, 2000), but the extent of retrieval disruption may only directly influence collaborative inhibition when the former is measured at the individual level (Barber & Rajaram, 2011).

Other studies have focused on how manipulating the encoding phase or recall phase influences the strength of collaborative inhibition. Collaborating at encoding has been shown to reduce or eliminate collaborative inhibition compared to collaborating at retrieval (Barber et al., 2010; Barber, Rajaram, & Fox, 2012; Harris, Barnier, & Sutton, 2013). Although giving collaborative groups instructions to “guess” increases false recall over instructions not to guess, these instructions do not affect collaborative inhibition in either younger or older adults (Meade & Roediger, 2009). The strength of the effect is the same for both age groups. All of these studies pinpoint retrieval disruption as an explanation for collaborative inhibition. However, there is some evidence that collaboration can change the goals of recall, suggesting that retrieval disruption may not account for all that occurs during collaboration (Hyman, Cardwell, & Roy, 2013).

Although collaborative inhibition is robust, collaboration has been found to benefit recall in other ways. One way that collaboration benefits recall is when individual recall occurs after collaboration; individuals, who previously have recalled collaboratively, later remember more (on a final individual recall test) than individuals who previously have recalled individually (Rajaram, 2011; Weldon & Bellinger, 1997). One study found more benefits for later individual recall when this task was preceded by individual then collaborative recall than when it was preceded by collaborative then individual recall (Blumen & Rajaram, 2008). They concluded that it was collaboration on the second recall only that drove these post-collaborative benefits.

Another benefit of collaborative recall is error pruning; collaborative groups often have fewer errors than nominal groups (Basden et al., 1997). However, this effect only has been found when groups collaborate at retrieval not encoding (Barber et al., 2010). Error pruning also has been found when collaborative groups are asked to reach consensus, but not when they are asked to take turns (Harris, Barnier, & Sutton, 2012). Meade and Roediger (2009) found that collaborative dyads of younger and older adults recalled fewer false items than nominal dyads, but not when they were cued by categories and asked not to guess items. Hyman et al. (2013) argued that error pruning occurred because collaborative groups' goals were to limit errors and to agree. Collaborative and nominal groups thus had different goals, meaning they essentially performed different tasks. These different goals may contribute to collaborative inhibition.

In order to answer my research questions outlined above, I needed to extend the collaborative recall paradigm beyond what has been done up to this point. All of the collaborative recall studies above examined the effect of collaboration on strangers' recall of items learned in the laboratory, which may unfairly hinder collaborative groups. If collaborative groups of strangers have different goals to nominal groups, the goals of collaborative groups of friends and siblings may be even more different. Similarly, asking them to recall stimuli they already knew before entering the laboratory may add to the different goals of collaborative and nominal groups, and impact their recall differently depending on their relationship. The current collaborative recall paradigm has limited ecological validity because it involves asking participants who have never met to recall information they learnt in the laboratory that is not meaningful to them. As I outlined in the Social and Collaborative Memory section above, remembering with others is closely intertwined with our close relationships and goals. In order to better understand these links, I needed to extend the collaborative recall paradigm to people in close relationships recalling self-relevant stimuli they generated themselves.

However, extending the collaborative recall paradigm is not a straightforward process. One problem with self-generated stimuli is that they are difficult to control. Using laboratory-learnt stimuli means that every participant recalls the same set of items. Using self-generated stimuli, on the other hand, means that each subject recalls from a different pool of items, which may be inaccessible to the experimenter. Thus, each participant may know different items as well as a different number of items before they enter the laboratory. Each task may be more difficult for some participants than others simply because they know more items and so have more to recall, or because the information is less accessible to them than to other participants. Additionally, using laboratory-learnt stimuli makes it easier to identify which items have been recalled, gained, or lost. Due to the fact that self-generated stimuli come from a different pool of knowledge for each participant, it is impossible to determine on a single recall which items have been lost.

This problem relates to both self-generated lists and autobiographical memories. Unlike short stories or similarly rich stimuli learnt in the laboratory, autobiographical memories are difficult to quantify. Not only is it impossible to track which aspects of the event are recalled and which are forgotten, determining how much has been recalled is not simply a matter of counting the number of items. Therefore, I needed to adapt the collaborative recall paradigm to allow for a base measurement of each self-generated list to determine the pool that each participant drew from in order to see the effects of collaboration, as well as a method to deal with the richness of the stimuli I intended to use.

Another problem with self-generated stimuli is identifying equivalent self-generated stimuli for stranger, friend, and sibling dyads. In my research, I was looking for evidence of collaborative success in real-world dyads. In order to do so, I needed to ask friend and sibling dyads to recall information that would be relevant to their relationship and would allow them to benefit from their shared history and knowledge. However, by definition, strangers do not share the same kinds of information as friends and siblings, and so it was difficult to compare strangers with acquainted dyads without conflating relationship with the stimuli they recalled.

Despite the difficulties in extending the collaborative recall paradigm to explore the role of prior acquaintance on collaborative recall, several studies, described below, have done so using friends or married couples. Findings have been mixed for both relationships, but no study has found group level collaborative facilitation due to prior acquaintance. Instead, collaborative inhibition has been eliminated or merely reduced compared to non-acquainted groups (Rajaram & Pereira-Pasarin, 2010). The effect of prior acquaintance has so far depended on the recall task. For instance, friends consistently show equal collaborative inhibition to strangers when recalling word lists (Andersson & Rönnberg, 1995; Harris et al., 2013; Peker & Tekcan, 2009), but reduced or eliminated collaborative inhibition when recalling more elaborate stimuli such as short stories or video tapes (Andersson & Rönnberg, 1995, 1996). Married couples showed collaborative inhibition in a grocery store task (Ross, Spencer, Linardatos, Lam, & Perunovic, 2004), and short stories (Johansson, Andersson, & Rönnberg, 2005), but not for more personally relevant stimuli (Harris et al., 2011). Of these studies, some compared acquainted groups with strangers and others simply measured collaborative inhibition in acquainted groups without comparing them to strangers. Some used only one task and others compared collaboration across several tasks. Nevertheless, no study has compared groups with close relationships with each other and with strangers, and certainly none has done so while also comparing collaborative inhibition across several tasks. Further, no studies have examined collaborative recall in siblings or twins. Thus, my thesis was the first to compare groups in different relationships with each other and with strangers as they recalled different kinds of stimuli.

Product And Process

Previous research on process. Aside from extending the collaborative recall paradigm to people in acquainted groups, another significant way to extend it is by examining not just how much collaborative groups remember, but also the processes they use to remember collaboratively. Collaboration depends on communication. In order to understand collaborative recall, therefore, researchers need to study *how* groups collaborate (Barnier, Harris, & Congleton, 2013; Meade, 2013). I use the term collaborative processes to refer to the specific communicative practices that group members use that may influence how they recall collaboratively. Although the study of collaborative processes is an emerging field, several studies have analysed collaborative processes in recall. The pioneering work on collaborative processes was by Reese and Fivush (1993; Reese, Haden, & Fivush, 1993), who observed mothers' use of elaborations, repetitions, and evaluations when they recalled past events with their young children. They found that the use of these collaborative processes influenced the children's recall not only at the time, but also several years later. This work was among the first in a now vast literature on mother-child reminiscing styles (for reviews of this literature, see Fivush, 2011a; Nelson & Fivush, 2000, 2004; Reese, 2009).

More recently, Meade et al. (2009) compared collaborative processes used by expert pilots, novice pilots, and non-pilots when they recalled aviation scenarios. They found that expert pilots, who showed collaborative facilitation, used more repetitions and elaborations during recall than did novices and non-pilots. The expert pilots in this study had been trained (as part of their pilot training) in communication as well as aviation, and their collaborative recall success was likely due to a combination of their communication training and aviation expertise. Thus, the use of collaborative processes varied between dyads and may have impacted recall. Further examining different collaborative processes is the work of Bietti (2010, 2011, 2013; Bietti & Castello, 2013), in which he examined collaborative processes embedded in multi-modal interactions between strangers, family members, or friends recalling their shared past (i.e. pointing while asking a question). His qualitative analysis of these practices highlights how fundamental communication is to collaborative remembering.

The most promising study on product and process in terms of my research questions was from Harris et al. (2011) on older couples' collaborative recall. They tested 12 long-term couples who had been married for a range of 26 to 60 years on three different tasks: a word list, a personal list, and a semi-structured autobiographical interview. They found a great deal of variability in older married couples' collaborative recall performance. Some couples showed collaborative inhibition, whereas others showed collaborative facilitation. Couples did not necessarily show the same outcome across all three tasks, and the strategies or processes they used to collaborate predicted their success or failure. The researchers coded transcripts of the couples recalling the personal list for various collaborative processes such as cuing, strategy use, elaborations and strategy disagreements. They found three factors that contributed to the couples' recall performance. Factor 1 was group-diminishing, as it predicted worse collaborative recall performance. This factor included strategy disagreements, mentions of expertise and failed cues. Factor 2 was group-enhancing, as it predicted better collaborative recall performance. This factor included successful cues, new information in response to cues and repetitions. Factor 3 was considered a filler factor, as it was less clear how it impacted collaborative recall performance and included processes that may have served to maintain the relationship rather than to support remembering, such as acknowledgments and elaborations. Thus, the processes of couples' collaboration impacted the product of their collaborative recall, including whether they experienced collaborative inhibition or facilitation.

In my research, I based my collaborative process coding on the first two of these factors. In each experiment, I audio-recorded and transcribed collaborative dyads' conversations during recall and coded them for collaborative processes. Factors 1 and 2 were the inspiration behind the collaborative processes I used in my research (outlined in Chapters 2 and 4) to examine conversational acts that had a potentially positive or negative influence on collaborative recall.

Another way to facilitate collaborative recall is through the use of group-level strategies. Dyads who structure their recall in categories show reduced collaborative inhibition (Basden et al., 1997). Harris et al. (2011) found that the couples who used a coordinated group-level strategy to support their recall recalled more words from a categorised word list when they collaborated than when they recalled individually. This effect occurred even though the strategies used varied from couple to couple, from cuing each other using the categories to dividing the list between the husband and wife. Thus it was not the type of strategy, but the fact that is was a coordinated strategy used by both people that supported recall.

Johansson et al. (2005) found that older married couples that divided the responsibility of recalling semantic information when collaborating performed as well as nominal couples, but the extent to which the couples agreed with each other did not affect collaboration. Thus, division of responsibility eliminated collaborative inhibition in these couples. The collaborative processes used by expert pilots in the study by Meade et al. (2009) also included the use of a coordinated strategy, because the pilots had been trained to explicitly use these processes in their workplace. When communicating with air traffic control, pilots are required to repeat the information given to them before adding new information. Applying communicative practice to the recall task is thus a coordinated strategy, albeit one focused on communication rather than recall. This communicative strategy may have enhanced the expert pilots' collaborative recall. Therefore the use of a coordinated strategy may produce collaborative facilitation or at least eliminate collaborative inhibition.

If collaboration is a primarily communicative process, the way participants' responses are recorded may impact how they recall collaboratively. In the vast majority of collaborative recall studies reported above, participants either typed or wrote their responses on a piece of paper. Only four studies asked participants to recall aloud (Basden et al., 1997; Harris et al., 2011; Meade & Roediger, 2009; Peker & Tekcan, 2009). Of these, half had the previously recalled items visible to participants, and the other half did not. All of these factors may influence how groups collaborate. For instance, collaboration may be quite different when one group member must frequently stop talking to the other group member(s) to write down or type the item just recalled, compared to when group members are able to continue recalling without stopping to write or type. Stopping to record items may interrupt the flow of recall, which may increase retrieval strategy disruption, impact the collaborative processes used and how much a collaborative group can recall. On the other hand, having no record of items already recalled to refer to also may impact how much a collaborative group can recall, as they would need to keep in mind what they and their partner(s) already have recalled. Recalling aloud without a record to refer to may increase the number of items that are repeated. Group members may rely more on certain collaborative processes in order to deal with the additional demands of keeping in mind what has already been recalled. However, there have not been enough comparable studies using written or typed versus spoken recall to determine whether the way recall is recorded may impact the process of collaboration.

My Research

My research was unique in the degree to which I extended the collaborative recall paradigm to examine the product and process of recall in dyads in different relationships, and how these change according to the kind of information recalled. Across the following five chapters, I used the collaborative recall paradigm in dyads of strangers, friends, and siblings. I asked them to recall categorized word lists, self-generated autobiographical lists, self-generated non-autobiographical lists, shared autobiographical events, and unshared autobiographical events.

Preview

I conducted four experiments, one re-analysis of the four experiments, and one case study. Across experiments, there were three important elements: (1) the relationships between participants, (2) the tasks they performed, and (3) the product and process of their collaboration. In Chapters 2 and 3 (Experiments 1 and 2, respectively), I compared collaborative recall of a categorized word list and two self-generated lists by dyads of strangers, friends, and siblings. Whereas in Experiment 1 participants typed their recall into a computer, in Experiment 2 they recalled aloud.

In both Experiments 1 and 2, I asked participants to recall a standard word list in line with the current literature on collaborative recall. In Experiment 1, the self-generated lists were different for strangers, friends, and siblings. Strangers' lists were based on shared non-autobiographical semantic knowledge (e.g. news events), whereas friends' and siblings' lists were based on shared autobiographical knowledge (e.g. shared holidays). In Experiment 2, the self-generated lists were the same for strangers, friends, and siblings. One list was based on shared non-autobiographical semantic knowledge, and the other was based on shared or unshared autobiographical knowledge. In Experiment 1, I attempted to ensure the stimuli for each list drew from a pool of information that was as shared as possible for each kind of dyad. In Experiment 2, I attempted to ensure strangers', friends', and siblings' tasks were as comparable to each other as possible. In both experiments, I also coded collaborative dyads' conversations during recall for collaborative processes. I measured friends' and siblings' intimacy to determine whether it influenced how well they collaborated.

In Chapters 4 and 5 (Experiments 3 and 4, respectively), I compared collaborative recall of autobiographical events in dyads of strangers, friends, and siblings, which was typed and spoken, respectively. For friends and siblings, these were shared autobiographical events, whereas for strangers these were unshared autobiographical events. As in the previous chapters, I coded collaborative dyads' conversations during recall for collaborative processes. I also sought evidence of shared versus individual identity by looking at the personal pronouns the dyads said or typed in their recall of the events, and I measured intimacy in friends and siblings as in previous chapters.

In Chapter 6, I compared twins to siblings. In the four experiments described in Chapters 2 to 5, the siblings included both twins and non-twin siblings. I originally had intended to test twins as a separate group from siblings, but due to difficulties in recruiting large numbers of sibling and twin dyads I grouped them together in my analysis of each experiment. Thus, in the first section of Chapter 6, I re-examined the sibling data from my experiments by comparing twins' collaborative recall with other siblings' collaborative recall of word lists, self-generated lists of shared autobiographical memory and non-autobiographical memory, and shared autobiographical events. The second section of Chapter 6 was a case study. In this case study, I took a more descriptive approach than in previous chapters and examined in depth the collaborative recall of autobiographical events of a pair of female twins and their brother. I interviewed them in different dyads and as a triad, and measured the different dyads' intimacy and shared identity in more depth than in previous chapters. I analyzed their event recall in the same way as in Experiment 4 and attempted to relate their collaborative recall to their relationships.

Thus, my thesis will reveal how people in different kinds of non-romantic peer relationships remember together, and whether this changes according to task. This in turn will highlight the tight links between autobiographical memory and shared identity, and how autobiographical memory can enhance intimate relationships.

CHAPTER TWO

Experiment 1:
Strangers, Friends, and Siblings' Collaborative Recall of Typed Lists

In this experiment I aimed to determine: (1) whether relationship influences how two people remember together, (2) whether this depends on what they are trying to remember, and (3) whether the conversation between them during recall influences how well they remember together. As I argued in Chapter 1, transactive memory suggests that people in intimate relationships may benefit from their shared history such that they remember more successfully when together than when alone (Barnier, Sutton, Harris, & Wilson, 2008; Hollingshead, 1998a; Wegner, 1987; Wegner et al., 1985). Thus, people in intimate relationships should recall better together than those who are less intimate. However, intimate dyads' recall performance might be moderated by what they remember. When they remember shared experiences or information relevant to their relationship, dyads should benefit more from their relationship than when they remember unshared, less relevant information. Finally, consistent with transactive memory theory, dyads may use collaborative processes that allow them to access shared and unshared knowledge. If so, aspects of a dyad's conversation will predict how well they remember together.

With these aims in mind, I used the collaborative recall paradigm to compare the recall of collaborative and nominal dyads of strangers, friends, and siblings. If, on the whole, friends and especially siblings perform better than strangers on collaborative recall tasks, such as by showing less collaborative inhibition or by cuing each other more effectively, this would be consistent with the claims of transactive memory theory. I gave participants three recall tasks to determine whether collaborative recall performance in these three groups depends on the task. The first task was a word list, in which participants individually encoded a categorized word list and then recalled it either collaboratively or individually. The second was a self-generated list of people's names: mutual friends and acquaintances for friends and siblings, and either Psychology lecturers and tutors or current Hollywood movie stars for strangers. The third was a list of events: news events for strangers, shared social events for friends, and shared holidays for siblings. As I outlined in Chapter 1, few collaborative recall studies have used self-generated stimuli (but see Harris et al., 2011). I used self-generated stimuli to better understand the links between shared remembering, close relationships, and goals of remembering with close others. The self-generated lists in this study were designed to allow dyads to access their shared knowledge according to their relationships. I attempted to ensure strangers' self-generated tasks were based on knowledge they might still share despite their lack of a shared history.

I compared collaborative and nominal dyads' recall on each task to determine whether they demonstrated collaborative inhibition. I also counted items gained and lost from individual recall to collaborative or nominal recall. I audio recorded and transcribed collaborative dyads' conversations during each task and coded them for various collaborative processes (similar to some of the Factor 1 and Factor 2 collaborative process variables used in Harris et al., 2011) to determine whether recall processes predicted collaborative success. I gave participants the Personal Assessment of Intimacy in Relationships (PAIR) Inventory (Schaefer & Olson, 1981) to determine whether intimacy influenced collaborative success for friends and siblings. Barnier et al. (2014) found that scores on the PAIR Inventory predicted successful autobiographical recall of shared experiences in younger couples, but it has not yet been shown to predict collaborative recall performance. I also gave participants the Transactive Memory System (TMS) Scale (Lewis, 2003) to determine whether self-reported transactive features or processes predict collaborative dyads' recall performance across the tasks. The TMS Scale has been found to predict collaborative performance in organizational groups (Lewis, 2003), but has not yet been shown to predict collaborative performance in intimate dyads. According to transactive memory theory, intimacy has a positive influence on dyad's recall (Wegner, 1987; Wegner et al., 1991; Wegner et al., 1985). If friends and siblings score higher on this scale than strangers, this would support the claim that dyads in intimate relationships can develop transactive memory. Finally, I gave participants the Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988) to ensure the procedure did not negatively impact participants' emotional states, as it involved recalling personal information, as well as to determine whether collaboration influenced participants' subsequent mood.

I predicted that strangers would show collaborative inhibition regardless of task, given the robustness of the effect (Rajaram & Pereira-Pasarin, 2010), but that friends and siblings would only show collaborative inhibition for the word list. Consistent with transactive memory theory, friends and siblings should benefit from their intimacy and shared experience more when recalling people and events than when recalling a word list. These two self-generated tasks involved recalling information relevant to their shared experience. Strangers did not have shared history, and therefore may not have benefited from shared knowledge as much as friends and siblings.

I was especially interested in items gained and items lost as important and informative measures for understanding collaborative recall. Although items gained and lost may operate simultaneously to effectively cancel out each other's effects on the product of recall, they reflect different processes. If collaborative dyads gained more items than nominal dyads, this would indicate that members of the collaborative dyads successfully cued each other to recall more items (Meudell, Hitch, & Boyle, 1995). If collaborative dyads lost more items than nominal dyads, this would indicate that collaboration resulted in the interruption of each member's individual retrieval strategies so they were not able to recall items they recalled or elicited previously (Basden et al., 1997; Congleton & Rajaram, 2014; Rajaram & Pereira-Pasarin, 2010).

A number of collaborative processes have been shown to support recall. Based on the findings of Harris et al. (2011), I predicted that collaborative processes similar to their Factor 1 (group-diminishing) processes would occur more frequently in tasks that showed collaborative inhibition, and in dyads who were less able to benefit from intimacy and shared experience. On the other hand, I predicted that collaborative processes similar to their Factor

2 (group enhancing) processes would occur more frequently in tasks that did not show collaborative inhibition, and in dyads who had more intimate relationships. I also predicted that the extent to which dyads shared the recall would be revealed in the distribution of words and turn taking in their transcripts. Specifically, I predicted that more "shared" collaborative strategies (in which both members equally contribute to the task) would support recall and be less susceptible to disruption.

I predicted that higher scores on the TMS Scale and the PAIR Inventory would relate to better collaborative recall performance. I predicted that participants who had collaborated previously would report higher positive emotion and lower negative emotion on the PANAS.

Method

Participants

I tested 156 individuals (28 males, 128 females) recruited from Macquarie University. They made up 78 dyads: 26 dyads each of strangers, friends, and siblings. Strangers included 18 female-female, one male-male, and seven male-female dyads, ranging in age from 17 to 42 years (*M* = 22.26 years, *SD* = 7.44). Strangers were all first year Psychology students at Macquarie University participating for course credit. Seven nominal stranger dyads participated separately; the rest participated with the other member of their nominal dyad.

Friends were 18 female-female, one male-male, and seven male-female dyads, ranging in age from 18 to 32 years (*M* = 21.60 years, *SD* = 3.35). Friends were only eligible if they had been close for at least one year. The time they had known each other ranged from 1 year to 19 years 10 months (*M* = 4.50 years, *SD* = 4.20). Thirty-five per cent of the friend dyads had lived together for a mean of 1.09 years (*SD* = 0.86), ranging from four months to three years. Eighty-eight percent of friends said they saw each other at least once a week or more. None saw each other less than once a month. I recruited friends using posters around the university and via the first year Psychology participant pool. I either paid them $15 each per hour or gave them course credit for their participation.

Siblings included 17 female-female, one male-male, and eight male-female dyads, ranging in age from 17 years 9 months to 31 years and one month (*M* = 21.43 years, *SD* = 3.11). Four sibling dyads were twins: one female-female identical twin dyad, two female-female non-identical twin dyads, and one male-female non-identical twin dyad. The remaining siblings' age gap ranged from 1 year 2 months to 5 years 10 months (*M* = 2.73 years *SD* = 1.14). Seventy-three percent of siblings lived together with their parents and 8% lived together but not with their parents. The remaining 19% did not live together, with one sibling living with their parents but not the other. Ninety-two percent of siblings saw each other at least once a week or every day. The remaining 8% saw each other once every one to two weeks. I recruited siblings using posters around the university and via the first year Psychology participant pool. I either paid them $15 each per hour or gave them course credit for their participation.

Research Design

The experiment was a between subjects design, with dyads as the unit of analysis. In the second phase of the experiment, I divided strangers, friends, and siblings into collaborative and nominal dyads, giving the experiment a 3 x 2 (relationship x collaborative condition) design, with 13 dyads per cell. Collaborative dyads worked individually in Phase 1 and collaboratively in Phase 2. Nominal dyads worked individually in both Phase 1 and Phase 2. I pooled the individual responses of nominal dyad members to create a nominal dyad score, counting overlapping items only once. Participants also completed autobiographical memory tasks during the experiment, which are reported in Chapter 4.

Materials

Audio recording and software. I used Superlab software to present the word list and to collect participants' typed responses to each task. I recorded collaborative dyads' conversations during Phase 2 using a Blue Snowball microphone and Audacity software.

Word list. I gave participants a word list comprised of Lists 1 and 4 of the Hopkins Verbal Learning Test–Revised (HVLT-R; Benedict, Schretlen, Groninger, & Brandt, 1998) as used by Harris et al. (2011). Unlike Harris et al., who used Lists 1 and 4 separately for their sample of older adult couples, I added Lists 1 and 4 together to create a 24-word list in order to avoid ceiling effects in my sample of university undergraduate dyads. Each list of the HVLT-R contains 12 words, which comprise three categories of four words each. Thus, the combined 24-word list contained six categories of four words. The categories were: birds (bluebird, canary, eagle, crow), four-footed animals (horse, cow, tiger, lion), gems (sapphire, emerald, pearl, opal), clothing (skirt, pants, blouse, shoes), tools (screwdriver, nails, chisel, wrench) and dwellings (cave, hut, tent, hotel). I did not tell participants about the categories. I presented the word list in a random order using Superlab in a black Times 24 point font on a white screen, such that all words were visible at the same time, with each word on a single line. Each member of the dyad saw the words in the same order.

Questionnaires. Participants completed the questionnaires individually. I gave them different questionnaires depending on their relationship and collaborative condition. I gave all participants a demographic questionnaire asking for age, gender, country of birth, and languages spoken at home. Friends' demographic questionnaire also asked them how often they saw each other on a 5-point Likert scale from 1 (less than once a month) to 5 (every day), how long they had known each other (in years and months), and whether they lived together. Siblings' demographic questionnaire also asked them how often they saw each other, whether they lived together, when they moved apart if they no longer lived together, whether they lived with their parents, and when they moved out of home if they no longer lived with their parents.

I asked friends and siblings to complete the PAIR Inventory (Schaefer & Olson, 1981). I adapted the inventory as appropriate for each relationship by removing the sexual intimacy subscale and replacing "partner" with "friend" or "sibling". This left a 30-item questionnaire with four intimacy subscales (emotional, social, intellectual, and recreational) and a conventionality subscale. The conventionality subscale measures individuals' desire to make a good impression. Each subscale included six items, which were statements such as "I enjoy spending time with other people." Participants responded to each item using a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). The subscale scores were the sum of the six items, and therefore ranged from 6 to 30 for individuals. I summed the scores from each dyad member to create a dyad score for each of the five subscales, which ranged from 12 to 60.

Participants in collaborative dyads completed the Transactive Memory Scale (Lewis, 2003), which I again adapted for their relationship by replacing the word "partner" with "friend" or "sibling" where appropriate. The Transactive Memory Scale is a 15-item questionnaire with three subscales: specialization, credibility, and coordination. It was designed to measure dyad members' perceptions of their collaborative performance on a particular task. Items include statements such as "Each of us has specialized knowledge of some aspect of the task" from the specialization subscale, "I was confident relying on the information that my partner brought to the discussion" from the credibility subscale, and "My partner and I accomplished the task smoothly and efficiently" from the coordination subscale. Participants responded to each item using a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). They completed the scale in reference to three of the tasks: the word list, the people list (as one of the self-generated lists), and one autobiographical memory (see Experiment 3 in Chapter 4). Therefore, each statement required three responses, one for each task, making it a 45-item questionnaire. I summed the scores from each dyad member to create a dyad score for each of the three subscales, which ranged from 10 to 50.

Finally, all participants completed the PANAS to ensure that the experiment was not upsetting to them (Watson et al., 1988). Therefore, I changed the wording of the instructions, so that participants rated, "to what extent you felt this way while doing the memory tasks in this session.” Items were positive and negative emotions such as “interested” and “distressed”. Participants responded using a 5-point Likert scale from 1 (very slightly or not at all) to 5 (extremely). The PANAS included 20 items, consisting of 10 positive and 10 negative affect items. I summed positive and negative items to create two subscale scores: positive affect and negative affect, respectively. I summed the scores from each dyad member to create a dyad score for positive and negative affect, which ranged from 20 to 100.

Procedure

Participants completed a number of memory tasks in one 90-minute session in a laboratory on Macquarie University campus. The session involved two phases, Phase 1 and Phase 2, separated by an eight-minute distraction. Participants responded to all tasks by typing their responses into the computer. Following the experimental tasks, participants completed the pen-and-paper questionnaires.

Phase 1. In Phase 1, participants always worked individually, typing their responses into separate computers at either side of a partition. In this phase, they generated two semantic lists (one of people and one of events), encoded a word list, generated two autobiographical memories (reported in Chapter 4), and finally recalled the word list. I timed all tasks using a stopwatch and warned participants when they had 30 seconds left on each task.

People list elicitation. After participants encoded the word list, they generated a list of people’s names (hereafter, “people list”). I told the first 32 strangers that I tested, “I would like you to type into the computer all of the names of Psychology lecturers and tutors at this university that you know. You can include any you think of, even if you haven’t had a class with them. I will give you four minutes to do this task.” However, I excluded this task from analysis because few strangers were able to name more than one or two lecturers or tutors. I told the last 20 stranger participants, who made up six collaborative and four nominal dyads, “I would like you to type into the computer all of the names of current Hollywood movie stars that you know. You can include any you think of. I will give you four minutes to do this task."

I told friends and siblings, "I would like you to type into the computer all of your mutual friends and acquaintances, so that means everyone you can think of that you both know. I will give you four minutes to do this task." All participants completed the task individually even though friends and siblings generated people they shared with each other.

Event list elicitation. After they generated the people list, I gave participants four minutes to generate a list of events (hereafter, "event list"). I designed the event list for each relationship type to tap into shared knowledge. Therefore, strangers generated news events from the past 12 months, friends generated shared social events in the past 12 months, and siblings generated shared holidays.

I told strangers, "I would like you to list all of the news events you can think of that occurred in the past twelve months. They don't have to be in chronological order, just type them as you think of them. You will have four minutes to do this task." I told friends, "I would like you to list all of the social events you can think of that you shared in the past twelve months. They don't have to be in chronological order, just type them as you think of them. You will have four minutes to do this task." I told siblings, "I would like you to list all of the holidays you have taken together in your life. If you have taken lots of holidays, you can just type in the significant ones. They don't have to be in chronological order, just type them as you think of them. You will have four minutes to do this task." All participants completed the task individually even though the events that friends and siblings generated were shared with each other.

Word list encoding. At word list encoding, I told participants to memorize a list of words presented on the computer screen. I then gave each participant two minutes to individually view the words. All of the words appeared on the computer screen simultaneously. I told participants, “Please try to memorize the words because I will ask you to recall them later.”

Autobiographical memory elicitation. Participants elicited two autobiographical memories for Experiment 3, outlined in Chapter 4. All participants completed the task individually even though the autobiographical memories that friends and siblings generated were shared with each other.

Word list recall 1. At the end of Phase 1, all participants individually recalled the word list. I told participants, “Now I will give you three minutes to type into the computer all the words you can think of from the list you saw earlier. They don’t have to be in the order you saw them, just type them in as you remember them.”

Distraction. After they recalled the word list for the first time, I gave all dyads eight minutes to work together to complete a Sudoku puzzle. They completed this task using pencils and paper at a table away from their computers in the same room. Some participants in the Nominal condition completed the distraction individually because there was no other participant in their session. This situation occurred when only one participant who had been scheduled to participate in that session attended.

Phase 2. After the distraction, nominal dyads went back to the computers they used in Phase 1 and completed Phase 2 individually. Collaborative dyads moved to a shared computer and completed the tasks together. Participants therefore recalled the same lists as in Phase 1 in the following order: (1) recall of the word list, (2) recall of the event list, (3) recall of the people list, and (4) recall of the autobiographical memories.

Word list recall. For the word list, I told collaborative dyads, “For this next task I will give you three minutes to type into the computer as many words as you can remember from the list you saw earlier. Please try to remember the words from the original list, rather than just what you typed earlier. Please try to work together as much as possible.” I gave nominal dyads the same instructions, omitting the last sentence about working together. Collaborative dyads worked together on this task and nominal dyads worked individually.

Event list recall. For the event list, I told collaborative strangers, "I will give you four minutes to type into the computer as many news events that occurred in the past twelve months as you can think of. You don't have to type them in any particular order. Please don't just try to retype what you typed earlier, please come up with the list again, together. Please try to work as together as much as possible to recall the events." I told collaborative friends, "I will give you four minutes to type into the computer as many of the social events that you shared in the past twelve months as you can think of. You don't have to type them in any particular order. Please don't just try to retype what you typed earlier, please come up with the list again, together. Please try to work together as much as possible to recall the events." I told collaborative siblings, "I will give you four minutes to type into the computer as many of the holidays you have taken together as you can think of. You don't have to type them in any particular order. Please don't just try to retype what you typed earlier, please come up with the list again, together. Please try to work as together as much as possible to recall the holidays." I gave nominal strangers, friends, and siblings the same instructions omitting the last sentence about working together. Collaborative dyads worked together on this task and nominal dyads worked individually.

People list recall. For the people list, I told the first 14 collaborative strangers that I tested, "For this next task I will give you four minutes to type into the computer as many names of Psychology lecturers and tutors at this university that you know. You don't have to type them in any particular order. Please don't just try to retype what you typed earlier, please come up with the list again, together." I gave the first 19 nominal strangers that I tested the same instructions, omitting the last sentence concerning working together. I told the remaining 12 collaborative strangers, "For this next task I will give you four minutes to type into the computer as many names of current Hollywood movie stars that you know. You don't have to type them in any particular order. Please don't just try to retype what you typed earlier, please come up with the list again, together." I gave the remaining eight nominal strangers that I tested the same instructions, omitting the last sentence about working together.

I told collaborative friends and siblings, "For this next task I will give you four minutes to type into the computer as many names of your mutual friends and acquaintances that you can think of. You don't have to type them in any particular order. Please don't just try to retype what you typed earlier, please come up with the list again, together. Please try to work together as much as possible." I gave nominal strangers, friends, and siblings the same instructions omitting the parts about working together. Collaborative dyads worked together on this task and nominal dyads worked individually.

I did not give collaborative dyads specific instructions on how to collaborate to prevent interfering with their collaborative processes. The shared keyboard forced collaborative dyads to negotiate the typing. I told them that could decide who typed or whether they shared the typing. Most collaborative dyads negotiated the typing before they began each task or at the beginning of Phase 2.

Post-experiment interview and debriefing. At the end of Phase 2, participants completed the questionnaires, and were debriefed before leaving.

Coding

Product coding. As all participants generated the lists individually in Phase 1, I created a pooled dyad score for each list. To do this, I pooled the non-overlapping responses of each member of that dyad. That is, I counted each unique item recalled by each dyad member and only counted once any items recalled by both dyad members. I used the same method to create nominal dyads' scores in Phase 2. Collaborative dyads' recall was simply the number of items they recalled for each task.

Because the lists of people and events depended on participant-generated stimuli, I based analyses for these tasks on performance in Phase 2 compared to Phase 1 (proportional recall), to take into account differences in baseline recall for different dyads. In order to make this comparison, I calculated proportional recall for each dyad for each task using the equation:

$$Proportional\ recall = (Phase\ 2\ Recall - Phase\ 1\ Elicitation) \,/\, (Phase\ 1\ Elicitation)$$

Proportional recall was negative if dyads recalled fewer items in Phase 2 than Phase 1, and positive if they recalled more items in Phase 2 than Phase 1. If they recalled the same number of items in Phase 1 and Phase 2, proportional recall was 0. For instance, if a dyad elicited six items in Phase 1 and recalled eight items in Phase 2, their proportional recall would be (8 - 6) / 6 = 0.33. If a dyad elicited ten items in Phase 1 and recalled eight items in Phase 2, their proportional recall would be (8 – 10) / 10 = -0.2.

Across tasks, I was interested in whether strangers, friends, and siblings showed collaborative inhibition. In the word list, I defined collaborative inhibition as occurring if nominal dyads recalled more words in Phase 2 than collaborative dyads, and collaborative facilitation as occurring if collaborative dyads recalled more words in Phase 2 than nominal dyads. In the people and event lists, I defined collaborative inhibition as occurring if nominal dyads' proportional recall was higher than collaborative dyads' proportional recall, and collaborative facilitation as occurring if collaborative dyads' proportional recall was higher than nominal dyads' proportional recall. Therefore, for the word list, collaborative inhibition was a between subjects measure (nominal dyads compared to collaborative dyads). In the people and event lists, collaborative inhibition was a combination of a between subjects measure (nominal dyads compared to collaborative dyads) and a within subjects measure as indexed by proportional recall (Phase 2 recall as a proportion of Phase 1 elicitation).

Items gained and lost. In order to understand the mechanisms by which collaborative inhibition might occur amongst strangers, friends, and siblings, I counted the number of items gained and the number of items lost from Phase 1 to Phase 2 in the word list, people list, and event list. I then divided the number of items gained and lost by each dyad by their Phase 1 recall or elicitation and multiplied it by 100, creating two scores for each dyad on each task: percentage of items gained and percentage of items lost. Thus, I used the following two equations to calculate the percentage of items gained and lost, respectively:

Percentage of items gained = 100((Items gained) / (P□ase 1 Elicitation))*

Percentage of items lost = 100((Items lost) / (P□ase 1 Elicitation))*

In collaborative dyads, I counted an item as gained if it appeared in their Phase 2 collaborative recall but not in either member's Phase 1 elicitation or recall. In nominal dyads, I counted an item as gained if it appeared in either member's Phase 2 recall but not in either member's Phase 1 elicitation or recall. I counted an item as lost in collaborative dyads if it appeared in at least one dyad member's Phase 1 elicitation or recall but not in their Phase 2 collaborative recall. I counted an item as lost in nominal dyads if it appeared in either dyad member's Phase 1 elicitation or recall but in neither dyad member's Phase 2 recall. That is, if an item appeared in member A's Phase 1 recall and then only in member B's Phase 2 recall, I did not count it as gained or lost, even though it was lost from member A's individual recall and gained in member B's individual recall.

Collaboration style. *Collaborative process coding.* I coded collaborative dyads' typed recall for the presence or absence of category use, and the transcripts of their interactions during the tasks for the presence or absence of: (1) group strategy use, (2) individual strategy use, (3) successful cues, (4) unsuccessful cues, (5) mirrored repetitions, and (6) corrections or disagreements. I then also counted the number of turns in the transcript that were: (1) successful cues, (2) unsuccessful cues, (3) mirrored repetitions, and (4) corrections or disagreements. I therefore created seven categorical process variables for each task that showed the presence or absence of each collaborative process (category use, group strategy use, individual strategy use, successful cues, unsuccessful cue, mirrored repetitions, and corrections and disagreements) across the whole transcript, and four continuous process variables for each task that showed the number of turns (conversational units that began when one partner started speaking and ended when the other partner spoke) that represented each collaborative process within each transcript.

I defined category use as more than one instance of: two or more words from the same category being recalled together in the word list, two or more related names being recalled together in the people list (two or more names with the same first or last name, or two or more names that had occurred together in at least one participant's elicitation), or two or more related events being recalled together in the event list.

I coded transcripts of collaborative dyads' interactions for the presence or absence of group strategy and individual strategy. Group strategy use could be explicit or implicit, and was defined as both participants coordinating their recall with each other. Individual strategy use was defined as one participant using his or her own strategy that the other participant did not use, such as associations developed in encoding. Use of categories could be classed as a group strategy if both participants used categories to coordinate their recall, or an individual strategy if only one participant used categories.

I defined cues in a broad sense to include all instances in which one participant attempted to elicit information from the other participant. Cues could include questions such as "what was the other tool?" or statements such as "there was another tool", open-ended questions such as "what else?" or narrow questions such as "did you say screwdriver?" I used this broad definition of cues so as to incorporate all of the ways that participants could attempt to elicit information from their collaborating partner. I coded cues as successful if a question or statement successfully elicited new task-relevant information. This could be a whole item, such as "screwdriver," or a partial item, such as "Smith," in reply to "what is Tom's last name?" in the people list. Note that in cases such as "did you say screwdriver?" I considered a reply of "yes" or "no" to indicate a successful cue, and a reply of "I don't remember screwdriver" or "I don't know" to indicate an unsuccessful cue. I coded cues as unsuccessful if a question or statement did not elicit new task-relevant information.

I coded a turn as a mirrored repetition if one participant immediately repeated an item said by their partner. The repetition could be the whole item or part of an item. I only counted mirrored repetitions if the repetition occurred in the next turn. The mirrored repetition could be uttered as a question (e.g., “screwdriver”, “screwdriver?” in response to a question such as “screwdriver?”, “yeah screwdriver”, as part of a sentence such as “screwdriver”, “There was screwdriver”), or as a simple re-statement, such as. “screwdriver”, “screwdriver”.

I coded a turn as a correction or disagreement if one participant explicitly corrected or disagreed with their partner. I included instances in which one participant rejected or corrected their partner’s input, or disagreed with the way their partner performed the task or which items were relevant to the task. I did not include instances in which one participant indicated doubt over their partner’s input (e.g., by saying “maybe”, or “I don’t remember”) because the response was not an explicit correction or disagreement. I also did not include “no” responses to questions (e.g. “was there screwdriver?” no there was no screwdriver”) as corrections or disagreements (see Appendix A for the collaborative process coding scheme for typed lists).

Distribution of words and turn taking. In order to gain a better understanding of how dyad members shared the task, I coded collaborative dyads’ transcripts for: (1) whether one or both dyad members typed in each task, (2) the difference in the proportion of words spoken by each member, and (3) mean words per turn. When dyads changed who was typing, they would either negotiate it verbally or I noted the sound of the keyboard moving across the desk. A shift in who was typing indicated a shift in the member controlling what was recorded, and tended to occur when the member who was not typing had more expertise in that section of the task. Thus, I was able to note in the transcripts when participants were typing, which allowed me to determine the number of members who typed during the task.

I calculated the difference in the proportion of words spoken by each member of a dyad in each transcript by counting the number of words spoken by each member, dividing each by the total number of turns, and taking the difference between member A's and member B's proportion of total words spoken. This variable indicated how much one member dominated the conversation during the task. Lower scores on this variable indicated that the conversation was more evenly distributed between members, and higher scores indicated that one member spoke more than the other member, suggesting they may have dominated recall or at least the way they approached the task.

Finally, I calculated the mean words per turn in each transcript. Lower mean words per turn (shorter turns) indicated rapid turn taking, for instance because participants discussed the task very little beyond naming items. Higher mean words per turn (longer turns) indicated longer monologues, for instance because one dyad member listed many items at once, participants discussed items in more detail, talked about how to do the task, or talked about topics not related to the task.

Results

I present a series of five analyses: (1) tests for baseline differences in pooled individual Phase 1 recall and elicitation, (2) tests for collaborative inhibition in Phase 2, (3) analysis of items gained and lost from Phase 1 to Phase 2, (4) analysis of collaboration style, including collaborative processes in collaborative dyads' Phase 2 recall performance and distribution of words and turn taking, and (5) analysis of questionnaire data. I present analyses of each task separately within each section. In Section 4 (analysis of collaborative processes), I present separate analyses of each process for each task. In Section 5 (analysis of questionnaire data), I present separate analyses for each questionnaire.

In all analyses of the "people list" task, I only included data for friends and siblings, giving it a 2 x 2 (relationship x collaboration condition) design. I was forced to exclude strangers from this task because they knew so few names of Psychology lecturers and tutors at Macquarie University that they struggled with the task. I changed strangers' stimuli midway through the experiment to current Hollywood movie stars to prevent floor effects and to maintain the timing of the rest of the tasks. As strangers performed one of two tasks for the people list, I excluded them from the final analysis. However, where applicable, I report strangers' product results without statistical analysis for the six collaborative and four nominal dyads who completed the Hollywood movie stars task.

Across all analyses, when I found a significant effect of relationship in the word list and event list, I used planned Helmert contrasts to determine whether: (1) strangers were significantly different from friends and siblings combined, and (2) friends and siblings were different from each other. Helmert contrasts are orthogonal contrasts that compare each level of a variable to the mean of the subsequent levels of the variable. Therefore, the first contrast always compared strangers to the mean of friends and siblings, and the second contrast compared friends and siblings to each other.

Baseline Phase 1 Recall and Elicitation

Word list. Baseline word list recall ranged from 9 to 24 words (see Table 2.1 for means). Using a 3 x 2 (relationship x collaborative condition) ANOVA, I found no evidence of any baseline differences due to relationship or collaborative condition, all Fs < 1.60, all ps $> .210$. I did find a significant interaction between relationship and collaborative condition, $F(2, 70) = 3.17$, $p = .048$, $\eta_p^2 = .08$. However, when I performed follow-up t-tests comparing pre-collaborative and nominal dyads for each relationship separately, I found no differences for stranger or sibling dyads, and pre-collaborative friends recalled only marginally more words than nominal friends, $t(22) = 2.06$, $p = .051$. Thus, I found insufficient evidence for baseline differences in word list recall prior to the experimental manipulation. These findings suggest that all groups learned the list equally well.

People list. Baseline elicitation of friend and sibling dyads' pooled individual recall of mutual friends and acquaintances ranged from 5 to 80 names (see Table 2.1 for means). I found no evidence of any baseline differences between pre-collaborative and nominal dyads, $F(1, 48) = 0.57$, $p = .456$, between friends and siblings, $F(1, 48) = 1.11$, $p = .298$, or any interaction between them, $F(1, 48) = 0.20$, $p = .654$. However, the longer friends had known each other in years, the more names of mutual friends and acquaintances they elicited, $r = .50$, $p = .009$, demonstrating that friends who had known each other for longer had more mutual friends and acquaintances.

The subset of stranger dyads who recalled Hollywood movie stars had pooled individual recall ranging from 21 to 42 names (see Table 2.1 for means). Although I excluded strangers from my analysis, there did not appear to be a substantial difference between pre-collaborative and nominal dyads' elicitation of Hollywood movie stars, although pre-collaborative dyads elicited slightly fewer names than nominal dyads.

Event list. Baseline elicitation of dyads' pooled individual recall ranged from 2 to 34 events (see Table 2.1 for means). I found no evidence of any baseline differences between pre-collaborative and nominal dyads, $F(1, 70) = 0.40$, $p = .529$, between strangers, friends, and siblings recalling news events, shared social events, and shared holidays, respectively, $F(2, 70) = 1.29$, $p = .282$, or any interaction, $F(2, 70) = 1.57$, $p = .215$.

Baseline summary. I found no evidence for baseline differences between nominal and collaborative dyads in all relationships for all three tasks. Thus, all tasks were successful and comparable across the different relationship types.

Table 2.1

Mean Baseline Recall and Elicitation Scores by Task, Relationship, and Collaborative Condition

Relationship	Nominal	Collaborative[a]	Total
		Word List Recall 1	
Strangers	20.54 (2.50)	18.69 (3.68)	19.62 (3.23)
Friends	16.85 (3.67)	19.91 (3.56)	18.25 (3.87)
Siblings	18.55 (2.87)	18.77 (3.19)	17.88 (3.98)
Total	18.65 (3.37)	19.08 (3.43)	18.59 (3.73)
		People List Elicitation	
Strangers[b]	33.75 (7.41)	28.67 (7.69)	30.70 (7.62)
Friends	35.08 (12.24)	40.00 (13.93)	37.54 (13.09)
Siblings	32.62 (19.59)	33.85 (11.94)	33.23 (15.91)
Total[c]	30.48 (12.16)	36.92 (13.09)	35.38 (14.59)
		Event List Elicitation	
Strangers	12.00 (4.49)	14.23 (4.21)	13.15 (4.45)
Friends	12.00 (4.93)	13.62 (6.23)	14.88 (7.65)
Siblings	10.69 (6.20)	13.69 (6.09)	12.19 (6.13)
Total	11.48 (5.19)	13.85 (5.44)	13.39 (6.21)

Note. Standard deviations appear in parentheses. All scores are pooled dyad scores of individual recall or elicitation.

[a]Individual performance prior to collaboration. Collaborative dyads participated individually in Phase 1, and their scores were pooled in the same way as nominal dyads in this phase.

[b]Strangers who completed the Hollywood movie stars task only. For collaborative dyads, N = 6, and for nominal dyads, N = 4.

[c]Total is for friends and siblings only.

Effects of Collaboration

Word list. Proportional recall of the word list was quite high overall (see Table 2.2 for means). Using a 3 x 2 (relationship x collaborative condition) ANOVA, I found no difference in word list recall due to relationship or collaborative condition, all *F*s < 1.61, all *p*s > .206. Although, I found a significant interaction between relationship and collaborative condition, $F(2, 70) = 3.13$, $p = .050$, $\eta_p^2 = .08$, when I performed follow-up t-tests comparing collaborative and nominal dyads' word list recall for each relationship separately, I found no significant differences, all *t*s < 1.8, *p*s > .093. Thus, I found no evidence of collaborative inhibition in recall of the word list, across all relationships. However, there was a trend for strangers to show collaborative inhibition, and friends and siblings to show collaborative facilitation (see Table 2.2).

People list. Proportional recall of the people list was positive overall, meaning dyads recalled more mutual friends and acquaintances in Phase 2 than in Phase 1 (see Table 2.2 for means). Using a 2 x 2 (relationship x collaborative condition) ANOVA, I found no difference in recall of mutual friends and acquaintances between collaborative and nominal dyads, between friends and siblings, or any interaction between them, all *F*s < 1.79, all *p*s > .188. Thus, I found no evidence of collaborative inhibition in recall of mutual friends and acquaintances. However, there was a trend for siblings to show collaborative inhibition but for friends to show collaborative facilitation.

Strangers' proportional recall of Hollywood movie stars was slightly positive overall, although very close to 0, suggesting that their recall did not change much from Phase 1 to Phase 2 (see Table 2.2 for means). Although I was unable to perform statistical analysis on strangers' proportional recall, the pattern of their results trended towards collaborative inhibition, with collaborative dyads having slightly negative proportional recall and nominal dyads having positive proportional recall (see Table 2.2).

Event list. Proportional recall of the event list was positive overall, meaning dyads recalled more news events, shared social events, and shared holidays in the second recall test than in the first recall test (see Table 2.2 for means). I found nominal dyads recalled more events than collaborative dyads $F(1, 70) = 18.02$, $p < .001$, $\eta_p^2 = .20$. I found no difference between strangers, friends, and siblings, $F(2, 70) = 0.95$, $p = .393$. However I found an interaction between relationship and collaborative condition, $F(2, 70) = 7.41$, $p = .001$, $\eta_p^2 = .17$. When I performed separate t-tests comparing collaborative and nominal dyads' recall of events for each relationship separately, I found collaborative inhibition in stranger dyads' recall of the news events, $t(24) = 4.72$, $p < .001$, $d = 1.92$, but not in friend dyads' recall of shared social events or sibling dyads' recall of shared holidays, all ts < 1.04, all ps > .307. Thus, I found evidence of collaborative inhibition for strangers recalling news events, but not for friends and siblings recalling events they had shared. However, I did find a slight trend towards collaborative inhibition in friends and siblings (see Table 2.2).

Collaborative inhibition summary. I found no collaborative inhibition for friends and siblings in any task. That is, collaborative friend and sibling dyads recalled as many words, mutual friends and acquaintances, and shared social events or holidays as nominal friend and sibling dyads. I only found collaborative inhibition for strangers recalling news events; collaborative stranger dyads recalled as many words from the word list as nominal dyads, although they may have been subject to ceiling effects. In eight comparisons between collaborative and nominal dyads, I found significant collaborative inhibition once.

Items Gained and Lost

Word list. In Phase 2, dyads gained few new words compared to Phase 1 ($M = 3.75\%$ of Phase 1 recall, $SD = 6.13$). Dyads lost slightly more words from Phase 1 to Phase 2 than they gained ($M = 5.18\%$ of Phase 1 recall, $SD = 7.31$). The number of new words gained ranged from 0 to 27.27% of Phase 1 and the number of words lost ranged from 0 to 35.71% of

Phase 1. The large standard deviations show that the percentage of words gained and lost varied greatly across dyads.

Table 2.2

Mean Phase 2 Recall by Task, Relationship, and Collaborative Condition

Relationship	Nominal	Collaborative	Total	Collaborative - Nominal[b]
		Word List Proportion of Total Correct		
Strangers	.86 (.11)	.75 (.19)	.80 (.16)	-0.11
Friends	.72 (.16)	.80 (.14)	.76 (.15)	0.08
Siblings	.69 (.19)	.77 (.15)	.73 (.16)	0.08
Total	.76 (.16)	.77 (.16)	.76 (.16)	0.01
		People List Recall 2 as Proportion of Elicitation		
Strangers[a]	.19 (.09)	-.08 (.21)	.03 (.22)	-0.27
Friends	.13 (.25)	.20 (.35)	.16 (.30)	0.07
Siblings	.33 (.37)	.17 (.24)	.25 (.31)	-0.16
Total	.23 (.33)	.18 (.30)	.21 (.31)	-0.05
		Event List Recall 2 as Proportion of Elicitation		
Strangers	.42 (.41)	-.14 (.12)	.14 (.41)	-0.56
Friends	.12 (.30)	.01 (.24)	.06 (.27)	-0.11
Siblings	.09 (.19)	.02 (.13)	.05 (.16)	-0.07
Total	.22 (.34)	-.04 (.18)	.09 (.30)	-0.26

Note. Standard deviations appear in parentheses.

[a]Strangers who completed the Hollywood movie stars task only. For collaborative dyads, N = 6, and for nominal dyads, N = 4.

[b]Difference = Collaborative – Nominal.

Using a 2 x 3 (relationship x collaborative condition) ANOVA, I found a marginally significant interaction between relationship and collaborative condition for the percentage of words gained from Recall 1 to Recall 2, $F(2, 70) = 3.06$, $p = .053$, as there was a trend towards nominal friends gaining more words and collaborative friends gaining fewer words than the other groups. I found no other significant effects of relationship, collaborative condition or the interaction between them for the percentage of words gained or lost, all Fs < 2.82, all ps > .098. Thus, there was no consistent evidence that relationship or collaborative condition influenced the gain or loss of words from Phase 1 to Phase 2, paralleling the lack of collaborative inhibition or facilitation in this task.

People list. In Phase 2, friend and sibling dyads gained a mean of 37.99% (SD = 25.88) of the names they elicited in Phase 1 and lost a mean of 18.88% (SD = 12.49) names (see Table 2.3 for mean names gained and lost as a percentage of people list elicitation). The percentage of names gained ranged from 0 to 117.65% (meaning they gained more names than they elicited in Phase 1), and the percentage of names lost ranged from 0 to 56.76%.

In Phase 2, stranger dyads who recalled Hollywood movie stars gained a mean of 39.41% of the names they elicited in Phase 1 (SD = 15.57) and lost a mean of 36.96% of the names they elicited (SD = 11.83). The percentage of names gained ranged from 11.90% to 60.71%, and the percentage of names lost ranged from 15.79% to 59.26%. All dyads gained and lost at least one name. Although stranger dyads gained and lost a large number of names from Phase 1 to Phase 2, their proportional recall was close to 0, indicating that overall, the number of names gained and lost was close to equal.

For friends and siblings, I found no effects of relationship or collaborative condition on the percentage of names gained or lost from Recall 1 to Recall 2, all Fs < 2.85, all ps > .098. Thus, I found that the gains and losses they made were not meaningfully related to relationship or to collaboration. Instead, I found large individual differences across dyads in all relationships and collaborative conditions.

Table 2.3

Mean Items Gained and Lost in Phase 2 as a Percentage of Number of Items Elicited in Phase 1 by Task, Relationship, and Collaborative Condition

	Nominal		Collaborative		Total	
Relationship	Gained	Lost	Gained	Lost	Gained	Lost
			Word List			
Strangers	2.43 (3.65)	2.47 (3.72)	4.02 (4.73)	8.22 (10.42)	3.22 (4.22)	5.35 (8.21)
Friends	7.14 (10.42)	4.28 (4.60)	0.83 (1.84)	5.13 (5.84)	4.25 (8.27)	4.67 (5.10)
Siblings	3.63 (6.84)	4.55 (6.21)	4.00 (4.29)	6.42 (10.10)	3.82 (5.59)	5.49 (8.27)
Total	4.40 (7.57)	3.77 (4.91)	3.07 (4.09)	6.67 (9.02)	3.75 (6.13)	5.18 (8.27)
			People List			
Strangers[a]	14.4 (6.91)	9.80 (3.11)	8.33 (2.50)	11.50 (4.59)	11.09 (5.68)	10.73 (3.90)
Friends	27.17 (15.02)	20.67 (16.38)	38.27 (27.78)	19.20 (11.45)	32.72 (22.60)	19.94 (13.86)
Siblings	46.53 (34.16)	12.81 (10.60)	39.99 (21.74)	22.83 (9.53)	43.26 (28.25)	17.82 (11.12)
Total	36.85 (27.68)	16.74 (14.10)	39.13 (24.45)	21.02 (10.49)	37.99 (25.88)	18.88 (12.49)
			Event List			
Strangers	91.32 (43.50)	41.35 (31.61)	29.72 (13.61)	39.63 (16.05)	60.52 (44.54)	40.49 (24.58)
Friends	36.32 (27.58)	12.97 (13.03)	21.02 (22.75)	25.15 (15.47)	23.19 (24.35)	20.17 (15.46)
Siblings	16.52 (20.66)	4.82 (5.67)	11.44 (9.65)	10.40 (14.66)	13.98 (16.01)	7.61 (11.26)
Total	46.82 (47.08)	20.48 (26.06)	20.73 (17.57)	25.06 (19.26)	33.07 (36.95)	22.90 (22.69)

Note. Standard deviations appear in parentheses.

[a]Strangers who completed the Hollywood movie stars task only. For collaborative dyads, N = 6, and for nominal dyads, N = 4.

Event list. In Phase 2, dyads gained a mean of 33.07% of the events they elicited (*SD* = 36.95) and lost a mean of 22.90% of the events (*SD* = 22.69) (see Table 2.3 for mean events gained and lost as a percentage of event list elicitation). The percentage of events gained ranged from 0 to 160% (meaning they gained more items than they elicited in Phase 1), and the number of events lost ranged from 0 to 100% (meaning none of the events they elicited in Phase 1 were recalled in Phase 2). The high variability in the data, as revealed by the large standard deviations, may be caused by the different stimuli used by strangers, friends, and siblings (news events, shared social events and shared holidays, respectively). Strangers gained a mean of 60.52% of the news events they elicited in Phase 1 and lost a mean of 40.49%. Friends gained a mean of 23.19% of the shared social events they elicited in Phase 1 and lost a mean of 20.17%. Siblings gained a mean of 13.98% of the shared holidays they elicited in Phase 1 and lost a mean of 7.61%. Therefore, it appeared that siblings' recall of shared holidays was more stable than friends' recall of shared social events and especially strangers' recall of news events. These potential differences should be taken into account when interpreting the data below.

I found that collaborative dyads gained a lower percentage of events from Phase 1 to Phase 2 than nominal dyads, $F(1, 70) = 10.23$, $p = .002$, $\eta_p^2 = .13$. I also found a significant effect of relationship on the percentage of events gained and the percentage of events lost. Following up the overall ANOVA using planned Helmert contrasts, I found that strangers (M = 60.52, SD = 44.54) gained a significantly higher percentage of events than friends and siblings, $p < .001$. Friends (M = 23.19, SD = 24.35) and siblings (M = 13.98, SD = 16.00) gained a similar percentage of events to each other, $p = .194$. I also found a significant interaction between relationship and collaborative condition, $F(2, 70) = 5.14$, $p = .008$, η_p^2 = .13. In separate t-tests comparing collaborative and nominal dyads for each relationship separately, I found that collaborative dyads gained a lower percentage of items than nominal dyads for strangers, $t(24) = 4.87$, $p < .001$, $d = 1.99$, but not for friends or siblings, all *t*s <

0.82, all *p*s > .429. Thus, I found that collaboration reduced the percentage of news events gained by strangers. I found no evidence that collaboration influenced the percentage of shared social events gained by friends or the percentage of shared holidays gained by siblings.

I found a similar pattern of results for loss of events from Phase 1 to Phase 2. Collaborative dyads lost a higher percentage of events from Phase 1 to Phase 2 than nominal dyads, $F(1, 69) = 4.06$, $p = .048$, $\eta_p^2 = .06$. I found a significant effect of relationship on the percentage of events lost, $F(2, 69) = 13.41$, $p < .001$, $\eta_p^2 = .28$. Using planned Helmert contrasts, I found that strangers ($M = 40.49$, $SD = 24.57$) lost a significantly higher percentage of events than friends and siblings, $p < .001$, and friends ($M = 20.17$, $SD = 15.46$) lost a higher percentage of events than siblings ($M = 7.61$, $SD = 11.26$), $p = .034$. I found no interaction between relationship and collaborative condition in terms of events lost from Phase 1 to Phase 2, $F(2, 69) = 0.08$, $p = .920$. Thus, I found that collaboration increased the percentage of events lost from Phase 1 to Phase 2, and strangers recalling news events lost more events than friends recalling shared social events, who lost more events than siblings recalling shared holidays.

Items gained and lost summary. The results for items gained and lost mirror my findings reported above regarding a lack of collaborative inhibition in most tasks. There were no significant effects of relationship or collaborative condition on items gained or lost in the word list and people list, reflecting the lack of collaborative inhibition, and the lack of relationship effects I found in these tasks. Collaborative and nominal friend and sibling dyads recalling shared social events and shared holidays also showed equal gains and losses, reflecting their lack of collaborative inhibition. Collaborative stranger dyads recalling news events gained fewer items than nominal stranger dyads, which may have been due to the nature of the task, as news events are a broader category than events friends and siblings shared together.

Collaboration Style

Collaborative process coding. In order to further investigate why my groups appeared to collaborate particularly effectively (at least in terms of eliminating collaborative inhibition), I coded collaborative dyads' transcripts and typed recall for three collaborative processes corresponding to Factor 1 (group-diminishing), and four collaborative processes corresponding to Factor 2 (group-enhancing) from Harris et al. (2011). Factor 1 collaborative processes included one dyad member using an individual strategy that their partner could not use, unsuccessful cuing attempts, and corrections and disagreements. One explanation for my lack of collaborative inhibition could be that collaborative dyads used more Factor 2 processes than Factor 1 processes. Factor 2 collaborative processes included use of categories to support recall, use of a coordinated group strategy to support recall, successful cuing attempts, and mirrored repetitions (repetitions of the most recent item recalled by one's collaborative partner).

Below I present the results of two scoring methods for Factor 1 and 2 collaborative processes. The first method was the number and percentage of dyads using each collaborative process in their interactions, which I performed for all collaborative processes (see Table 2.4). The second method was the number of turns within each interaction representing each countable collaborative process (successful cues, mirrored repetition, unsuccessful cues, and corrections and disagreements; see Table 2.5).

Factor 1 collaborative processes. *Individual strategy use***.** In each transcript, I coded for the presence of an individual strategy. Few dyads used an individual strategy across the three lists (see Table 2.4). Strangers, friends, and siblings were equally unlikely to use an individual strategy in the word list, $\chi^2 = 1.10$, $p = .282$, and event list, $\chi^2 = 0.31$, $p = .855$, and friends and siblings were equally unlikely to use an individual strategy in the people list, $\chi^2 = 2.85$, $p = .092$. These findings help to explain the finding of collaborative inhibition in only one of nine instances.

Table 2.4

Number and Percentage of Dyads Using Collaborative Process Coding Variables by Relationship and Task

		Factor 1			Factor 2			
Relationship	N^a	Individual Strategy	Unsuccessful Cues	Corrections and disagreements	Categories	Group Strategy	Successful Cues	Mirrored Repetitions
Word list								
Strangers	12	4 (33.3%)	11 (91.7%)	3 (25.0%)	10 (76.9%)	11 (91.7%)	11 (91.7%)	10 (83.3%)
Friends	11	4 (36.4%)	10 (90.9%)	8 (72.7%)	10 (76.9%)	8 (72.7%)	5 (45.5%)	9 (81.8%)
Siblings	13	6 (46.2%)	12 (92.3%)	12 (92.3%)	8 (61.5%)	11 (84.6%)	8 (61.5%)	12 (92.3%)
People list								
Friends	10	2 (20.0%)	6 (60.0%)	9 (90.0%)	12 (92.3%)	8 (80.0%)	10 (100%)	10 (100%)
Siblings	13	0 (0%)	12 (92.3%)	12 (92.3%)	13 (100%)	10 (76.9%)	13 (100%)	13 (100%)
Total	23	2 (8.7%)	18 (78.3%)	21 (91.3%)	25 (96.2%)	18 (78.3%)	22 (100%)	23 (100%)
Event list								
Strangers	12	2 (16.7%)	12 (100%)	5 (41.7%)	9 (69.2%)	3 (25.0%)	10 (83.3%)	9 (75.0%)
Friends	11	1 (9.1%)	11 (100%)	10 (90.9%)	8 (61.5%)	3 (27.3%)	11 (100%)	11 (100%)
Siblings	13	2 (15.4%)	12 (92.3%)	13 (100%)	10 (76.9%)	7 (53.8%)	13 (100%)	13 (100%)
Total	36	5 (13.9%)	35 (97.2%)	28 (77.8%)	27 (69.2%)	13 (36.1%)	34 (94.4%)	33 (91.7%)

[a]For category coding $N = 13$ for strangers, friends, and siblings. For all other variables N is as stated due to errors in audio recording.

Table 2.5

Mean Number and Percentage of Turns Showing Each Collaborative Process by Task and Relationship

Relationship	Successful Cues	Mirrored Repetitions	Unsuccessful Cues	Corrections and disagreements
		Word list		
Strangers	2.67 (1.87) 6%	6.08 (5.20) 12%	2.83 (2.69) 5%	0.75 (1.60) 1%
Friends	1.91 (2.95) 3%	3.73 (3.29) 7%	1.82 (1.17) 3%	3.18 (3.76) 7%
Siblings	1.85 (2.03) 3%	4.62 (3.55) 8%	2.69 (1.80) 5%	6.08 (5.50) 12%
Total	2.14 (2.27) 4%	4.83 (4.10) 9%	2.47 (1.99) 5%	3.42 (4.51) 7%
		People list		
Friends	4.90 (2.08) 6%	9.70 (7.67) 11%	3.20 (3.58) 4%	6.30 (6.98) 7%
Siblings	4.85 (2.34) 6%	8.46 (3.78) 10%	2.85 (1.99) 3%	8.00 (7.84) 9%
Total	4.87 (2.18) 6%	9.00 (5.68) 10%	3.00 (2.73) 4%	7.26 (7.36) 8%
		Event list		
Strangers	3.17 (2.08) 6%	2.25 (2.05) 4%	3.50 (2.28) 7%	0.83 (1.19) 1%
Friends	3.64 (2.38) 5%	3.09 (2.66) 5%	1.73 (0.65) 3%	3.82 (3.97) 5%
Siblings	6.08 (3.82) 8%	6.38 (3.93) 8%	3.08 (2.10) 4%	10.69 (10.33) 13%
Total	4.36 (3.12) 6%	4.00 (3.47) 6%	2.81 (1.95) 5%	5.31 (7.74) 7%

Note. Standard deviations appear in parentheses.

Unsuccessful cues. In each transcript, I coded for: (1) the presence of unsuccessful cues (see Table 2.4), and (2) the number of turns that constituted unsuccessful cues (see Table 2.5). Unsuccessful cues were common across all three lists (see Table 2.4). In the word list, strangers, friends, and siblings were equally likely to have unsuccessful cues, $\chi^2 = 0.02$, $p = .992$. Dyads in all three relationships had an equal number of turns that were unsuccessful cues, $F(2, 33) = 0.86$, $p = .432$ (see Table 2.5). In the people list, siblings were marginally more likely to have unsuccessful cues than friends in the people list, $\chi^2 = 3.47$, $p = .063$. Friends and siblings had an equal number of turns that were unsuccessful cues, $F(1, 33) = 0.09$, $p = .766$. In the event list, strangers, friends, and siblings were equally likely to have unsuccessful cues, $\chi^2 = 1.82$, $p = .403$. I found a marginally significant effect of relationship on the number of turns that were unsuccessful cues, with friends having marginally fewer than strangers and siblings, $F(2, 33) = 2.83$, $p = .074$. Harris et al. (2011) found that unsuccessful cues negatively loaded on Factor 1, which meant that the absence of unsuccessful cues predicted poorer performance in their study. Therefore, the high rates of unsuccessful cues reflect my groups' collaborative success. However, as strangers had as many unsuccessful cues as friends and siblings in the event list, the rate of unsuccessful cues does not explain strangers' collaborative inhibition in this task.

Corrections and disagreements. In each transcript, I coded for: (1) the presence of corrections and disagreements (see Table 2.4), and (2) the number of turns that constituted corrections and disagreements (see Table 2.5). Corrections and disagreements occurred at different rates across the three tasks (see Table 2.4). In the word list, more siblings but fewer strangers had corrections and disagreements than friends, $\chi^2 = 12.79$, $p = .002$. I also found an effect of relationship on the number of turns that were corrections and disagreements, $F(2, 33) = 5.51$, $p = .009$, $\eta_p^2 = .25$ (see Table 2.5). Using planned Helmert contrasts, I found strangers had fewer turns that were corrections and disagreements than friends and siblings, $p = .010$. Friends and siblings had equal numbers of corrections and disagreements, $p = .088$. Thus, when recalling words, strangers had the fewest corrections and disagreements of the three relationships. In the people list, friends and siblings were equally likely to have corrections and disagreements, $\chi^2 = 0.04$, $p = .846$. Friends and siblings also had an equal number of turns that were corrections and disagreements, $F(1, 33) = 0.29$, $p = .595$. In the event list, more friends and siblings had corrections and disagreements than strangers, $\chi^2 = 13.87$, $p = .001$. I found an effect of relationship on the number of turns that were corrections and disagreements $F(2, 33) = 7.28$, $p = .002$, $\eta_p^2 = .31$ (see Table 2.5). Using planned Helmert contrasts, I found that friends and siblings had more corrections and disagreements than strangers, $p = .010$, and siblings had more than friends, $p = .016$. Thus, when recalling events, siblings had the most corrections and disagreements of the three relationships, and strangers had the fewest. Thus, unlike in Harris et al. (2011), corrections and disagreements did not appear to be group diminishing for friends and siblings, because despite their higher rates of corrections and disagreements than strangers, only strangers showed collaborative inhibition.

Factor 2 collaborative processes. *Category use.* In each transcript, I coded for the presence of the use of categories to support recall (see Table 2.4). Category use was common in all three lists, but especially so in the people list, in which they listed mutual friends and acquaintances. Dyads were more likely to use categories when recalling mutual friends and acquaintances than when recalling words and events because the lists of people's names were much longer on average than the lists of words and events (see Table 2.4), so may have required a greater reliance on categories to support recall. I found that strangers, friends, and siblings were equally likely to use categories when recalling both the word list, $\chi^2 = 1.01$, $p = .603$, and event list, $\chi^2 = 0.72$, $p = .697$, and friends and siblings were equally likely to use categories in the people list, $\chi^2 = 1.04$, $p = .308$. The widespread use of categories to support recall may have contributed to the lack of collaborative inhibition I found across tasks.

Group strategy use. In each transcript, I coded for the presence of a group-level strategy (see Table 2.4). Most dyads used a coordinated group strategy to recall the words and people's names, but few dyads used a group strategy to recall the events. The fact that less than half of dyads overall used a group strategy in the event list is consistent with my above findings of collaborative inhibition in this task. Strangers, friends, and siblings were equally likely to use a group strategy when recalling the word list, $\chi^2 = 1.51$, $p = .471$, and event list, $\chi^2 = 2.79$, $p = .248$, although somewhat more siblings used a group strategy in the event list. Friends and siblings were equally likely to use a group strategy in the people list, $\chi^2 = 0.03$, $p = .859$. The widespread use of a group strategy in the word and people lists may also have contributed to the lack of collaborative inhibition I found in these two tasks.

Successful cues. In each transcript, I coded for: (1) the presence of successful cues (see Table 2.4), and (2) the number of turns that constituted successful cues (see Table 2.5). Successful cues were common in most dyads' transcripts in all three tasks, but especially so in the people list, in which all dyads had successful cues (see Table 2.4). In the word list, marginally more strangers had successful cues than friends and siblings, $\chi^2 = 5.76$, $p = .056$. Dyads in all three relationships also had an equal number of turns that were successful cues, $F(2, 33) = 0.47$, $p = .627$ (see Table 2.5). In the people list, all friends and siblings had successful cues, with an equal number of turns that were successful cues, $F(1, 33) < 0.01$, $p = .955$. These findings are consistent with the lack of collaborative inhibition in these tasks.

In the event list, strangers, friends, and siblings were equally likely to have successful cues $\chi^2 = 4.24$, $p = .120$ (see Table 2.4). I found an effect of relationship on the number of turns that were successful cues, $F(2, 33) = 3.62$, $p = .038$, $\eta_p^2 = .18$ (see Table 2.5). Using planned Helmert contrasts, I found that strangers had an equal number of successful cues to friends and siblings, $p = .110$, while siblings had more successful cues than friends, $p = .049$. Thus, siblings recalling shared holidays had more successful cues than friends recalling shared social events and strangers recalling news events. This finding is consistent with siblings' lack of collaborative inhibition in this task.

Mirrored repetition. In each transcript, I coded for: (1) the presence of mirrored repetitions (see Table 2.4), and (2) the number of turns that constituted mirrored repetitions (see Table 2.5). Mirrored repetitions were common across all three lists (see Table 2.4). In the word list, strangers, friends, and siblings were equally likely to have mirrored repetitions, χ^2 = 0.66, p = .717. Dyads in all three relationships also had an equal number of turns that were mirrored repetitions, F(2, 33) = 0.97, p = .388 (see Table 2.5). In the people list, all friends and siblings had mirrored repetitions (see Table 2.4), and they had an equal number of mirrored repetitions (see Table 2.5), F(1, 21) = 0.26, p = .616. In the event list, fewer strangers than friends and siblings had mirrored repetitions, χ^2 = 6.55, p = .038, reflecting strangers' collaborative inhibition in this task. I also found an effect of relationship on the number of mirrored repetitions in the event list, F(2, 33) = 6.54, p = .004, η_p^2 = .28. Using planned Helmert contrasts, I found that strangers had fewer turns that were mirrored repetitions than friends and siblings, p = .027, and friends had fewer than siblings, p = .012. Thus, when recalling events, siblings had the most mirrored repetitions of the three relationships, and strangers had the least. Siblings' and friends' greater use of mirrored repetitions than strangers when recalling the event list is consistent with my findings regarding collaborative inhibition in this task.

Process coding summary. Strangers, friends, and siblings commonly used the four collaborative processes related to Harris et al.'s (2011) group-enhancing Factor 2 (categories, a group strategy, successful cues, and mirrored repetitions). The high rates of Factor 2 processes helps to explain the lack of collaborative inhibition I found across tasks. Dyads used group strategies less frequently in the event list, consistent with the collaborative inhibition I found in strangers recalling this list.

In terms of Harris et al.'s group-diminishing Factor 1 collaborative processes, strangers, friends, and siblings commonly used unsuccessful cues in all three tasks. As the absence of unsuccessful cues was associated with poorer performance in Harris et al.'s study, this finding is consistent with the collaborative success I found across tasks. Unsuccessful cues demonstrate that collaborative dyads at least attempted to cue each other. Strangers, friends, and siblings used individual strategies at relatively low rates, consistent with the lack of collaborative inhibition I found across most of the experiment. Friends and siblings had higher rates of corrections and disagreements, in terms of both the number of friends and siblings engaging in corrections and disagreements, and the number of corrections and disagreements they shared. Unlike in married couples, friends' and siblings' high rates of corrections and disagreements did not appear to reduce their collaborative success, because dyads in these relationships did not show any collaborative inhibition across the experiment.

Distribution of words and turn taking. ***Number of typers.*** I counted the number of dyad members typing in each task because it could indicate a change in which dyad member was considered to have more expertise in the task. The number of typers could be one, if only one dyad member typed the list, or two if the typer changed during the task or the typing was shared between dyad members. The vast majority of collaborative dyads had one member typing in each task. Only three dyads (8.3%) shared the typing amongst the two of them in the word list (one stranger dyad and two sibling dyads), only two friend dyads (8.7%) shared the typing during the people list, and five dyads (13.9%; two stranger dyads, one friend dyad and two sibling dyads) shared the typing during the event list. In the word list and the event list, strangers, friends, and siblings were equally likely to share the typing, $\chi^2 = 1.85$, $p = .397$, and $\chi^2 = 0.31$, $p = .855$, respectively, and in the people list, friends and siblings were equally likely to share the typing, $\chi^2 = 2.85$, $p = .092$. I found no evidence that a change in who was typing, which reflected changing expertise within the task, differed due to relationship in any task.

Proportion of words spoken by each dyad member. In all transcripts, I measured the proportion of words spoken by each dyad member, and calculated the difference between each dyad member's contribution. Higher scores indicated that one dyad member dominated the task, and lower scores indicated that both dyad members contributed equally to the task. In the word list, the difference in the proportion of words spoken by each dyad member ranged from .01, indicating that both members spoke an approximately equal number of words, to .85, indicating that one member spoke the majority of the words in the transcript, (M = .25, SD = 0.20). The difference in the proportion of words spoken by each member did not differ across stranger, friend, and sibling dyads in the word list, $F(2, 33) = 0.10$, $p = .903$. Thus, strangers, friends, and siblings shared the conversation to a similar extent in the word list. The difference in the proportion of words spoken by each member did not correlate with word list recall, $r = .11$, $p = .552$. Thus, the extent to which one member of the dyad dominated the conversation during the word list did not significantly affect the number of words the dyad recalled.

In the people list, the difference in the proportion of words spoken by each dyad member ranged from .02 to .35 (M =.14, SD = 0.09). This difference did not differ between friend and sibling dyads, $F(2, 33) = 0.10$, $p = .903$. Thus, friends and siblings shared the conversation to a similar extent when recalling a people list. Nevertheless the difference in the proportion of words spoken by each member correlated positively with proportional people list recall, $r = .57$, $p = .005$, and this effect appeared to be driven by siblings, $r = .60$, $p = .038$. Thus, the more one sibling dominated the conversation when recalling the people list, the more names they recalled in Phase 2 relative to their pooled individual recall in Phase 1.

In the event list, the difference in the proportion of words spoken by each dyad member ranged from .01 to .56 (M = .15, SD = 0.13). This difference did not differ across stranger, friend, and sibling dyads, $F(2, 33) = 1.01$, $p = .380$. Thus, strangers, friends, and siblings shared the conversation to a similar extent when recalling the event list. The difference in the proportion of words spoken by each dyad member did not correlate with event list recall, $r = .04$, $p = .841$. Thus, I found no evidence that the extent to which one member dominated the conversation when recalling the event list affected recall on this task.

Words per turn. I calculated the mean number of words per turn to determine how quickly the speaker changed within dyads in each task. More words per turn, or longer turns, indicated that there were more monologues in dyads' conversations during the task. Fewer words per turn, or shorter turns, indicated more rapid turn taking. In the word list, dyads said a mean of 5.38 words per turn (SD = 1.45). I found no significant difference in the number of words per turn across strangers, friends, and siblings, $F(2, 33) = 0.58$, $p = .568$. The number of words per turn did not correlate with word list recall, $r = .19$, $p = .280$.

In the people list, dyads said a mean of 4.84 words per turn (SD = 1.01). Siblings (M = 5.45, SD = 0.95) took longer turns than friends (M = 4.35, SD = 0.88), $F(1, 20) = 5.20$, $p = .034$, $\eta_p^2 = .21$, indicating that siblings discussed each name more, or said more names at a time than friends. However, the number of words per turn did not correlate with proportional people list recall, $r = -.10$, $p = .668$.

In the event list, dyads said a mean of 6.23 words per turn (SD = 1.47). I found no significant difference in the number of words per turn across strangers, friends, and siblings, $F(2, 33) = 0.58$, $p = .563$. The number of words per turn did not correlate with proportional event list recall, $r = .06$, $p = .711$. Thus, I found no evidence that words per turn influenced recall in this task. Therefore, there is no evidence that the amount dyads spoke about each item influenced how many items they recalled relative to Elicitation.

Distribution of words and turn taking summary. The task that showed the most effects of distribution of words and turn taking was the people list. When recalling mutual friends and acquaintances, siblings had longer turns than friends, and the more the conversation during the task was dominated by one sibling, the more people they recalled. The number of dyad members who typed in each task did not influence the product of recall, even though it may have indicated a change in dyad members' expertise.

Questionnaires

PAIR Inventory. I created dyad PAIR scores by summing each member's ratings for each subscale. Dyad scores may not necessarily reflect both dyad members' questionnaire ratings, as two dyads can get the same dyad scores even when individual dyad members give different ratings. For instance, two dyads might have a score of 40, even though in one dyad, both members had a score of 20, and in the other dyad, one member had a score of 30 and the other a score of 10. These two scores of 40 are clearly not equivalent to each other. However, as all of my other measures were dyad scores, this method was the most effective way to answer my research questions using individually rated questionnaires.

Friends rated themselves significantly higher than siblings on all five subscales of the PAIR Inventory: emotional intimacy, social intimacy, intellectual intimacy, recreational intimacy and conventionality, all Fs > 5.59, all ps < .022 (see Table 2.6). There were no significant effects of collaborative condition on any of the PAIR subscales, all Fs < 1.54, ps > .221, except for recreational intimacy, for which collaborative dyads (M = 3.68, SD = .43) rated themselves slightly higher than nominal dyads (M = 3.45, SD = .43), $F(1, 48) = 4.12$, $p = .048$, $\eta_p^2 = .08$. The fact that the friends rated themselves higher than siblings on the conventionality subscale as well as the four intimacy subscales suggests they may have been more concerned than siblings about making a good impression of their relationship.

The only PAIR subscale that correlated significantly with recall on any task was the recreational subscale, which correlated negatively with proportional event list recall, $r = -.38$, $p = .008$. In other words, the more friends and siblings rated themselves as having "shared experiences of interests in hobbies, mutual participation in sporting events" (Schaefer & Olson, 1981, p. 50) the fewer events they recalled in Phase 2 as a proportion of the events they recalled in Phase 1. Analysing this relationship by nominal and collaborative friend and sibling dyads separately showed this effect was only significant for nominal sibling dyads, $r = -.79$, $p = .002$, suggesting that recalling shared holidays a second time may be more difficult for siblings with high recreational intimacy, as they may have more items to recall than siblings with lower recreational intimacy. Indeed, recreational intimacy correlated positively with dyads' Phase 1 elicitation, $r = .30$, $p = .031$, suggesting that dyads who had higher recreational intimacy elicited more events in Phase 1.

Table 2.6

Mean Ratings on PAIR Inventory and TMS Scale by Relationship

Subscale	Strangers	Friends	Siblings
		PAIR Inventory	
Emotional Intimacy		50.96 (4.84)	43.92 (9.33)
Social Intimacy		45.04 (6.73)	39.54 (8.62)
Intellectual Intimacy		48.69 (6.39)	43.15 (8.08)
Recreational Intimacy		47.31 (5.63)	42.88 (7.14)
Conventionality		45.35 (5.79)	39.15 (8.23)
		Transactive Memory Scale[b]	
		Word list	
Specialization	36.31 (4.05)	36.38 (5.75)	38.46 (3.55)
Credibility	44.08 (3.33)	44.31 (4.27)	43.54 (4.20)
Coordination	43.15 (2.54)	43.54 (3.64)	43.62 (3.57)
		People list[a]	
Specialization	36.33 (5.32)	35.00 (6.03)	37.62 (5.58)
Credibility	45.17 (2.64)	45.08 (4.97)	44.15 (3.41)
Coordination	43.17 (2.04)	43.54 (3.04)	44.69 (3.22)

Note. Standard deviations appear in parentheses.

[a]Strangers were those who completed the Hollywood movie stars task only, $N = 6$.

[b]Collaborative dyads only.

TMS scale. I created dyad ratings for each TMS subscale by summing each member's ratings for specialization, credibility, and coordination for each task, giving three subscale ratings per dyad (see Table 2.6 for means). None of the dyad subscale ratings correlated significantly with recall scores for the word list, all $r < .10$ and $> -.11$, $p > .523$. I found no significant effects of relationship on subscale ratings for the word list, all Fs $< .834$, all ps $> .443$.

Dyad credibility for the people list correlated negatively with recall scores on that task, $r = -.47$, $p = .016$, which means that dyads who collaborated less successfully on the people list actually rated each other as more credible on this task. Separating the analysis by relationship showed this effect was only significant for friends, $r = -.62$, $p = .023$. Thus, some friends appeared to have misplaced confidence in their partners' credibility, and those who collaborated more effectively were less trusting of their friend's input. Specialization and coordination subscales did not correlate with proportional people list recall $r = -.07$, $p = .720$ and $r = -.08$, $p = .690$, respectively. I found no significant effects of relationship on people list TMS subscale scores, all Fs < 1.92, ps $> .179$.

Dyad credibility was marginally negatively correlated with the proportion of turns that were corrections and disagreements in the word list, $r = -.31$, $p = .066$, and positively correlated with the proportion of turns that were mirrored repetitions in the people list, $r = .53$, $p = .011$. Thus, participants from dyads who corrected or disagreed with each other later reported trusting their partner's input less, and participants from dyads who mirrored each other's input rated trusting their partner's input more. Dyad coordination was negatively correlated with the proportion of turns that were unsuccessful cues, $r = -.43$, $p = .038$. Thus, participants from dyads who were more unsuccessful at cuing each other later rated their performance as more confused and disorganized. No other TMS subscales correlated with collaborative processes in either task. Therefore, the TMS Scale appeared to reflect the process of collaboration rather than the product.

PANAS. I created dyad PANAS scores by summing each partners' positive affect and negative affect scores respectively, giving two subscales per dyad (dyad positive affect and dyad negative affect) each with a maximum of 100. Dyad positive affect scores ranged from 29 to 82 (M = 57.81, SD = 11.62) and dyad negative affect scores ranged from 20 to 36 (M = 25.37, SD = 4.54). I found no significant difference in dyad positive affect scores due to relationship type, $F(2, 72) = 1.22$, p = .300. However there was a significant difference due to collaboration, $F(1, 72) = 8.41$, p = .005, $\eta_p^2 = .10$, such that collaborative dyads (M = 61.56, SD = 11.14) had higher rated positive affect than nominal dyads (M = 54.05, SD = 11.63). This effect did not interact with relationship type, $F(2, 72) = .40$, p = .669, suggesting that collaborative dyads enjoyed the experiment more than nominal dyads, regardless of their relationship.

I found no differences in negative affect due to relationship or collaboration condition, all Fs < .73, p > .484. Therefore, while collaborative dyads rated themselves higher in positive affect, they did not show a corresponding reduction in negative affect.

Discussion

I found no evidence of collaborative inhibition, except in strangers recalling news events. The lack of collaborative inhibition in the word list or people list was surprising. Collaborative inhibition has been found to be less robust in dyads than in larger groups, but the effect is still found more often than not (Rajaram & Pereira-Pasarin, 2010). A closer look at collaborative dyads' transcripts may help to explain my findings.

Process Findings: Quality of Collaboration

Some collaborative processes were beneficial for recall, and their widespread use may help to explain the lack of collaborative inhibition in this experiment. Below I show two examples from transcripts that demonstrate how these collaborative processes contributed to collaborative success. One important collaborative process is use of a group strategy. The following example shows an effective use of a group strategy by a stranger dyad recalling the word list. This dyad performed well, recalling 23 of the 24 words. They agreed on a strategy to use the categories, as shown by their typed recall as well. In this example A suggested a strategy, then B agreed with the strategy, and both participants used the strategy for the rest of the task.

A: Okay so I remembered, like animals, is that what you did as well? So there was,

B: Yeah.

A: A cow, and,

B: Cow and crow.

Other important collaborative processes were successful and unsuccessful cues, which were both beneficial for recall, similar to Harris et al. (2011). Below I present again the "squishy apartment" example that led the introduction to this thesis, from a sibling dyad recalling mutual friends and acquaintances. This case may help explain why unsuccessful cues aided recall. In this example, A had three unsuccessful attempts to cue her sister, B, before the final successful cue, which resulted in B recalling the name that neither member recalled in Phase 1. This dyad performed well across all three tasks, and they recalled 35 people when they collaborated at Phase 2, which was 46% more than the 24 people they recalled individually at Phase 1.

A: And, what's the other one's name? Oma's sister? (pause) You met her, the one from Haarlem.

B: (laughs)

A: (laughs) Dude that's no help!

B: (laughs)

A: Okay just stop (laughs) I forget what her name is.

B: Umm.

A: She was really nice. The one who lived in the squishy apartment.

B: Squishy apartment?

A: Did you go to her house? She lives in Haarlem.

B: Oh!

A: She has a small little apartment.

B: Yeah, yeah Ta- Ta- Tin- Tinike!

A: Yes that's it! (typing)

The above extract is consistent with transactive memory theory, because when A cued B for information she knew that B possessed she used B as an external memory resource. According to Wegner (1987; Wegner et al., 1991; Wegner et al., 1985) this behaviour occurs when people in close relationships share the encoding, storage and retrieval of information. This example shows that this behaviour was best demonstrated when the dyad members had difficulty remembering items, rather than when the task was relatively easy. Thus, in this task, these sisters appeared to have benefited greatly by their ability to cue each other for shared knowledge.

However, cuing did not always result in collaborative success. The following extract showed an example in which cuing was ultimately less successful, and resulted in a disagreement between a different sibling dyad recalling mutual friends and acquaintances in the people list. As in the above example, this disagreement occurred at the end of the task, when the sisters were attempting to recall the names of people they could access less easily. A attempted to recall the names of people she incorrectly thought B also knew. Not surprisingly, she was ultimately unsuccessful in cuing B. They recalled 32 people when they collaborated at Phase 2, which was one less than the 33 people they recalled individually at Phase 1.

Therefore, this dyad appeared not to have benefited from their attempts to cue each other for knowledge they thought they shared in this task.

A: Oh yeah her kid's name's Matt.

B: I have no idea who they are!

A: Oh you minded her children. How could you not know?

B: I don't know it's insulting.

A: Oh Kate Downing.

B: Clearly not memorable.

A: All the names! Oh.

B: You're such a weirdo.

A: I like to remember children who I spend hundreds of hours with.

B: I don't.

The above example suggests that corrections and disagreements may have been indicative of unsuccessful collaboration, but in fact, corrections and disagreements did not produce costs of collaboration in terms of product. Friends and siblings had many more corrections and disagreements than strangers, but they showed similar collaborative success. The example above demonstrates how many turns siblings often spent disagreeing with each other. In comparison, the following is an example from strangers recalling the word list. This dyad performed well in this task, and recalled 21 of the 24 words. The disagreement was much shorter than the above example between siblings, and is typical of the disagreements between strangers, which tended to be more straightforward corrections.

A: And sapphire?

B: Sapphire, yep. Sapphire's got 2 Ps but it doesn't matter.

Not only is this correction short compared to those of friends and siblings, but it is also quite innocuous and neutral in its language, and is not relevant to the task at hand. B dismissed the correction as soon as she said it in order to prevent causing offence. Thus, strangers were reluctant to disagree with each other, and their low numbers of corrections and disagreements were consistent with strangers having lower intimacy than friends and siblings.

Each of the above examples demonstrates how differently each dyad approached the tasks in this experiment. Even when I found no differences in strangers', friends', and siblings' processes, it did not mean that all dyads interacted in the same way. Instead, it meant even within the same relationship groups, dyads collaborated in very different ways, and one friend dyad may have collaborated more differently from another friend dyad than from a sibling dyad. This variability in collaborative dyads' processes reflected similar findings by Harris et al. (2011), as well as the vast individual differences I found in the product of collaborative recall, which I describe below.

Product Findings

In the lists of people's names and events, dyads gained many items from Phase 1 to Phase 2. This may be because the stimuli used in these tasks were based on participants' prior real-world knowledge, rather than a limited set of items learned in the laboratory. There was also a lot of variability in the data in terms of items gained and lost, which depended on the stimuli and task. Nominal strangers gained a higher proportion of events than collaborative strangers. The low proportion of events that stranger dyads gained from Phase 1 to Phase 2 suggests this finding was due to a lack of cross-cuing to access new information. Indeed, strangers had a higher proportion of turns that were unsuccessful cues than friends and siblings in this task, although this variable did not correlate with recall in the event list.

The high levels of category use and group strategy use may explain why all other collaborative dyads performed as well as nominal dyads. These variables supported recall, but only in the word list. In the people list, the fact that so many dyads used these strategies may have masked their beneficial effects. Fewer dyads used a group strategy in the event list, yet collaborative friends and siblings performed as well as nominal friends and siblings in this task.

The most important distinction between strangers, and friends and siblings in the event list was the stimuli recalled by each relationship; friends and siblings recalled information about shared experiences. Strangers, on the other hand, recalled news events, which may be considered 'general knowledge', but were far less relevant to the stranger dyads than shared social events were to friend dyads and shared holidays were to sibling dyads. The lack of collaborative inhibition by friends and siblings in the event list, and indeed in the people list, may have occurred because they recalled information relating to their shared knowledge and experience. Therefore, friends and siblings may have benefited from their shared history in these tasks, consistent with transactive memory (Wegner, 1987; Wegner et al., 1991; Wegner et al., 1985).

However the transactive memory scale did not relate to recall performance on any of the tasks. This finding is inconsistent with the findings by Lewis (2003) that high credibility is a marker of an effective transactive memory system. However the TMS Scale was designed for use in workplace teams, and so may be a less reliable indicator of transactive memory use in the sample and tasks used here, at least in terms of product. Thus, this scale does not appear to be an appropriate scale to determine the effectiveness of a transactive memory system in strangers, friends, and siblings performing the tasks in my experiment. Nevertheless, the transactive memory scale did relate to some collaborative processes, as dyads who had more mirrored repetitions later rated their credibility higher than those who had fewer mirrored repetitions. Similarly, dyads who had more unsuccessful cues rated their coordination lower than those who had fewer unsuccessful cues. Thus, this scale appeared to reflect the process of collaboration more than the product.

Intimacy as measured by the PAIR inventory played a modest role in this experiment; no subscales correlated with collaborative dyads' recall performance. The only role intimacy appeared to play was a negative role in the number of shared holidays recalled by nominal siblings. This finding may have occurred because the dyads I tested in this experiment did not show enough variability in their intimacy ratings. Friends had very high intimacy ratings, and although siblings rated their intimacy lower than friends did, they still showed quite low variability.

The higher the proportion of turns in all three tasks that were mirrored repetitions, the higher dyads later rated their positive affect during the tasks. No other processes correlated with positive or negative affect. This finding suggests that mirrored repetitions played an important role in interactions between the dyad members, even though this collaborative process did not relate to collaborative recall performance. However, I only administered the PANAS at the end of the experiment, so it is difficult to determine the direction of causality here. In Experiment 2 (Chapter 3), I administered the PANAS at the beginning and the end of the experiment to see the change in positive and negative affect due to the experiment.

The distribution of words and turn taking as measured by the number of dyad members typing in each task, the difference in the proportion of words spoken by each dyad member and mean words per turn did not predict dyads' recall performance. Although there were many individual differences between dyads, the only significant effects here were that a larger difference in the proportion of words spoken by each dyad member was related to better collaborative recall performance only in the people list. Siblings had more words per turn than friends did in the people list, but words per turn did not relate to recall performance in any task.

I was unable to analyse strangers' people list data due to problems with the stimuli. The loss of strangers' people list data is problematic because it could have given me a better understanding of how strangers performed across different tasks. I found no collaborative inhibition in strangers in the word list, but I did find collaborative inhibition when they recalled news events. In the subset of strangers who completed the Hollywood movie stars list, there appeared to be a trend toward collaborative inhibition, but without a large enough sample, I was unable to confirm this pattern with statistical analysis. In Experiment 2, I made improvements to the strangers' people list to determine whether strangers would have collaborative inhibition when recalling people's names.

Strangers, friends, and siblings recalled different stimuli in the event list. My aim to determine whether friends and siblings would benefit from transactive memory on tasks that were based on their shared knowledge led me to design the event list in this way. It was difficult to find comparable recall stimuli across all three groups that allowed friends and siblings to effectively use their potential transactive memory but were still appropriate for strangers. This difficulty is what led me to give strangers, friends, and siblings different tasks; so I could give each of them the best chance to benefit from shared knowledge. In Experiment 2, I kept the stimuli constant across the three relationships so that more definite comparisons could be made between them.

This experiment was the first to compare collaborative recall in dyads of strangers, friends, and siblings in tasks that differed in self-relevance and real-world knowledge. It was also one of few experiments to show a consistent lack of collaborative inhibition. This experiment therefore demonstrated that dyads of friends and siblings could draw on their shared knowledge to recall lists together, whereas strangers were less able to do so. The coding scheme I developed to account for the collaborative processes that occurred during the task to some degree explained why the collaborative dyads in this experiment did not show collaborative inhibition in most tasks. My coding scheme allowed me to assess the processes of collaboration that helped dyads access shared knowledge in ways consistent with transactive memory.

CHAPTER THREE

Experiment 2:
Strangers', Friends' and Siblings' Collaborative Recall of Verbal Lists

Like in Experiment 1, my aims for this experiment were to determine: (1) whether recalling with a stranger, friend or sibling influences the product of remembering together, (2) whether relationship influences the process of remembering together, and (3) whether the process by which they remember together influences the product of remembering together. In contrast to Experiment 1, I investigated these aims in verbal recall. I also aimed to determine if any effects of relationship would be better revealed if strangers, friends, and siblings recalled the same lists.

The design of this experiment was the same as Experiment 1 with some changes. The first change I made was to ask participants to recall verbally, rather than type their responses, to make collaborative recall as naturalistic as possible and to remove any interruptions that typing might have made in Experiment 1. Many studies using the collaborative recall paradigm have found that collaboration benefits subsequent individual recall (e.g. Harris et al., 2012; Harris et al., 2013). Therefore, the second change I made was adding an individual Recall 2 to determine whether collaboration had any lasting effects on recall of the lists. In Experiment 1, I did not find collaborative inhibition in the word list, which could be argued to be due to ceiling effects. The word list in Experiment 1 contained only 24 words (six categories of four words), and the amount dyads recalled was quite high and changed little from individual to collaborative recall. To ensure I found no ceiling effects in this experiment, I increased the word list to 48 words (six categories of eight words). I also removed the first individual recall of the word list because it may have contributed to the lack of collaboration effects in Experiment 1.

I changed the list of mutual friends and acquaintances to a list of each individual dyad member's own social circles, to ensure that strangers had the same stimuli as friends and siblings. This change meant that friends and siblings now recalled a personally relevant but less relationship relevant list than the mutual friends and acquaintances they recalled in Experiment 1. Friends' and siblings' social circles may be partially overlapping, and they may have some knowledge of the non-overlapping parts of each other's social circles. Thus, I expected the social circle task to still rely on shared knowledge to some extent for friends and siblings, but not strangers.

Finally, I also changed the list of news events, shared social events and shared holidays to a news event list to ensure that strangers, friends, and siblings had the same stimuli. This change meant that I could directly compare the effects of relationship on collaborative recall of each list, without the confounding effects of different stimuli. News events were less personally and relationship relevant than the shared social events and shared holidays that friends and siblings recalled in Experiment 1. Instead, recalling news events relies on knowledge that is shared on a societal level, rather than a relationship level. Nevertheless, I hypothesized that strangers, friends, and siblings would have enough shared knowledge about news events to collaborate on this task. Finally I did not use the Transactive Memory System Scale in this experiment because it did not appear to predict collaborative recall in Experiment 1.

Given the robustness of collaborative inhibition (Rajaram, 2011), I predicted that strangers would show this effect for all three tasks. Although they did not show collaborative inhibition for the word list in Experiment 1, I predicted that this experiment's longer list and lack of individual recall prior to collaboration would mean that strangers, friends, and siblings would show collaborative inhibition for the word list. I made this prediction because although the word list was based on shared knowledge that all participants received at the beginning of the experiment, it was not personally relevant and so friends and siblings would not be able to benefit from their shared knowledge of each other. I predicted that strangers would show collaborative inhibition on this task because they have almost always shown collaborative inhibition in previous word list recall studies (Rajaram, 2011).

I predicted that strangers would show collaborative inhibition for the list of each other's social circles because, even though this task was personally relevant, it was based on wholly unshared knowledge for strangers. I predicted that friends and siblings would show either reduced or eliminated collaborative inhibition for the social circle task because of the personal relevance of the task and their shared knowledge of each other's social circles prior to the experiment.

I predicted that strangers would replicate the collaborative inhibition I found in Experiment 1 for the news event list, because this task was based on partially but not wholly shared knowledge, unlike the word list. For friends and siblings, I predicted that they would show reduced or eliminated collaborative inhibition in the news event list, but less so than in the social circle list, because this task was less personally relevant than the social circle list, which meant that friends and siblings would be less able to benefit from their shared knowledge of each other. However, friends and siblings may have some knowledge of the news events each other would be more likely to know, based on their knowledge of each others' interests. Thus, they may be able to use this information to cue each other more effectively than strangers, consistent with transactive memory, and so may show reduced collaborative inhibition compared to strangers. As in Experiment 1, I predicted that use of collaborative processes would reflect collaborative inhibition or lack thereof in each task.

Method

Participants

I recruited 140 new participants from Macquarie University in exchange for undergraduate psychology course credit or cash payment of $15 an hour. These participants made up 70 dyads of strangers, friends, and siblings or twins.

Strangers were 42 females and four males, aged from 18 to 50 years (M = 22.44 years, SD = 6.89). These strangers made up 23 dyads (one male-male, two male-female, and 20 female-female dyads).

Friends were 24 females and 12 males, aged from 18 to 32 years (M = 19.29, SD = 2.25). These friends made up 23 dyads (three male-male, six male-female, and 14 female-

female dyads). As in Experiment 1, I invited only friends who had been close for at least one year to participate in this study, and the friend dyads had known each other for a mean of 7.47 years (*SD* = 3.56). Sixty-nine per cent of friends saw each other at least once a week or every day. Four friend dyads lived together. The vast majority (74%, 17 dyads) knew each other from high school; another 9% (2 dyads) knew each other through mutual friends, and the remaining 17% (1 dyad each) knew each other from primary school, family friends, church or preschool.

Siblings were 32 females and 16 males, aged from 18 to 45 years (*M* = 21.67, *SD* = 6.27). These siblings made up 24 dyads (four male-male, eight male-female, and 12 female-female). Seven sibling dyads were twins (three identical, three non-identical, and one unsure), including one dyad who were two of non-identical triplets. For the purposes of this chapter I did not perform a separate analysis of the twin data, as I was unable to recruit 24 twin dyads and 24 non-twin sibling dyads, and so analysing twins and non-twin siblings separately would mean comparing groups with unequal sample sizes. Instead I included grouped twins and non-twin siblings into one relationship group, which I refer to as 'siblings' for the purposes of this chapter. I compare twin and non-twin siblings' data in Chapter 6. The age gap between non-twin siblings ranged from 1 year 7 months to 10 years 7 months (*M* = 3.83, *SD* = 2.39). Most siblings (71%) lived together, and 85% of siblings who lived together lived with their parents. Most siblings (96%) saw each other at least once a week or every day.

I randomly assigned half of the stranger, friend, and sibling dyads to be collaborative dyads, and the other half to be nominal dyads. There were 11 collaborative and 12 nominal stranger dyads, 12 collaborative and 12 nominal friend dyads, and 12 collaborative and 12 nominal sibling dyads.

Research Design

As in Experiment 1, the experiment was a between subjects design, with dyads as the unit of analysis. At Recall 1, I divided strangers, friends, and siblings into nominal and collaborative dyads, giving the experiment a 3 x 2 (relationship x collaborative condition) design, with 11 to 12 dyads per cell. Collaborative dyads worked individually in Encoding/Elicitation, collaboratively at Recall 1 and individually at Recall 2. Nominal dyads worked individually across the whole experiment. For all tasks in which dyads worked individually (Encoding/Elicitation and Recall 2 for both collaborative and nominal dyads, and Recall 1 for nominal dyads only), I pooled their responses to create a dyad score.

Materials and Stimuli

Audio recording. I recorded the entire experiment using Blue Snowball microphones and Audacity software on Macbook Pro laptops.

Word list. I gave participants a list of 48 words to memorize. The list was comprised of 8 exemplars from 6 categories taken from Battig and Montague (1969). Categories were four-footed animals, birds, items of clothing, precious stones, food flavourings, and dwellings (see Table 3.1 for the word list exemplars by category, and in alphabetical order). I presented the words one at a time for two seconds each in capital letters using black Calibri 44 point font on a white background.

Questionnaires. I gave participants different questionnaires depending on their relationship. I gave all participants a demographic questionnaire asking for age, gender, country born in, and language spoken at home. I also asked friends how often they saw each other on a 5-point Likert scale from 1 (less than once a month) to 5 (every day), how long they had known each other (in years and months), how they knew each other, and whether they lived together. I asked siblings how often they saw each other, whether they lived together, whether they lived with their parents, whether they were twins, and the age and gender of any other siblings.

Table 3.1

Word List Exemplars by Category

	Category					
Exemplar	Four-footed animals	Birds	Items of clothing	Precious stones	Food flavourings	Dwellings
1	Bear	Bluebird	Blouse	Amethyst	Cinnamon	Cave
2	Cow	Canary	Coat	Emerald	Cloves	Cottage
3	Elephant	Crow	Dress	Jade	Garlic	Hotel
4	Horse	Eagle	Hat	Onyx	Oregano	Hut
5	Lion	Hawk	Pants	Opal	Paprika	Igloo
6	Mouse	Parrot	Shoes	Pearl	Pepper	Mansion
7	Pig	Robin	Skirt	Sapphire	Sugar	Shack
8	Tiger	Sparrow	Tie	Topaz	Vanilla	Tent

Note. Exemplars appear here in alphabetical order by category, but were presented in a random order during the experiment.

I gave friends and siblings the Personal Assessment of Intimacy in Relationships (PAIR) inventory (Schaefer & Olson, 1981). I used the same adapted scales for friends and siblings that I used in Experiment 1 and scored it using the method described there.

I gave all participants the Positive and Negative Affect Scale (PANAS) at the beginning (PANAS 1) and end (PANAS 2) of the experimental session (Watson et al., 1988). I scored this scale using the method described in Experiment 1 for each time point.

Procedure

I conducted the study over two sessions, approximately one week apart. Each session took place on Macquarie University campus, with two experimenters. I was one experimenter and the other experimenter was a research assistant.

In Session 1, I gave participants the demographic questionnaire. I also ran the first session of the autobiographical memory task, which is reported in Chapter 5 (Experiment 4). I ran Session 2 in three phases: Encoding/Elicitation, Recall 1 and Recall 2. In Encoding/Elicitation and Recall 2, all participant dyads worked individually. At Recall 1, nominal dyads worked individually and collaborative dyads worked collaboratively. Participants said their responses aloud across all three phases, which I audio-recorded and transcribed, as well as wrote down during the session.

Encoding/Elicitation. When the dyads arrived, I separated them into two rooms, each with a different experimenter. They began the session by completing PANAS 1. I then asked participants to encode the list of words, which was presented on a laptop computer screen in a random order for two seconds per word. Both dyad members saw the same order as each other. I instructed participants to "try to memorize the words as much as you can because I will be testing your memory for these words later."

Following encoding of the word list, I asked participants to elicit two self-generated lists. The first was a list of the names of people in their regular social circle. I instructed participants

> For this task, I want you to think of all of the people in your regular social circle. I would like you to recall aloud as many names of people in your social circle as you can. You don't have to go into any detail, just say their names as you think of them, but if there's more than one person with the same name try to distinguish one from the other so I know you're not repeating yourself. I will stop you after 2 minutes.

The second was a list of events that had been widely reported in the news in the past 12 months. I instructed participants

> I would like you to think about all of the events that have been widely reported in the news in the past 12 months. I would like you to list aloud all of the news

> events from the past 12 months you can think of, so try to say as many as possible. Please don't describe them in detail, just say each event as you think of it. Don't worry if you can't think of very many; most people find this quite difficult. I'll stop you after 2 minutes.

These individually elicited lists formed the baseline for their subsequent recall.

Recall 1. For Recall 1, I moved collaborative dyads into the same room with both of the experimenters. I kept nominal dyads in separate rooms with one experimenter each, as in Encoding/Elicitation.

Autobiographical Memory Task. I gave participants a recall task based on the procedure by Addis, Pan, Vu, Laiser, and Schacter (2009), which was cued using details elicited in Session 1. Collaborative dyads recalled the events with their partner and nominal dyads recalled the events individually. This task is described in detail in Chapter 5 (Experiment 4).

Word list. Immediately following the autobiographical memory task, I asked participants to list verbally all of the words they could remember from the list I presented at the beginning of the experiment. I asked collaborative dyads to "think back to all the words that were presented to you on the computer and together recall aloud as many of the words as you can remember. I would like you to help each other by working together to remember the list." I did not give them any instructions on how to work together, and they did not have to both agree on each word for it to be counted in recall. I instructed nominal participants "to think back again to all the words that were presented to you on the computer and recall aloud as many of the words as you can remember." Word list recall continued until participants indicated they could not recall any more words.

Social circle list. Following word list recall, I asked participants to recall the names of people in their social circle. I gave nominal participants the same instructions as at Elicitation, except that I began the instructions with, “Now, as you did before…” I instructed collaborative dyads

> Now, as you did before, I would like you to think about all of the people in your regular social circles. This time, I would like you to work together and try to help each other to recall aloud as many names of people in each of your social circles as you can. Remember you don’t have to go into any detail, just say their names as you think of them, but if there’s more than one person with the same name try to distinguish one from the other so I know you’re not repeating yourself. And again, I will stop you after 2 minutes.

News event list. Finally, I asked participants to recall the events that had been widely reported in the news in the past 12 months. I gave nominal participants the same instructions as at Elicitation, except that I began the instructions with, “Now, as you did before…” I instructed collaborative dyads

> Now, as you did before, I would like you to think of all of the news events from the past 12 months you can think of. But this time, I want you to work together and try to help each other to list as many news events as you can. Remember, be as specific as possible, so I know you are recalling an actual event rather than just saying things that might have happened. You don’t have to describe them in detail, just say each event as you think of it, and I will stop you after 2 minutes. You don’t need to worry about saying exactly what you said before, just work together and say any that you think of now.

Distractor task. Following the news event list, I separated collaborative dyads into two rooms again with the same experimenter as in Encoding/Elicitation. I gave participants 10 minutes to complete a set of Sudoku puzzles individually. I gave them a simple set of verbal instructions of how to do Sudoku if they needed it. I told them to start on the first puzzle and complete as much as possible. I gave friends and siblings the PAIR Inventory to complete before they began the Sudoku puzzles.

Recall 2. At Recall 2, all participants worked individually again. I asked them to recall the word list, social circle list and news event list in that order, with the same instructions as the nominal dyads had been given at Recall 1.

Post-experimental interview and debrief. Finally, I asked participants individually about their experience of the experiment and debriefed participants individually before they left.

Coding

Product coding. I used the same procedure as in Experiment 1 to calculate pooled dyad scores for each task in which dyads responded individually; that is, all of nominal dyads' tasks and collaborative dyads' Elicitation and Recall 2 tasks. To do this calculation, I counted the non-overlapping responses of each dyad member. Scores for collaborative dyads' Recall 1 tasks were the total number of items they recalled together. Thus, to test for collaborative inhibition in the word list, I compared collaborative dyads' recall at Recall 1 to pooled nominal dyads' recall at Recall 1.

Because the social circle and news event lists depended on participant-generated stimuli, I based analysis for these tasks on proportional recall, using the following equation, which was the same as the one I used in Experiment 1:

$$\textit{Proportional recall} = (\textit{Dyad Recall 1} - \textit{Dyad Elicitation}) / (\textit{Dyad Elicitation})$$

Again, negative proportional recall indicated that dyads recalled fewer items at Recall 1 than at Elicitation, and positive proportional recall indicated that they recalled more items at Recall 1 than at Elicitation. Thus, to test for collaborative inhibition in the social circle and news event lists, I compared collaborative dyads' proportional recall to nominal dyads' proportional recall.

In addition to my test for collaborative inhibition, I also tested for post-collaborative benefits on subsequent individual recall. To test for this in the word list, I pooled individual dyad member scores at Recall 2, and compared these scores for previously collaborative dyads to these scores for previously nominal dyads. For the social circle and news event lists, I created a subsequent proportional recall score comparing Recall 2 to Elicitation, in the same way as proportional recall. That is, I calculated subsequent proportional recall using the following equation:

Subsequent proportional recall = (Dyad Recall 2 – Dyad Elicitation) / (Dyad Elicitation)

Subsequent proportional recall was negative if dyads recalled fewer items at Recall 2 than at Elicitation, and positive if they recalled more items at Recall 2 than Elicitation. For instance, if a dyad elicited ten items at Elicitation and recalled 12 items at Recall 2, their subsequent proportional recall would be (12 – 10) / 10 = 0.2. If a dyad elicited ten items at Elicitation and recalled eight items at Recall 2, their subsequent proportional recall would be (8 – 10) / 10 = -0.2. I could not perform the same analysis for the word list, because there was no Elicitation for the word list, as they only encoded it in Encoding/Elicitation.

Thus, due to the different sources of stimuli in the word list compared to the social circle and news event lists, I defined collaborative inhibition differently for each type of task. In the word list, collaborative inhibition occurred if collaborative dyads recalled fewer words than nominal dyads at Recall 1. In the social circle and news event lists, collaborative inhibition occurred if collaborative dyads had a lower proportional recall than nominal dyads. I therefore defined collaborative inhibition in the word list using a between subjects comparison only, whereas I defined collaborative inhibition in the social circle and news event lists using the combination of a between subjects comparison (nominal versus collaborative dyads) and a within subjects comparison (Recall 1 as a proportion of Elicitation). Nominal dyads acted as a measure of the effect of recalling the same information several times. Thus, I measured the additional effects of collaboration beyond repetition effects.

Items gained and lost. Using the same method that I used in Experiment 1, I counted the number of items gained and lost from Elicitation to Recall 1 in the social circle list and news event list. I could not perform the same analysis for the word list, because there was no Elicitation for the word list, as they only encoded it in Encoding/Elicitation. I then calculated the number of items gained and lost at Recall 1 as a percentage of items originally elicited at Elicitation, using the following two equations.

Percentage of items gained = 100((Items gained) / (P□ase 1 Elicitation))*

Percentage of items lost = 100((Items lost) / (P□ase 1 Elicitation))*

These scores allowed me to investigate further the effects of collaboration on the number of items recalled. If collaborative dyads gained a higher percentage of items from Elicitation to Recall 1 than nominal dyads, it would indicate that collaborative dyads cross-cued each other to recall extra information. If collaborative dyads gained a lower percentage of items from Elicitation to Recall 1, it would indicate that collaboration disrupted the individual recall of each member of the dyad, so they were not able to access the items they had previously elicited individually, providing support for the retrieval disruption explanation for collaborative inhibition (Basden et al., 1997).

Collaboration style. ***Collaborative process coding.*** I used the same collaborative process coding outlined in Experiment 1, with a few differences. Unlike in Experiment 1, participants did not type their responses into a computer; instead they said them aloud. Therefore, I used transcripts of the audio-recordings for each task to determine: (1) category use, (2) group strategy use, (3) individual strategy use, (4) successful cues, (5) unsuccessful cues, (6) mirrored repetitions, and (7) corrections or disagreements. I then also counted the number of turns in the transcript that were: (1) successful cues, (2) unsuccessful cues, (3) mirrored repetitions, and (4) corrections or disagreements (see Appendix B for the collaborative process coding scheme for verbal lists).

Types of strategies reported. I coded participants' responses to open-ended questions regarding the type of strategy they used as: (1) categories, (2) using each others' responses as cues, and (3) other strategy. Using each other's responses as cues was in practice quite similar to using categories, because each other's responses tended to cue items within the same category. However, I differentiated the two because cuing each other indicated less awareness of the categories than reporting category use as a strategy.

Turn taking. In order to determine how shared the collaboration was, I calculated the mean words per turn in each transcript. Fewer mean words per turn (shorter turns) indicated rapid turn taking because, for instance, participants discussed the task very little beyond naming items. Greater mean words per turn (longer turns) indicated longer monologues because, for instance, one dyad member listed many items at once, participants discussed items in more detail, talked about how to do the task, or talked about topics not related to the task.

Results

I present a series of five analyses: (1) tests to ensure there were no baseline differences between future collaborative and nominal dyads' pooled individual Elicitation of the social circle and news event lists, not for the word list because participants did not have a baseline recall for the word list, (2) tests for collaborative inhibition or facilitation in Phase 2, (3) analysis of items gained and lost from Elicitation to Recall 1, (4) analysis of collaboration style, including collaborative processes in collaborative dyads' performance at Recall 1, and distribution of words and turn taking, and (5) analysis of questionnaire data regarding intimacy and relationship quality. I separated each analysis by task. For collaborative processes, I conducted separate analyses for each process within each task. For the questionnaire data, I conducted separate analyses of each questionnaire.

As in Experiment 1, across all analyses, when I found a significant effect of relationship I used planned Helmert constrasts to determine whether: (1) strangers were significantly different from friends and siblings, and (2) friends and siblings were different from each other. The first contrast always compared strangers to the mean of friends and siblings, and the second contrast compared friends and siblings.

Baseline Elicitation

Social circle list. The baseline of dyads' pooled individual elicitation of each dyad member's social circle ranged from 14 to 78 names (see Table 3.2 for means). Using a 3 x 2 (relationship x collaborative condition) ANOVA, I found a significant effect of relationship, $F(2, 64) = 5.60$, $p = .006$, $\eta_p^2 = .15$. Using planned Helmert contrasts I found that stranger dyads had more names in their social circles than friend and sibling dyads, $p = .006$, whereas sibling dyads had marginally more names in their social circle than friend dyads, $p = .071$. I found no evidence of any baseline differences between pre-collaborative and nominal dyads, $F(1, 64) = 0.47$, $p = .495$. Relationship did not significantly interact with collaborative condition, $F(2, 64) = 0.20$, $p = .817$.

Thus, the only baseline difference I found prior to the experimental manipulation was due to the fact that strangers had no overlap in their social circles, which meant their pooled individually elicited social circles were larger than friends' and siblings'. Most friends and siblings (87% and 79%, respectively), on the other hand, had some overlap, which ranged from 2.22% to 26.32% of elicited names in friends ($M = 11.58\%$, $SD = 7.70$), and from 2.78% to 39.66% of elicited names in siblings ($M = 10.13\%$, $SD = 10.25$). This overlap resulted in friends' and siblings' social circle lists being shorter than strangers' lists. The fact that strangers' pooled individual social circle lists had no overlap, and thus were two different lists added together, meant that the nominal comparison had some limitations in this task. I return to this issue in my thesis Discussion in Chapter 7. However, I found no evidence of baseline differences in social circle recall by pre-collaborative and nominal dyads.

Table 3.2

Dyads' Mean Baseline Elicitation by Relationship, Collaborative Condition, and Task

Relationship	Nominal	Collaborative[a]	Total
		Social Circle List	
Strangers	48.00 (17.78)	48.55 (14.24)	48.26 (15.82)
Friends	33.55 (12.80)	34.67 (11.30)	34.13 (11.78)
Siblings	39.08 (15.74)	44.50 (13.24)	41.79 (14.49)
Total	40.40 (16.34)	42.40 (13.88)	41.40 (15.08)
		News Event List	
Strangers	14.42 (4.68)	14.00 (7.72)	14.22 (6.17)
Friends	11.91 (3.30)	13.67 (4.91)	12.83 (4.22)
Siblings	9.75 (3.67)	11.92 (5.98)	10.79 (4.93)
Total	12.03 (4.30)	13.17 (6.14)	12.59 (5.29)

Note. Standard deviations appear in parentheses.

[a]Individual performance prior to collaboration. Collaborative dyads participated individually at Elicitation, and were their scores were pooled in the same way as nominal dyads.

News event list. Baseline elicitation of dyads' pooled individual recall of news events ranged from 2 to 29 events (see Table 3.2 for means). Using a 3 x 2 (relationship x collaborative condition) ANOVA, I found no evidence of any baseline differences between strangers, friends, and siblings, $F(2, 64) = 2.55$, $p = .086$, or between pre-collaborative and nominal dyads, $F(1, 64) = 0.92$, $p = .341$. Relationship did not significantly interact with collaborative condition, $F(2, 64) = 0.43$, $p = .652$. Thus, I found no evidence of any baseline differences in recall of news events prior to the experimental manipulation.

Baseline elicitation summary. Friends' and siblings' social circle lists were shorter than strangers' social circle lists due to the lack of overlap in strangers' social circles. I found no other evidence for baseline differences in the social circle and news event lists due to relationship, collaborative condition, or the interaction between them.

Collaboration Effects

Word list. Dyads recalled a mean of 22.16 words (*SD* = 6.85) out of the total of 48 words at Recall 1 (see Table 3.3 for mean proportions of the word list recalled by relationship and collaborative condition). Using a 3 x 2 (relationship x collaborative condition) ANOVA, I found no significant difference in dyads' word list recall by relationship, $F(2, 64) = 1.72$, $p = .188$, or collaborative condition, $F(1, 64) = 0.39$, $p = .532$. Relationship did not significantly interact with collaborative condition, $F(2, 64) = 0.33$, $p = .723$. Therefore, there was no evidence of collaborative inhibition in word list recall. As in Experiment 1, and contrary to my predictions, I abolished collaborative inhibition in recall in the word list.

Social circle list. Overall, proportional scores for the recall of one's social circles were negative, meaning that in general dyads recalled fewer items at Recall 1 than at Elicitation (see Table 3.3). Using a 3 x 2 (relationship x collaborative condition) ANOVA, I also found a significant effect of relationship, $F(2, 64) = 4.78$, $p = .012$, $\eta_p^2 = .13$. Using planned Helmert contrasts I found that strangers' proportional recall of the social circle list was not significantly different to that of friends and siblings combined, $p = .600$, but friends' proportional recall of the social circle list was higher than that of siblings, $p = .003$, regardless of whether they were nominal or collaborative dyads. I found that collaborative dyads' proportional recall of the social circle list was lower than nominal dyads', indicating collaborative inhibition, $F(1, 64) = 25.42$, $p < .001$, $\eta_p^2 = .28$. Relationship did not significantly interact with collaborative condition, $F(2, 64) = 0.34$, $p = .710$. Therefore, I found collaborative inhibition overall in the social circle list, and overall, friends recalled the most names relative to Elicitation out of the three relationships.

News events list. Proportional recall of news events was positive overall, meaning dyads, on average, recalled more news events at Recall 1 than during Elicitation (see Table

3.3). Using a 3 x 2 (relationship x collaborative condition) ANOVA, I found a significant effect of relationship on proportional recall of the news events list, $F(2, 64) = 3.83$, $p = .027$, $\eta_p^2 = .11$. Using planned Helmert contrasts I found that friends' and siblings' proportional recall was higher than strangers, $p = .007$, but I found no difference between friends' and siblings' proportional recall, $p = .977$. I found that collaborative dyads' proportional recall of the news event list was lower than nominal dyads', indicating collaborative inhibition, $F(1, 64) = 18.57$, $p < .001$, $\eta_p^2 = .22$. Relationship did not significantly interact with collaborative condition, $F(2, 64) = 1.55$, $p = .220$. Therefore, I found collaborative inhibition across all relationships in the news event list, despite the fact that strangers' proportional recall was lower than friends' and siblings'.

Collaboration effects summary. I found no effects of relationship or collaborative condition in the word list. However, I found collaborative inhibition for both the social circle and news event lists. Friends had higher proportional recall in the social circle list than strangers and siblings, but this effect did not interact with collaborative condition. Friends and siblings had higher proportional recall in the news event list than strangers, which also did not interact with collaborative condition. Thus, I primarily found costs of collaboration in this experiment, but not in the word list.

Post-Collaborative Effects

Word list. Dyads recalled a mean of 22.37 words (*SD* = 6.66) out of the 48 words at Recall 2 (see Table 3.4 for mean proportion of word list recalled). Using a 3 x 2 (relationship x collaborative condition) ANOVA, I found the number of words recalled did not differ significantly by collaborative condition, $F(1, 64) = 0.12$, $p = .734$, or relationship, $F(2, 64) = 2.15$, $p = .124$. The interaction between relationship and collaborative condition also was not significant, $F(2, 64) = 0.49$, $p = .616$. Therefore, consistent with the lack of collaborative inhibition at Recall 1, I found no evidence that collaboration affected dyads' subsequent individual recall in the word list task.

Table 3.3

Dyads' Mean Word List Recall 1 and Proportional Social Circle and News Event Recall 1 by Relationship, Collaborative Condition, and Task

	Nominal	Collaborative	Total	Collaborative - Nominal
		Word list		
Strangers	23.08 (5.84)	25.64 (6.90)	24.30 (6.36)	2.56
Friends	21.45 (8.47)	20.75 (4.16)	21.09 (6.43)	-0.70
Siblings	20.50 (7.50)	21.75 (7.69)	21.13 (7.46)	1.25
Total	21.69 (7.18)	22.63 (6.57)	22.16 (6.85)	0.94
		Social circle list		
Strangers	0.04 (0.20)	-0.21 (0.14)	-0.08 (0.21)	-0.25
Friends	0.13 (0.23)	-0.09 (0.21)	0.02 (0.25)	-0.22
Siblings	-0.06 (0.14)	-0.23 (0.14)	-0.14 (0.16)	-0.17
Total	0.04 (0.20)	-0.18 (0.17)	-0.07 (0.22)	-0.22[a]
		News event list		
Strangers	0.11 (0.16)	-0.02 (0.30)	0.05 (0.24)	-0.13
Friends	0.46 (0.27)	0.03 (0.25)	0.23 (0.24)	-0.43
Siblings	0.39 (0.24)	0.09 (0.40)	0.24 (0.36)	-0.30
Total	0.32 (0.27)	0.03 (0.32)	0.18 (0.32)	-0.29[a]

Note. Standard deviations appear in parentheses.

[a]Significant collaborative inhibition effect.

Social circle list. Subsequent proportional recall of the social circle list was slightly positive overall, meaning dyads recalled slightly more people at Recall 2 than at Elicitation (see Table 3.4 for means). Using a 3 x 2 (relationship x collaborative condition) ANOVA, I found no significant effect of relationship on subsequent proportional recall of the social circle list, $F(2, 64) = 2.14$, $p = .126$. I found that collaborative dyads' subsequent proportional recall for the social circle list was lower than nominal dyads', $F(1, 64) = 7.83$, $p = .007$, $\eta_p^2 = .11$. Thus, collaboration in fact impaired dyads' later individual recall. Relationship did not significantly interact with collaborative condition, $F(2, 64) = 0.39$, $p = .680$. Therefore, I found that collaboration impaired subsequent performance at Recall 2 relative to Elicitation in the social circle list.

News events list. Subsequent proportional recall of news events was positive overall, meaning dyads, on average, recalled more news events at Recall 2 than during Elicitation (see Table 3.4). Using a 3 x 2 (relationship x collaborative condition) ANOVA, I found that collaborative dyads' subsequent proportional recall of news events was marginally lower than nominal dyads', indicating that collaboration may have impaired later individual recall for some dyads, $F(1, 64) = 3.69$, $p = .059$. I found no significant effect of relationship on subsequent proportional recall of news events, $F(2, 64) = 1.34$, $p = .270$. The interaction between relationship and collaborative condition was not significant, $F(2, 64) = 1.18$, $p = .313$. Therefore, I found that recall of news events increased with each recall, but collaboration prevented this increase from reaching its full potential.

Post-collaborative effects summary. The lack of collaborative inhibition I found for the word list continued as a lack of post-collaborative effects at Recall 2. In terms of the social circle and news event lists, the relationship effects I found at Recall 1 did not persist into Recall 2. Despite collaborative inhibition at Recall 1, which would normally lead to post-collaborative benefits at Recall 2, I found that the costs of collaboration at Recall 1 continued to impact dyads' individual recall at Recall 2.

Table 3.4

Dyads' Mean Recall 2 Scores by Relationship, Collaborative Condition, and Task

	Nominal	Collaborative	Total	Collaborative - Nominal
		Word List Recall		
Strangers	23.67 (5.55)	25.82 (7.21)	24.70 (6.34)	2.15
Friends	22.27 (8.19)	20.67 (3.77)	21.43 (6.19)	-2.03
Siblings	20.50 (6.91)	21.58 (7.48)	21.04 (7.06)	1.08
Total	22.14 (6.85)	22.60 (6.56)	22.37 (6.66)	0.46
		Social Circle List Proportional Recall		
Strangers	0.14 (0.33)	-0.07 (0.16)	0.04 (0.28)	-0.21
Friends	0.20 (0.25)	0.10 (0.22)	0.15 (0.24)	-0.1
Siblings	0.09 (0.15)	-0.04 (0.17)	0.03 (0.17)	-0.13
Total	0.14 (0.25)	0.00 (0.19)	0.07 (0.24)	-0.14[a]
		News Event List Proportional Recall		
Strangers	0.36 (0.24)	0.39 (0.43)	0.34 (0.29)	0.03
Friends	0.66 (0.22)	0.25 (0.22)	0.20 (0.24)	-0.41
Siblings	0.78 (1.05)	0.25 (0.40)	0.30 (0.49)	-0.53
Total	0.60 (0.65)	0.36 (0.36)	0.28 (0.36)	-0.24[a]

Note. Standard deviations appear in parentheses.

[a] Significant post-collaborative impairment.

Items Gained and Lost

Recall 1. ***Social circle list.*** At Recall 1, dyads gained a mean of 14.98% (*SD* = 17.10) of the names they elicited and lost a mean of 22.93% (*SD* = 13.86) of the names they elicited (see Table 3.5 for percentage of items gained and items lost from Elicitation to Recall 1). The percentage of names gained ranged from 0 to 80%, and the percentage of names lost ranged from 0 to 58.62%.

Using a 3 x 2 (relationship x collaborative condition) ANOVA, I found a significant effect of relationship on the percentage of names gained, $F(2, 64) = 4.05$, $p = .022$, $\eta_p^2 = .11$. Using planned Helmert contrasts, I found that strangers gained an equal percentage of names to friends and siblings, $p = .255$, but friends gained a higher percentage of names than siblings, $p = .011$. I found no significant effect of collaborative condition on the percentage of names gained from Elicitation to Recall 1, $F(1, 64) = 2.50$, $p = .119$. Relationship did not significantly interact with collaborative condition, $F(2, 64) = 1.23$, $p = .299$. Therefore, I found no evidence that collaboration produced cross-cuing in the social circle list because collaborative dyads did not gain more names than nominal dyads. Consistent with their high proportional recall, friends gained a higher percentage of names than siblings, regardless of their collaborative condition.

Using a 3 x 2 (relationship x collaborative condition) ANOVA, I found that collaborative dyads lost a higher percentage of names than nominal dyads, $F(1, 64) = 38.43$, $p < .001$, $\eta_p^2 = .38$. I found no significant effect of relationship on the percentage of names lost from Elicitation to Recall 1, $F(2, 64) = 2.14$, $p = .126$, and relationship and collaborative condition did not interact, $F(2, 64) = 1.67$, $p = .197$. Collaboration therefore appeared to disrupt collaborative dyad members' individual recall of their social circles, regardless of their relationship, consistent with the collaborative condition I found in this task.

I found a significant negative correlation between percentage overlap in friend and sibling dyads' social circles and the percentage of names lost from Elicitation to Recall 1, $r = -.36$, $p = .012$. Separating analysis by relationship and collaborative condition, I found this effect was only significant for collaborative sibling dyads, with a Bonferroni correction ($\alpha = .013$), $r = -.69$, $p = .012$. Thus, collaborative sibling dyads with more overlap in their social circles lost fewer names from Elicitation to Recall 1. Having a greater overlap in their social circles protected siblings from some of the negative effects of collaboration, even though it may not have allowed them to benefit. Having a greater overlap in their social circles may have made siblings' retrieval strategies more similar, decreasing the retrieval disruption caused by collaboration, but not similar enough to remove the disruption entirely. This effect may have affected siblings only due to their longer shared history than friends.

Table 3.5

Percentage of Items Gained and Lost from Elicitation to Recall 1

	Nominal		Collaborative		Total	
Relationship	Gained	Lost	Gained	Lost	Gained	Lost
			Social Circle List			
Strangers	19.06 (19.24)	15.05 (8.85)	4.55 (5.77)	24.52 (11.83)	12.12 (15.98)	19.58 (11.23)
Friends	24.56 (23.14)	12.23 (8.00)	20.93 (20.48)	32.35 (8.37)	22.67 (21.37)	22.73 (13.03)
Siblings	10.47 (10.91)	16.75 (10.98)	10.22 (10.19)	35.91 (15.62)	10.34 (10.33)	26.33 (16.44)
Total	17.84 (18.71)	14.75 (9.31)	12.11 (15.04)	31.11 (12.87)	14.98 (17.10)	22.93 (13.86)
			News Event List			
Strangers	38.39 (8.90)	26.80 (18.40)	34.30 (18.46)	39.63 (16.05)	34.35 (13.67)	30.38 (18.41)
Friends	62.31 (28.74)	17.19 (11.93)	34.53 (24.53)	29.29 (9.46)	47.81 (29.62)	23.50 (12.15)
Siblings	53.25 (24.49)	13.44 (10.85)	41.87 (13.17)	32.24 (13.46)	47.56 (29.10)	22.84 (15.33)
Total	50.97 (23.72)	19.20 (14.93)	35.64 (25.66)	31.87 (13.86)	43.30 (25.72)	25.54 (15.66)

Note. Standard deviations appear in parentheses.

News event list. At Recall 1, dyads gained a mean of 43.30% (*SD* = 25.72) of the news events they elicited and lost a mean of 25.54% (*SD* = 15.66) of the news events they elicited (see Table 3.5 for percentage of items gained and items lost from Elicitation to Recall 1). The percentage of news events gained ranged from 0 to 120%, meaning they gained more news events than they had originally elicited, and the percentage of news events lost ranged from 0 to 66.67%.

Using a 3 x 2 (relationship x collaborative condition) ANOVA, I found that collaborative dyads gained a lower percentage of news events from Elicitation to Recall 1 than nominal dyads, $F(1, 64) = 7.49$, $p = .008$, $\eta_p^2 = .10$. I found no significant effect of relationship on the percentage of news events gained from Elicitation to Recall 1, $F(2, 70) = F(2, 64) = 2.53$, $p = .087$, and relationship did not significantly interact with collaborative condition, $F(2, 64) = 1.09$, $p = .343$. Therefore, regardless of their relationship, collaborative dyads were less able than nominal dyads to generate additional news events that they had not previously elicited individually.

Using a 3 x 2 (relationship x collaborative condition) ANOVA, I found a similar pattern of results for percentage of news events lost. Collaborative dyads lost a higher percentage of news events than nominal dyads, $F(1, 64) = 14.28$, $p < .001$, $\eta_p^2 = .18$. I found no significant effect of relationship on the percentage of news events lost from Elicitation to Recall 1, $F(2, 64) = 2.18$, $p = .122$, and relationship did not significantly interact with collaborative condition, $F(2, 64) = 0.95$, $p = .393$. Therefore, collaboration prevented dyads from recalling all of the news events they had elicited individually.

Items gained and lost Recall 1 summary. In the social circle list, collaborative dyads lost a higher percentage of names but gained as many names as nominal dyads. This finding suggests that my finding of collaborative inhibition in the social circle list occurred because collaboration prevented dyad members from recalling all of the names they had previously elicited. Siblings gained a lower percentage of names, regardless of whether they were collaborative or nominal dyads, reflecting their lower proportional social circle recall compared to friends. Nevertheless, siblings lost fewer names when they had more overlap in each other's social circles at Elicitation, indicating the importance of shared history and knowledge in this task.

In the news event list, collaborative dyads gained a lower percentage and lost a higher percentage of news events than nominal dyads. This finding suggests that the collaborative inhibition I found in this task was due to both a lack of cross-cuing in collaborative dyads to gain more news events at Recall 1 than at Elicitation, and collaboration preventing dyad members from accessing the news events they previously recalled individually. This pattern of findings supports the retrieval disruption explanation of collaborative inhibition (Basden et al., 1997). Another possible explanation for this pattern of results is that collaborative dyads spoke more about each news event than participants in nominal dyads. Given the imposed time limit, discussing or explaining news events to each other may have impacted collaborative dyads' ability to recall as many items as nominal dyads, if participants in nominal dyads recalled each news event with little explanation.

Recall 2. ***Social circle list.*** At Recall 2, dyads gained a mean of 22.71% (SD = 20.72) of the names they elicited and lost a mean of 17.17% (SD = 10.80) of the names they elicited (see Table 3.6 for percentage of items gained and items lost from Elicitation to Recall 2). The percentage of names gained ranged from 0 to 110%, and the percentage of names lost ranged from 0 to 39.68%.

Using a 3 x 2 (relationship x collaborative condition) ANOVA, I found a marginally significant effect of relationship on the percentage of names gained, $F(2, 64) = 3.05$, $p = .054$. This marginally significant effect was likely due to a trend towards friends gaining more names from Elicitation to Recall 2 than strangers and siblings. Therefore, unlike at Recall 1, sibling dyads no longer gained fewer items than friend dyads. I found no significant effect of collaborative condition on the percentage of names gained from Elicitation to Recall 2, F(1,

64) = 2.79, p = .100. Relationship did not significantly interact with collaborative condition, $F(2, 64) = 0.498$, p = .610. Therefore, collaboration continued to have little effect on proportion of names gained from Elicitation to Recall 2.

Table 3.6

Items Gained and Lost from Elicitation to Recall 2

	Nominal		Collaborative		Total	
Relationship	Gained	Lost	Gained	Lost	Gained	Lost
			Social Circle List			
Strangers	23.96 (21.66)	15.19 (10.12)	9.82 (9.57)	18.20 (8.20)	17.20 (18.12)	16.63 (9.17)
Friends	34.62 (27.07)	12.46 (8.77)	27.18 (21.81)	18.09 (13.41)	30.74 (24.19)	15.40 (11.54)
Siblings	21.54 (16.59)	14.00 (10.67)	19.06 (19.40)	24.77 (10.13)	20.30 (17.70)	19.38 (10.57)
Total	26.48 (22.11)	13.92 (9.69)	18.94 (18.80)	20.41 (11.01)	22.71 (20.72)	17.17 (10.80)
			News Event List			
Strangers	59.09 (17.03)	21.62 (9.39)	55.97 (32.70)	22.50 (20.18)	57.59 (25.17)	22.04 (15.15)
Friends	91.06 (22.66)	24.23 (12.52)	56.19 (31.00)	31.00 (26.33)	72.86 (34.32)	27.76 (20.73)
Siblings	82.43 (30.88)	27.48 (16.60)	67.44 (43.19)	22.73 (13.93)	74.94 (37.51)	25.10 (15.34)
Total	77.17 (27.22)	24.45 (13.16)	59.97 (36.79)	25.49 (20.57)	68.56 (33.27)	24.97 (17.15)

Note. Standard deviations appear in parentheses.

Using a 3 x 2 (relationship x collaborative condition) ANOVA, I found collaborative dyads lost a higher percentage of names than nominal dyads from Elicitation to Recall 2, $F(1, 64) = 6.76$, $p = .012$, $\eta_p^2 = .10$. I found no significant effect of relationship on the percentage of names lost from Elicitation to Recall 2, $F(2, 64) = 0.95$, $p = .393$. Relationship did not significantly interact with collaborative condition, $F(2, 64) = 0.85$, $p = .433$. Thus, consistent with the collaborative inhibition I found in this task, but in opposition to the usual findings of post-collaborative benefits, collaboration continued to disrupt post-collaborative dyads' individual performance at Recall 2.

News event list. At Recall 2, dyads gained a mean of 68.56% (*SD* = 33.27) of the news events they elicited and lost a mean of 24.97% (*SD* = 17.15) of the news events they elicited (see Table 3.6 for percentage of items gained and items lost from Elicitation to Recall 2). The percentage of news events gained ranged from 0 to 180%, meaning they gained nearly twice as many news events as they had originally elicited, and the percentage of news events lost ranged from 0 to 85.71%.

Using a 3 x 2 (relationship x collaborative condition) ANOVA, I found no significant effect of relationship on the percentage of news events gained, $F(2, 64) = 2.18$, $p = .121$. I found that collaborative dyads gained a lower percentage of news events than nominal dyads from Elicitation to Recall 2, $F(1, 64) = 5.47$, $p = .023$, $\eta_p^2 = .08$. Relationship did not significantly interact with collaborative condition, $F(2, 64) = 1.48$, $p = .235$. Therefore, the effect that collaboration had on percentage of news events gained during Recall 1 continued to impact post-collaborative dyads' performance at Recall 2.

Using a 3 x 2 (relationship x collaborative condition) ANOVA, I found no significant effect of relationship on the percentage of news events lost from Elicitation to Recall 2, $F(2, 64) = 0.58$, $p = .561$. I also found no significant effect of collaborative condition on the percentage of news events lost from Elicitation to Recall 2, $F(1, 64) = 0.05$ $p = .818$. Relationship did not significantly interact with collaborative condition, $F(2, 64) = 0.64$, $p =$

.532. The disruption that collaboration had on recall during Recall 1 therefore no longer impacted post-collaborative dyads' performance at Recall 2.

Items gained and lost Recall 2 summary. The effects of collaboration on Recall 1 performance continued to affect Recall 2 performance in terms of items gained and lost in the social circle list, but only for items gained in the news event list. Former collaborative dyads lost a higher proportion of names from Elicitation but gained as many names as nominal dyads. Thus, collaboration appeared to have prevented participants from recalling names they had originally elicited, which persisted into Recall 2. However, collaborating at Recall 1 did not prevent individual participants from recalling new names at Recall 2. In the news event list, the effects of collaboration on Recall 1 performance continued to have an effect on Recall 2 performance only in terms of percentage of news events gained. Former collaborative dyads gained a lower percentage of news events from Elicitation but lost as many news events as nominal dyads. Thus, the findings for items gained and lost in Recall 2 reflect the surprising lack of post-collaborative benefits I found.

Collaboration Style

Collaborative process coding. Using the same coding scheme that I used in Experiment 1, I coded collaborative dyads' transcripts for collaborative processes corresponding to Factor 1 and Factor 2 in Harris et al. (2011). Factor 1 collaborative processes predicted poor collaborative performance in Harris et al.'s older married couples and included: one dyad member using an individual strategy that their partner did not use, unsuccessful cuing attempts, and corrections and disagreements. Factor 2 collaborative processes predicted collaborative success in Harris et al.'s older married couples and included: use of categories to support recall, use of a coordinated group strategy to support recall, successful cuing attempts, and mirrored repetitions. I present the number and percentage of dyads using each collaborative process in Table 3.7, and the number of turns representing each countable collaborative process (successful cues, mirrored repetition, unsuccessful cues, and corrections and disagreements) in Table 3.8.

Factor 1 collaborative processes. *Individual strategy use.* Few dyads used an individual strategy when recalling the word list, the social circle list, and the news event list (see Table 3.7). Strangers, friends, and siblings were equally likely to use an individual strategy in the word list, $\chi^2 = 0.48$, $p = .788$, and news event lists, $\chi^2 = 2.21$, $p = .331$, but friends and siblings were far less likely than strangers to use an individual strategy in the social circle list, $\chi^2 = 6.12$, $p = .047$. This finding is most probably due to the fact that, unlike strangers, friends and siblings had knowledge about each others' social circles, and therefore approached the task as a dyad. Strangers, on the other hand, recalled each dyad member's social circle one at a time and so were not genuinely collaborating.

Unsuccessful cues. In each transcript, I coded for: (1) the presence of unsuccessful cues (see Table 3.7), and (2) the number of turns that constituted unsuccessful cues (see Table 3.8). The vast majority of dyads had unsuccessful cues in the word list, but fewer had unsuccessful cues in the social circle and news event lists. Strangers, friends, and siblings were equally likely to have unsuccessful cues in all three tasks, all χ^2s < 2.27, all ps $> .323$ (see Table 3.7). Strangers, friends, and siblings also had equal numbers of unsuccessful cues in all three tasks, all Fs < 0.75, all ps $> .484$ (see Table 3.8). Therefore, relationship did not influence the rate of unsuccessful cues in any task. As Harris et al. (2011) found a lack of unsuccessful cues was associated with less successful collaborative performance, the pattern of unsuccessful cues across tasks reflects the pattern of collaborative inhibition, with more unsuccessful cues in the word list, in which no relationship showed collaborative inhibition and fewer unsuccessful cues in the social circle and news event lists, in which all relationships showed collaborative inhibition.

Corrections and disagreements. In each transcript, I coded for: (1) the presence of corrections and disagreements (see Table 3.7), and (2) the number of turns that constituted corrections and disagreements (see Table 3.8). Less than half of all dyads had corrections and disagreements in each task. In the word list and the social circle list, more friends and siblings had corrections and disagreements than strangers, $\chi^2 = 7.72$, $p = .021$ and $\chi^2 = 7.23$, $p = .027$, respectively (see Table 3.7). However, the strangers who did have corrections and disagreements had only marginally fewer than friends and siblings in the word list, $F(2, 32) = 3.10$, $p = .059$, and similar rates to friends and siblings in the social circle list, $F(2, 32) = 2.23$, $p = .124$ (see Table 3.8).

In the news event list, far more friends and siblings had corrections and disagreements than strangers, none of whom had corrections and disagreements, $\chi^2 = 13.51$, $p = .001$ (see Table 3.7), and I found a significant effect of relationship on the number of corrections and disagreements in each transcript, $F(2, 32) = 5.94$, $p = .006$, $\eta_p^2 = .27$ (see Table 3.8). Using planned Helmert contrasts I confirmed that friends and siblings had more corrections and disagreements than strangers (who had none), $p = .016$, and siblings had more corrections and disagreements than friends, $p = .020$. Corrections and disagreements were unlikely to have contributed considerably to collaborative inhibition in the social circle and news event lists because I found equal inhibition across relationships in these tasks, and in fact I found more corrections and disagreements in the word list than the social circle and news event lists.

Factor 2 collaborative processes. *Category use.* Most dyads used categories across all three tasks (see Table 3.7). All but one dyad used categories when recalling their social circles, mirroring the high levels of category use when recalling people's names in Experiment 1. Strangers, friends, and siblings were equally likely to use categories in all three tasks, all χ^2s < 2.25, all *p*s > .327. Thus, category use was extremely common across relationships and tasks, even if it did not prevent collaborative inhibition.

Group strategy use. Again, most dyads used a group strategy when recalling the word list, but fewer dyads used a group strategy when recalling social circles, and very few used a group strategy when recalling news events (see Table 3.7). Strangers, friends, and siblings were equally likely to use a group strategy in all three tasks, all χ^2s < 2.38, all *p*s > .306. Thus, friends' and siblings' lower rate of individual strategy use in the social circle task compared to strangers did not result in a higher rate of group strategy use. The lower levels of group strategy use in the social circle and news event lists than in the word list may have contributed to collaborative inhibition in those tasks.

Successful cues. In each transcript, I coded for: (1) the presence of successful cues (see Table 3.7), and (2) the number of turns that constituted successful cues (see Table 3.8). Most dyads had successful cues in all three tasks, especially the word list. Strangers, friends, and siblings were equally likely to have successful cues in all three tasks, all χ^2s < 3.54, all *p*s > .172 (see Table 3.7). Strangers, friends, and siblings had an equal number of turns that were successful cues in all three tasks, all *F*s < 1.56, all *p*s > .228 (see Table 3.8). Therefore, strangers, friends, and siblings were equally able to successfully cue each other in all three tasks. The collaborative inhibition I found in the social circle and news event lists did not appear to be due to a lack of successful cues in these tasks, although fewer dyads had successful cues in the social circle and news event lists than the word list.

Table 3.7

Number and Percentage of Dyads Using Collaborative Process Coding Variables by Relationship and Task

		Factor 1			Factor 2			
Relationship	*N*	Individual Strategy	Unsuccessful Cues	Corrections and Disagreements	Categories	Group Strategy	Successful Cues	Mirrored Repetitions
Word List								
Strangers	11	4 (36.4%)	10 (90.9%)	4 (36.4%)	10 (90.9%)	11 (100%)	11 (100%)	11 (100%)
Friends	12	3 (25.0%)	11 (91.7%)	10 (83.3%)	8 (66.7%)	11 (91.7%)	10 (83.3%)	11 (91.7%)
Siblings	12	3 (25.0%)	11 (91.7%)	10 (83.3%)	10 (83.3%)	11 (91.7%)	10 (83.3%)	12 (100%)
Total	35	10 (28.6%)	32 (91.4%)	24 (68.6%)	28 (80.0%)	33 (94.3%)	31 (88.6%)	34 (97.1%)
Social Circle List								
Strangers	11	6 (54.5%)	6 (54.5%)	0 (0%)	11 (100%)	8 (72.7%)	6 (54.5%)	1 (9.1%)
Friends	12	3 (25.0%)	7 (58.3%)	4 (33.3%)	11 (91.7%)	5 (41.7%)	8 (66.7%)	10 (83.3%)
Siblings	12	1 (8.3%)	6 (50.0%)	6 (50.0%)	12 (100%)	7 (58.3%)	9 (75.0%)	10 (83.3%)
Total	35	10 (28.6%)	19 (54.3%)	10 (28.6%)	34 (97.1%)	20 (57.1%)	23 (65.7%)	21 (60.0%)
News Event List								
Strangers	11	3 (27.3%)	5 (45.5%)	0 (0%)	8 (72.7%)	2 (18.2%)	8 (72.7%)	5 (45.5%)
Friends	12	1 (8.3%)	9 (75.0%)	8 (66.7%)	9 (75.0%)	2 (16.7%)	9 (75.0%)	10 (83.3%)
Siblings	12	1 (8.3%)	8 (66.7%)	8 (66.7%)	7 (58.3%)	0 (0%)	5 (41.7%)	11 (91.7%)
Total	35	5 (14.3%)	22 (32.9%)	16 (45.7%)	24 (68.6%)	4 (11.4%)	22 (62.9%)	26 (74.3%)

Table 3.8

Mean Number and Percentage of Collaborative Processes by Relationship and Task

Relationship		Successful Cues	Mirrored Repetitions	Unsuccessful Cues	Corrections and Disagreements
		Word List			
Strangers	M (SD)	3.91 (2.66)	6.45 (2.66)	5.45 (4.39)	0.73 (1.10)
	%	8%	8%	12%	1%
Friends	M (SD)	3.67 (2.39)	4.50 (2.47)	4.67 (3.98)	3.17 (2.76)
	%	9%	12%	11%	7%
Siblings	M (SD)	3.08 (2.27)	5.75 (2.86)	4.58 (2.94)	3.33 (3.73)
	%	7%	11%	14%	8%
Total	M (SD)	3.54 (2.39)	5.54 (3.90)	4.89 (3.71)	2.45 (2.95)
	%	8%	12%	12%	6%
		Social Circle List			
Strangers	M (SD)	1.09 (1.22)	0.64 (2.11)	0.72 (0.79)	0 (0.00)
	%	12%	8%	2%	0%
Friends	M (SD)	2.42 (1.78)	4.33 (4.05)	1.17 (1.34)	1.17 (2.59)
	%	7%	3	11%	3%
Siblings	M (SD)	2.42 (2.81)	4.17 (5.20)	0.92 (1.00)	1.75 (2.26)
	%	6%	4%	11%	6%
Total	M (SD)	2.00 (2.10)	3.11 (4.27)	0.94 (1.06)	1.00 (2.09)
	%	8%	5%	8%	3
		News Event List			
Strangers	M (SD)	1.81 (1.66)	0.91 (1.51)	1.09 (1.45)	0 (0.00)
	%	8%	3%	5%	0%
Friends	M (SD)	2.17 (1.53)	2.00 (1.86)	1.92 (2.07)	1.33 (1.50)
	%	7%	6%	5%	4%
Siblings	M (SD)	1.50 (2.35)	1.92 (1.51)	1.92 (1.98)	3.33 (3.70)
	%	5%	7%	6%	10%
Total	M (SD)	1.83 (1.85)	1.63 (1.66)	1.66 (1.85)	1.60 (2.66)
	%	7%	5%	5%	5%

Mirrored repetition. In each transcript, I coded for: (1) the presence of mirrored repetitions (see Table 3.7), and (2) the number of turns that constituted mirrored repetitions (see Table 3.8). Most dyads had mirrored repetitions in all three tasks, especially the word list. In the word list, strangers, friends, and siblings were equally likely to have mirrored repetitions, $\chi^2 = 1.97$, $p = .373$ (see Table 3.7), and had an equal number of turns that were mirrored repetitions, $F(2, 32) = 0.73$, $p = .489$ (see Table 3.8). In the social circle list, friends and siblings were far more likely to have mirrored repetitions than strangers, $\chi^2 = 17.32$, $p < .001$ (see Table 3.7), but the effect of relationship on the number of mirrored repetitions in the social circle list was only marginally significant, $F(2, 32) = 3.02$, $p = .063$ (see Table 3.8). Thus, although more friend and sibling dyads had mirrored repetitions than stranger dyads in the social circle list, the stranger dyads who did have mirrored repetitions did not use them at lower rates than friend and sibling dyads. In the news event list, friends and siblings were also more likely to have mirrored repetitions than strangers, $\chi^2 = 7.20$, $p = .027$, but again the effect of relationship on the number of turns that were mirrored repetitions in the social circle list was not significant, $F(2, 32) = 1.56$, $p = 227$. Thus, in both self-generated lists, although more friend and sibling dyads used mirrored repetitions than strangers, they did not use them at higher rates. As most dyads used mirrored repetitions in all three tasks, mirrored repetitions did not explain dyads' collaborative success in the word list, or the collaborative inhibition in the social circle and news event lists.

Process coding summary. Strangers, friends, and siblings commonly used the four Factor 2 collaborative processes (categories, a group strategy, successful cues, and mirrored repetitions) in all three tasks, but less than in Experiment 1, reflecting the collaborative inhibition I found in this experiment. Fewer collaborative dyads used group strategies when they recalled their social circles and news events than when they recalled the word list, consistent with the collaborative inhibition I found in these tasks. Dyads may have considered the word list as more amenable to group strategy use than the social circle and news event lists.

In terms of Factor 1 collaborative processes, unsuccessful cues were commonly used by strangers, friends, and siblings in all three tasks, but more so in the word list. In Harris et al. (2011) it was a lack of unsuccessful cues that predicted worse collaborative recall performance. Thus, the fact that more dyads had unsuccessful cues in the word list is consistent with their collaborative success in this task compared to the other two tasks. Unsuccessful cues demonstrate that collaborative dyads' at least attempted to cue each other. Relatively few strangers, friends, and siblings used individual strategies, and fewer friends and siblings used an individual strategy than strangers in the social circle list. Friends and siblings had higher rates of corrections and disagreements than strangers, in terms of both the number of strangers having corrections and disagreements, and the number of corrections and disagreements they had. The high rates of corrections and disagreements found in siblings' and friends' transcripts did not appear to negatively affect the number of items they recalled, because dyads in these relationships had equal collaborative inhibition to strangers.

Turn taking. Dyads said a mean of 5.84 words per turn (SD = 1.84) in the word list. I found no significant effect of relationship on the difference in words per turn in the word list, $F(2, 32) = 0.28$, $p = .756$. The number of words per turn in the word list did not correlate with word list recall, $r = .05$, $p = .757$. Thus, the extent to which dyads had back-and-forth turn taking did not influence how many words they recalled.

Dyads said a mean of 8.69 words per turn (SD = 7.72) in the social circle list. I found a significant effect of relationship on the difference in words per turn in the social circle list, $F(2, 32) = 7.58$, $p = .002$, $\eta_p^2 = .32$. I performed planned Helmert contrasts, which showed that friends and siblings had significantly shorter turns than strangers (M = 14.91, SD = 10.96), $p = .001$, but there was no significant difference in the length of friends' turns (M = 4.69, SD = 1.71) and siblings' turns (M = 7.00, SD = 3.58), $p = .396$. Friends and siblings had shorter turns than strangers because they approached the task in a more collaborative manner, in which they discussed the task and each contributed names throughout the task with a back-and-forth collaboration style. Strangers, on the other hand, approached the task as two individuals, listing their own social circles separately, creating longer monologues. The number of words per turn in the social circle list marginally negatively correlated with proportional social circle list recall, $r = -.32$, $p = .064$. Thus, I found a trend towards longer monologues impairing collaborative success.

Dyads said a mean of 8.82 words per turn ($SD = 2.74$) in the news event list. I found no significant effect of relationship on the difference in words per turn in the news event list, $F(2, 32) = 1.55$, $p = .227$. The length of turns in the news event list did not correlate with proportional recall of the news event list, $r = -.05$, $p = .792$. Thus, the length of turns in the news event list did not influence the number of items collaborative dyads recalled, suggesting that the collaborative inhibition I found in this task was not due to collaborative dyads discussing or explaining each news event more than nominal dyads.

Questionnaires

PAIR Inventory. Friends rated themselves significantly higher than siblings on emotional intimacy, $F(1, 43) = 4.21$, $p = .046$, $\eta_p^2 = .09$, but not social intimacy, intellectual intimacy, recreational intimacy or conventionality, all Fs < 3.12, all ps < .084, (see Table 3.9). I found no significant effects of collaborative condition on any PAIR subscales, all Fs < 0.96, all ps > .332, and I found no significant interaction effects, all Fs < 1.70, all ps > .199, meaning collaborative and nominal dyads did not appear to differ in intimacy across all five subscales. Thus, friends rated themselves higher than siblings in terms of emotional understanding and support, but not any other kind of intimacy.

Table 3.9

Mean Ratings on PAIR Inventory by Relationship

PAIR Subscale	Friends	Siblings	Total
Emotional Intimacy	47.70 (9.35)	41.21 (11.64)	44.38 (10.97)
Social Intimacy	43.35 (9.02)	39.13 (13.23)	41.19 (12.12)
Intellectual Intimacy	46.65 (9.12)	41.21 (11.78)	43.87 (10.81)
Recreational Intimacy	44.78 (8.88)	43.21 (12.13)	43.98 (10.58)
Conventionality	42.83 (9.75)	37.04 (11.93)	39.87 (11.19)
Total	45.06 (8.16)	37.20 (11.93)	41.05 (10.90)

Note. Standard deviations appear in parentheses.

The only task that correlated significantly with any of the PAIR subscales was proportional recall of the social circle list, which correlated positively with emotional intimacy, intellectual intimacy, and the conventionality subscales, $r = .33$, $p = .026$, $r = .30$, $p = .043$, and $r = .33$, $p = .026$, respectively. That is, the more friends and siblings rated themselves experiencing "a closeness of feelings" and "sharing ideas" (Schaefer & Olson, 1981, p. 50) the more names they recalled at Recall 1 of the social circle list as a proportion of the events they originally elicited. When I re-ran the correlations separately for nominal and collaborative dyads, using a Bonferroni correction ($\alpha = .025$), collaborative dyads showed significant correlations between social circle proportional recall and emotional intimacy, $r = .54$, $p = .007$, intellectual intimacy, $r = .45$, $p = .025$ and the conventionality subscale $r = .59$, $p = .002$. I found no significant correlations between PAIR subscales and recall performance in nominal dyads for any task. Therefore, intimacy appeared to promote relative collaborative success in the social circle task, even though dyads still showed collaborative inhibition overall.

Discussion

I found collaborative inhibition in the social circle and news event lists, but not the word list. Collaborative dyads gained just as many but lost more names in the social circle list from Elicitation to Recall 1 than nominal dyads. In the news event list, collaborative dyads gained fewer and lost more news events from Elicitation to Recall 1 than nominal dyads. These findings support the retrieval disruption explanation for collaborative inhibition; collaborative dyads lost more names and news events than nominal dyads from Elicitation to Recall 1 because collaboration disrupted dyad members' retrieval strategies, causing them to forget items they had previously recalled. Collaborative dyads did not appear to cross-cue each other to recall new items they had not previously elicited as individuals.

Process Findings: Quality of Collaboration

The major change I made to the experimental paradigm, asking participants to recall verbally instead of type their responses, meant that the tasks were more difficult than in Experiment 1. Within each task, participants had to remember which items they had already said. Members of collaborative dyads could also rely on their partner's memory, but they also had to keep track of what they each other had said. In contrast, in Experiment 1 participants could refer to what they had typed. A consequence of this was that in this experiment, many cues were of the form "have we said X?" particularly in the word list. The following extract from a stranger dyad in the word list demonstrates how having no written record of what they had already recalled influenced collaborative dyads' recall:

T: Did we say Bear?

K: Yeah.

T: Was Bear on it?

K: You said Bear. Did we say Paprika?

T: No.

Consequently, participants had more successful and unsuccessful cues in the word list in this experiment (8% and 12% of turns, respectively) than in Experiment 1 (4% and 5% of turns, respectively). These cues may have functioned to overcome the difficulty resulting from having to keep track of which words had been said. These findings demonstrate how the process of collaboration changes depending on task demands, and in doing so supports the product of collaboration. In Experiment 1, collaborative dyads were able to use their previously typed recall to cue new items and track what they had already said. In this experiment, the dyad members assumed this role themselves. In both cases, the processes dyad members used supported their collaborative recall to the extent that their recall was as successful as nominal dyads, at least in the word list.

Differences between strangers and acquainted dyads were the most apparent in the social circle list compared to the other tasks. In Experiment 1, I did not analyse strangers' people list recall because of task difficulties. In this experiment, I asked all participants to recall their own social circles. Considering strangers had no knowledge of each other's social circles, their collaboration in this task was quite different to other tasks. The following extract shows how strangers approached this task. Participant K listed all of her social circle before participant V started to list hers. There were very few collaborative processes in this example; only one cue, which starts the exchange, no mirrored repetitions, and no corrections and disagreements. This dyad did not use a group strategy; instead they recalled as individuals. This approach, typical of strangers, led to strangers having fewer and longer turns than friends and siblings.

V: Okay do you want to go first?

K: Okay um, then you got Victoria. Constance. Anthony D. Anthony C. Um, and Arthur. Ellis. James S. Georgia. I can't remember if I said Jen or Jennifer. They're the same person. Um, I said Matt L. Then there was Matt S. And then, who else? Then there was Anthony L. Christian. Christos. Nico. Liz. Amy.

Alex. Sotilli. Um. (pause) Cameron. Brendan. Malcolm. (pause) Elizabeth. George S. Fingail. And I'm pretty sure that's everyone.

V: Okay um I had Noemi. Priscilla. Cass. Diana. Soraya. Nicolette. Amelia. Testa. Galotta. All last names. Um Alex. Josh. (pause)

In comparison, the following extract from a friend dyads' recalling their social circles showed a much more collaborative approach to the task, typical of friends and siblings. The overlap between their social circles and their knowledge of each other's social circles is immediately apparent. There are quite a few mirrored repetitions even in this short extract, and the turns are much shorter, with only one or two names in each turn.

A: Um so Shelby.

J: Yep.

A & J: Izzy.

A: Anne.

J: Oh forgot her.

A: Annie.

J: Anne, Anne oh forgot her.

A: Chantal.

J: Chantal (laughs) Sally.

A: Ellie, Sophie.

J: Sophie, I said Sophie um C.

A: Yeah I said Sophie and Sophie S yeah.

J: I said Sarah.

A: Which one?

J: R.

A: I said your sister as like Sarah C.

J: Oh okay.

Thus, the social circle task was a different task for strangers compared to friends and siblings, and pushed the boundaries of strangers' abilities to collaborative effectively. In the news event task, strangers, friends, and siblings were on a more even playing field, and strangers were better able to collaborate, as the following extract shows. It also shows that simply counting the product of collaboration both depends on the task, and underestimates successful collaborative processes. The members of this stranger dyad used mirrored repetitions and were able to successfully cue each other based on shared knowledge.

O: Um I still remember that girl that, she got raped at Baulkham Hills.

A: Oh really, um I just remember that, that, that little girl who got um thrown bleach at.

O: Oh yeah! That was recent, yeah.

A: And um I said the Boston bombing.

O: Oh that's a good one! Um I had when Kevin Rudd like tried, almost took back his,

A: Position.

O: Um prime um,

A: Prime ministership.

O: Ministership.

A: Um I said,

O: I had some other ones as well.

A: I'm actually really bad at this.

O: I had when, the drug scandal in the NRL and AFL.

A: Oh okay, yeah I don't watch sport. Um I said the Sandy Hooks um shootings, like the, the primary school.

O: Oh yeah that's a good one! Yeah. Was there another shooting?

A: Yeah there was, um, the one at, the one in the theatre, for like Batman.

Thus, having some shared knowledge, even if it was not personal knowledge based on shared history, meant strangers could use collaborative processes more effectively. The difference in strangers' ability to collaborate on the social circle versus the news event task demonstrates how important shared knowledge is for the process of collaboration. However, more extensive use of collaborative processes was not necessarily enough to have a substantial impact on the product of recall. In the social circle list, friends and siblings showed collaborative inhibition, and in the news event list, all relationships showed collaborative inhibition despite their more back-and-forth collaboration style with better use of collaborative processes than strangers recalling their social circles. There may be some methodological reasons for collaborative dyads' inability to turn their use of collaborative processes into successful product of recall. On the other hand, it could be that self-generated lists are more prone to retrieval disruption than lists learnt in the laboratory. I will return to these possibilities in the section on product findings below.

Another difference in the quality of collaboration between this experiment and Experiment 1 was that I found much lower rates of corrections and disagreements in this experiment. One to two thirds of friends and siblings had corrections or disagreements in the social circle and news event lists, compared to 90% or more in Experiment 1. The most likely reason for this finding is that the two experimenters were more salient in this experiment than in Experiment 1, in which participants faced the computer during recall. As the experimenters, the second experimenter and I were silently involved in dyads' conversations in this experiment. Our salience may have led collaborative dyads to be more polite during recall. In contrast, in Experiment 1 participants faced a computer and may have been less aware of my presence during their conversations. Another consequence of experimenter salience during this experiment was that the nature of friends' and siblings' disagreements changed. Friends and siblings were more polite in the language they used during corrections and disagreements in this experiment. Compare the following polite disagreement from a sibling dyad correcting each other during the news event list with the examples in Experiment 1. In this example, both siblings expressed their disagreements with uncertainty.

V: I put um, the, the head of, the new religious person, the, I don't know what the title is, but you know the old one died so they bring a new one. There's smoke and stuff and it's a big deal for all the religious people. That's going on, well it's already happened, they picked him and he's like,

D: It wasn't the bishop?

V: I don't think so. Bishop is not so high up.

D: Bishop is retiring. Isn't he?

V: Oh so maybe he didn't die. I don't know. Well it was some new guy. I don't know.

D: Pretty sure the bishop retired.

This finding demonstrated that the processes of collaborative recall can be influenced not just by the relationship between the dyad and what they attempt to recall, but also the social context and method of recall.

Product Findings

The fact that I doubled the number of items in the word list did not change the lack of collaborative inhibition in this task. Therefore, it cannot be the case that my failure to find collaborative inhibition in the Experiment 1 word list was due to ceiling effects. In this experiment, dyads recalled a mean of less than half of the 48 words in both Recall 1 and Recall 2. Thus, although I did not find ceiling effects here, I still found no collaborative inhibition. In both experiments, category use and group strategy use supported recall in the word list. The fact that a large percentage of dyads in both experiments used categories and a group strategy is more likely to have led to a lack of collaborative inhibition in both experiments. However, the question remains why these strategies were so common in both experiments.

Despite friends' and siblings' more successful collaboration in terms of process than strangers in the social circle and news event lists, they did not show more successful product. I found collaborative inhibition across all relationships in these tasks. One reason for these findings could be that self-generated lists are more prone to retrieval disruption than an experimenter-prescribed word list. Collaborative inhibition has been shown to be stronger when the structure and organization of group members' recall are more different, and when there is less shared information, likely because these groups show more retrieval disruption (Congleton & Rajaram, 2014). The self-generated lists were elicited individually. Whereas both dyad members saw the same word list in the same order as each other, for both self-generated lists they elicited different items to each other and in a different order. Even when they were based on shared knowledge and when there were some overlapping items, they were quite idiosyncratic in their items, organization, and structure. Thus, it may have been more difficult for dyads to show collaborative success in the social circle and news event lists than in the word list, despite their use of collaborative processes. Friends and siblings may not have shown collaborative inhibition in Experiment 1 because the self-generated lists contained more shared knowledge than the self-generated lists in this experiment. Also, unlike in Experiment 1, participants were unable to read the items they had already said in this experiment. This methodological change may have increased the extent to which dyad members disrupted each other's retrieval, because they had the additional task of tracking what they had already recalled as well as recalling new items.

Another reason could be the time limit; collaborative dyads only had two minutes to recall the social circle and news event lists at Recall 1, whereas nominal dyads had two minutes each. I designed the tasks this way to ensure the time between Elicitation, Recall 1 and Recall 2 was the same for nominal and collaborative dyads. However it meant that collaborative dyads had less time to recall their social circles and news events. Recalling collaboratively also requires extra conversational work that recalling individually does not require, including the collaborative processes I coded in the transcripts. Although these collaborative processes may support collaborative recall, they take time. The list of news events in particular compelled collaborative participants to explain news events unknown to their partner. Participants in nominal dyads, on the other hand, did not explain news events they had already elicited. Removing the time limit in future research may therefore reduce collaborative inhibition in tasks such as these.

In Experiment 1, I found collaborative inhibition for strangers recalling news events. In this experiment, I found collaborative inhibition for strangers, friends, and siblings recalling news events. Thus, my findings in this study suggest that the collaborative inhibition I found in Experiment 1 was due to the stimuli of news events rather than strangers' lack of prior relationship. Most participants reported difficulty in recalling news events. The broad set of items to recall in this task meant that each dyad member often did not know about the news events their collaborative partner recalled, regardless of prior acquaintance. Thus, dyads across all three relationships lacked sufficient shared knowledge of news events to reduce or eliminate collaborative inhibition in this task.

I may have found collaborative inhibition in the social circle list because collaborative dyads had to recall two lists at the same time while members of nominal dyads had to recall only one list at a time. This difference meant that collaborative dyads had a more difficult task in the social circle list than nominal dyads. Most friends and siblings had overlapping social circles or at least some knowledge of each other's social circles that may have helped them collaborate. This knowledge may have helped but did not overcome the fact that collaborative dyads had to recall more names at a time than nominal dyads, although siblings with greater overlap in their social circles lost fewer names in collaboration than those with less overlap. Social circles tend to have a network structure (Ueno & Adams, 2006), so those with more overlap may have more similar structure and organization. Thus, the protective effect of overlapping social circles may have been due to dyad members having more similar retrieval strategies, resulting in less retrieval disruption (Basden et al., 1997). However, overall, the overlap was unlikely to completely eliminate retrieval disruption, particularly when collaborative dyads had more items to recall than individuals in nominal dyads in the two minutes given.

Unlike Harris et al. (2012) and Harris et al. (2013) I found no evidence that collaboration aided subsequent individual recall. Most of the negative product effects of collaboration that I found at Recall 1 persisted into Recall 2, with former collaborative dyads showing lower proportional recall than former nominal dyads in the social circle list, and marginally in the news event list, but not in the word list. The effects of collaboration on items gained and lost persisted into Recall 2, except that collaborative dyads no longer lost more news events than nominal dyads. Therefore, individual members of former collaborative dyads were able to remember the news events they had originally elicited but had forgotten at Recall 1. Yet they were not able to gain additional items at Recall 2 to the same extent as nominal dyads. This pattern of gained and lost items from Recall 1 to Recall 2 suggests that retrieval disruption was the mechanism for collaborative inhibition at Recall 1. However, it is unclear why individuals who previously collaborated were unable to recover from the retrieval disruption they experienced at Recall 2 to show post-collaborative benefits. However, it may be due to the self-generated nature of the tasks in this experiment, or my method of using proportional recall instead of the number of items recalled at each recall.

Friends had higher proportional recall of the social circle list than siblings, and strangers had lower proportional recall of the news event list than friends and siblings. These differences did not persist into Recall 2. In fact, relationship had surprisingly small and inconsistent effects on collaborative performance across the tasks. The biggest difference due to relationship was the way in which strangers, compared to friends and siblings, approached the social circle list. More strangers used an individual strategy in the social circle list than friends and siblings because strangers did not have any knowledge of each other’s social circles. In addition, fewer strangers than friends and siblings used mirrored repetition in both the social circle and news event lists, and strangers had a lower proportion of turns that were mirrored repetitions in the social circle list. A function of mirrored repetition is to say, “we are on the same page.” Strangers had less reason to use mirrored repetitions in the social circle list because they were not in a position to concur with what their partner recalled.

The other way that relationship influenced the tasks was that siblings were the most prone to corrections or disagreements. As in Experiment 1, siblings’ corrections and disagreements did not negatively affect their collaborative recall performance. Marginally more siblings than strangers and friends had corrections or disagreements in the social circle list. Siblings had a higher proportion of turns that were corrections or disagreements in the news event list and no strangers had corrections or disagreements in this task.

In keeping the stimuli constant across all three relationships in this experiment, I was better able to compare across strangers, friends, and siblings. However, in doing so, I may have prevented friends and siblings from benefiting from their prior acquaintance. In Experiment 1, friends and siblings recalled events they had shared in the event list, but here they recalled news events, which are much less personally relevant and certainly less relevant to their relationship. This may be why they performed no better than strangers in the news event list. Friends and siblings could benefit from knowledge of each other’s social circles in the social circle list. However the fact that I asked them to recall each of their social circles in the same time frame as nominal dyads recalled their own individual social circles meant that this knowledge did not result in better collaborative recall performance.

Taken together, Experiments 1 and 2 show that collaborative inhibition depends on task and relationship. For collaborative dyads to benefit from their shared history, the task must be relevant to their relationship. Friends and siblings showed collaborative inhibition when recalling news events in Experiment 2, but not events that related to their relationship in Experiment 1. They did not show collaborative inhibition when they recalled mutual friends and acquaintances in Experiment 1, but they did when they recalled two overlapping social circles in Experiment 2. These experiments highlight how difficult it is to design tasks that allow dyads with prior acquaintance to benefit from their shared history in ways consistent with transactive memory, while simultaneously comparing their performance with strangers, who do not have shared history to draw on.

CHAPTER FOUR

Experiment 3:
Strangers', Friends' and Siblings' Typed Recall of Autobiographical Memories

In this experiment, I aimed to explore the effects of relationship and collaboration on the typed recall of autobiographical memories. In particular, I aimed to determine whether recalling events with another person changed the quantity and quality of what was recalled, and whether the effect of collaboration was different when recalling shared events with a friend or sibling from when recalling unshared events with a stranger. Thus, I was interested in exploring how the costs and benefits of collaboratively recalling autobiographical events were influenced by the combination of intimacy and shared versus unshared experience.

Unlike list recall, it is difficult to define what successful autobiographical recall looks like. In Experiments 1 and 2, I determined successful recall by counting the number of items dyads recalled. This technique was not possible in this experiment because autobiographical memories are not a countable product of recall, due to their rich quality. As an experimenter I had no access to what happened during the event, and therefore could not determine the accuracy or completeness of participants' recall. Therefore, I had to use several measures of recall success to determine the effects of relationship and collaboration on autobiographical memory recall. The first was word count. I used the amount of words participants typed in their recall of each event as an approximate measure of how much they recalled. I also used two measures of memory quality: the global quality of the typed memories and the kinds of words the memories contained. To assess the global quality of the typed memories I used a coding system developed by Habermas and colleagues (Habermas & Diel, 2010, 2013; Habermas, Diel, & Heberer, 2009; Habermas, Diel, Mahmoudi, & Streck, 2009) and translated from German to English by me for this thesis. Using this coding scheme, I gave each typed event a global score on various kinds of details, emotionality and vividness, which allowed me to assess the effects of relationship and collaboration on the quality of the memory recalled. For example, I considered high vividness and high emotionality to be indicative of successful recall.

To assess the kinds of words the memories contained, I used Linguistic Inquiry and Word Count (LIWC) software (Pennebaker, Booth, & Francis, 2007). LIWC is a text analysis software, which counts the frequency of use of various categories of words in texts. It has been used to reliably identify different kinds of attentional focus and social relationships reflected in pronoun use, emotional valence, and other aspects of language use (Tausczik & Pennebaker, 2010). I used LIWC scores for first and second person pronouns and positive and negative emotions. Pronoun scores allowed me to compare how stranger, friend, and sibling individuals and dyads referred to themselves and whether dyads referred to each other. Positive and negative emotion scores allowed me to observe whether collaboration influenced the emotional valence of strangers', friends', and siblings' events. I was interested in singular and plural first person pronouns ("I" and "we") because more "we" pronouns than "I" pronouns in friends' and siblings' collaborative recall would indicate a strong shared identity, and low rates of "we" pronouns with high rates of "I" pronouns would indicate separate individual identities (Brewer & Gardner, 1996; Harris, Barnier, et al., 2014; Pennebaker, 2011; Tausczik & Pennebaker, 2010). More "you" pronouns in dyads' typed recall may indicate that dyads shared the recall in a more collaborative manner. Thus, I considered more "we" and "you" pronouns and fewer "I" pronouns to be indicative of collaborative success. I also considered higher positive and negative emotion to be indicative of success, as low rates of both forms of emotion would suggest that individuals or dyads only typed the bare facts of the event.

Simply comparing the qualities of the memories recalled by collaborative dyads' and individuals was not enough to thoroughly assess the effect of collaboration on autobiographical memory recall. I also assessed how the collaboration style adopted by dyads influenced how much they typed and the qualities of the memories they recalled. In particular, I explored how elements of the conversation such as how much dyads said while they typed the events, how many turns they took and the length of the turns they took influenced recall of shared or unshared events. More and shorter turns indicate recall was more genuinely shared between dyad members, whereas fewer and longer turns indicate monologues or one dyad member dominating recall or dictating to their partner.

My main prediction was that friends and siblings would collaborate more effectively than strangers to produce longer typed memories that would be richer in terms of detail, emotion, and vividness. I also predicted that strangers' recall would be dominated by first-person singular pronouns ("I"), whereas friends' and siblings' recall would include more first-person plural pronouns ("we") than strangers, as their events were more shared than strangers and I predicted that collaboration would increase the use of "we", especially for friends and siblings, and "you" for all three relationships. I predicted that the number of words dyads said, how many turns they took, and the length of the turns they took would influence the number of words they typed, as these three variables reveal the extent to which dyads were engaged in collaboration during the task. Finally, I predicted that friends and siblings would say more and take more and shorter turns than strangers, as they would be more practiced in jointly discussing autobiographical memories than strangers.

Method

Participants

I tested the same participants as in Experiment 1. These were 156 participants from Macquarie University. Strangers were 43 females and nine males, with mean age 22.26 years (*SD* = 7.44). Friends were 43 females and nine males, with mean age 21.60 years (*SD* = 3.35). Siblings were 42 females and ten males, with mean age 21.43 years (*SD* = 3.11), and included four twin dyads (see Chapter 2 for more detail). However, unlike in Experiment 1, I analysed those who recalled individually as individuals, instead of pooling their recall into nominal dyads. I made this decision because pooling two friends' or two siblings' recall of a shared event was difficult due to the rich nature of autobiographical events, and pooling two strangers' recall of two unshared events was not possible, as the details of two unrelated events were likely to be very different. Therefore, in this experiment, the participants were 13 dyads and 26 individuals each of strangers, friends, and siblings, giving a total of 39 dyads and 78 individuals.

Research Design

The study was a 2 x 3 between subjects design, with collaborative condition (collaborative dyads versus individuals) and relationship (strangers, friends, and siblings) as the independent variables. Collaborative dyads worked individually in Phase 1 and collaboratively in Phase 2. Individuals worked individually across the whole experiment and were treated as individuals for the purposes of this chapter.

Materials

Audio recording. I used Superlab software to present the word list (described in Chapter 2) and collect participants' typed responses to each task. I recorded collaborative dyads' conversations during Phase 2 using a Blue Snowball microphone and Audacity software.

Questionnaires. Participants completed the same questionnaires as in Experiment 1 (Chapter 2). Thus, all friends and siblings completed the Personal Assessment of Intimacy in Relationships (PAIR) Inventory (Schaefer & Olson, 1981), participants in collaborative dyads completed the Transactive Memory System (TMS) Scale (Lewis, 2003), and all participants completed the Positive and Negative Affect Scale (PANAS; Watson et al., 1988). For details of these scales, see Chapter 2.

Procedure

Participants completed the tasks described below as part of a 90-minute session in a laboratory at Macquarie University. As reported in Experiment 1, the session involved two phases, Phase 1 and Phase 2, separated by an eight-minute distraction. Participants responded to all tasks by typing their responses into the computer. Following the experimental tasks, participants completed the pen-and-paper questionnaires.

Phase 1. Participants always worked individually, typing their responses onto separate computers at either side of a partition. They completed the tasks in this experiment at the end of Phase 1, after word list encoding, people list elicitation, and event list elicitation, and immediately prior to word list recall. They elicited two autobiographical memories: the most recent birthday celebration and a significant event of their own choice. For strangers, these were unshared events, by definition, and both dyad members recalled one of each memory. For strangers in collaborative dyads, I randomly allocated one dyad member's birthday memory and the other dyad member's significant event memory for them to recall together in Phase 2. For friends and siblings, they were both events they had experienced together, and I asked them to decide together which events they would use. First I gave them ten minutes to type their memory of the most recent birthday celebration. I told strangers

> For the next task you will have 10 minutes in which to type into the computer your memory of your latest birthday celebration. Please try to include as many details as you can. These can include what you were doing, who you were with, where you were, what you thought and felt, what you saw, heard or smelt, and anything else you think is important. Please try to limit the information to what you actually remember, not what someone else may have told you about the event.

I gave friends and siblings the same instructions as strangers, except I asked them to type, "your memory of the latest birthday celebration for either one of you." I gave them a minute to decide together whose birthday they would type.

After they typed their events, I gave collaborative strangers two minutes to read each other's typed memories, so that they could have some knowledge about the event in Phase 2. I asked them to do this to prevent the memory owner from simply re-typing the memory in Phase 2 without any input from their partner. I then asked all participants to rate on the computer how clear their memory of the event was, how positive or negative the event was, and how important the memory was for them on a seven point Likert scale from 1 (not clear/very negative/not important at all) to 7 (very clear/very positive/very important). I also asked them to provide an approximate date for the event.

Then I gave them ten minutes to type their memory of a significant event of their own choice. I gave participants the same instructions as for the birthday memory except I asked strangers to type, “your memory of a significant event you have experienced” and I asked friends and siblings to type, “your memory of a significant event you and your friend/sibling experienced together.” I gave friends and siblings a minute to decide which event they would type. At the end of the ten minutes, I gave collaborative strangers two minutes again to read each other’s significant event memories. I then asked all participants to rate and date the memory as they did for the birthday memory.

Phase 2. Participants in collaborative dyads sat at one computer and recalled the two events together. Those who participated as individuals continued to sit at the same computer that they sat at in Phase 1 and recalled the two events individually. After recalling the word list, people list, and event list, I asked them to recall the significant event memory first. I told strangers who recalled as individuals

> For the next task you will have 10 minutes in which to type into the computer your memory of the significant event you chose earlier. Please try to include as many details as you can. These can include what you were doing, who you were with, where you were, what you thought and felt, what you saw, heard or smelt, and anything else you think is important. Please try to limit the information to what you actually remember, not what someone else may have told you about the event. Please don't just type what you typed earlier, try to remember the event afresh.

I gave other participants the same instructions except I asked strangers who participated as collaborative dyads to “type into the computer the memory of a significant event chosen by the participant sitting on the left”; friends and siblings who participated as individuals to “type into the computer the memory of a significant event you experienced with your friend/sibling that you chose earlier”; and friends and siblings who participated as collaborative dyads, “type into the computer the memory of a significant event you experienced together that you chose earlier.”

I then asked participants to recall the birthday memory. I gave participants the same instructions as for the significant event memory, except with “the memory of the most recent birthday” replacing “the memory of a significant event.”

Post-experiment interview and debriefing. At the end of Phase 2, participants completed the questionnaires, and were debriefed before leaving.

Coding

I analysed the typed recall of both collaborative dyads and individuals, and audio recorded and transcribed collaborative dyads’ conversations during Phase 2. I took three approaches to coding the memories. The first approach focused on both collaborative dyads’ and individuals’ typed recall output, and indexed the length of the output in terms of word count. The second approach focused on transcripts of collaborative dyads’ conversations, and indexed their collaboration style in terms of distribution of words and turn-taking, as I did in Experiments 1 and 2. The third approach also focused on both collaborative dyads’ and individual’s typed recall output, and indexed the qualities of the typed memories themselves. I coded memory quality in two ways: (1) global quality of the memories, using a coding scheme similar to that used by Habermas and Diel (2013), and (2) analysis of the transcripts using LIWC software (Pennebaker et al., 2007).

Length of recall output. I counted the number of words dyads and individuals typed in their recall of each event. In this way, I used word count as an indicator of the amount dyads recalled. Longer recall output was therefore a sign of recall success.

Collaboration style. I used three measures of the collaboration style between dyad members’ event recall: total words spoken, number of turns, and mean words per turn. I defined a turn as starting when one dyad member started speaking and finishing when the next dyad member started speaking. I did not count as a turn brief back-channelling utterances, such as “yeah”, or “mm” said by one dyad member while the other dyad member continued to speak. Instead I defined the whole of the main speaker’s utterance as a turn, and ended the turn when the speaker paused for a long period of time or the other dyad member made an utterance not defined as back-channelling.

Using this definition of a turn, I counted the number of words spoken in each turn across the transcript of each event recalled. I then calculated the mean number of words per turn for each event transcript, which I used in analysis of words per turn.

Memory quality coding. ***Global quality.*** I coded all events using a scheme adapted from Habermas and Diel (2013), based on Habermas, Diel, and Heberer (2009); Habermas, Diel, Mahmoudi, et al. (2009), which I translated from German to English for this thesis. The codes I used were person detail, place detail, time detail, vividness, and emotionality. Thus, I coded each event on a scale of 0 to 3 on all five codes. For person, place, and time detail, I gave recall of each event a minimum score of 0 (not mentioned/very imprecise) if there were no other people or places mentioned, or if the timing of the event was very imprecise, up to a maximum of 3 (person/place/time details very precise) if people were depicted in a very vivid manner, places were described very precisely, or the exact biographical or calendar date was provided. For instance, the following event scored a 0 for person detail because no other people were mentioned, a 2 for place detail because it mentions Macquarie University, and a 0 for time detail because it was very imprecise about when it occurred:

> My memory is started at Macquarie University. I was on my own as I started as a mature age student. I felt excited about coming and a sense of not knowing. I started attending classes and wanted to meet new people and friends. I enjoyed coming to classes and learning new knowledge. I felt a sense of satisfaction and fulfilment being here. The environment is great and a lovely university. Every time I come here I really feel happy. Its a nice place to be where I am able to pursue my education and hopefully one day become a registered psychologist. Macquarie University has changed my life dramatically giving me a sense of excitement and many possibilities to expand into in the future.

In contrast, the following event scored a 3 for person detail because it described the guru in great detail, a 3 for place detail because it not only named the town but specified almost exactly where in India it was located, and 1 for time detail because it only mentioned the time of day:

> Was early in the morning in South India a town called Whitefield like 3 hours from Bangalore. We had an interview with a vey holy person that show divinity power in his acts and miracles. We believe in him because he encourage people to become better person in their own religion to follow their own believes just by adding love, forgiveness and service to others as service to god regardless what they are or what they do. Was early in the morning about 7am I was very exited same as my sister, I think my sister was a little tiny bit sceptical about him. I did believe in him in every aspect 100 per cent. He told my sister that she just think about getting married all the time...

Finally, the following event scored a 1 for person detail because it only named people and didn't describe them, a 0 for place detail because it didn't mention where the event occurred, and a 3 for time detail because it dated the event exactly:

> Kristen's 21st birthday- November the 5th 2011. Lorando, Mum, Nichelle, Michael, Rochelle. Just had a quiet lunch because Kristen didn't want a big party. We played Cluedo, Titanic board games. Lorando had trouble following the instructions for Cluedo and we had to kick him out of the game. Kristen and Lorando didn't stay for long after the food because they ended up going to the beach for the rest of the day. I also remember that I didn't give the painting of the pug dog to her for her birthday, it was for Christmas last year. Nichelle had her laptop and was experimenting with a recording program on there, so Mum and I had to put up with her singing high pitch after everyone had gone.

For vividness, I gave recall of each event a minimum score of 0 (very dry) if it contained no emotion, evaluations, intensifiers or scene, up to a maximum score of 3 (very vivid) if it contained at least three of the four elements (emotion, evaluation, intensifiers and scene) and scene was present. For emotionality, I gave recall of each event a minimum score of 0 (not at all emotional), if it contained no emotions at all, up to a maximum of 3 (extremely emotional) if it contained multiple emotions, and at least one was described in detail. For instance, the following event scored a 0 for vividness and a 0 for emotionality because it only mentioned the bare facts:

> Tennis competition at Campbelltown.
>
> Mum drove me there, she didn't want me to be by myself.
>
> Played in the under 14 and 16 singles and under 14 doubles with my friend.
>
> I was twelve at the time and I had made it into the quarterfinals for the under 14's, the semi-final for the under 16's and my partner and I won the doubles event.
>
> It was late in the afternoon and finished at night, and we won the first set 6-3 and the second set was 7-6 (7-2).

The following event scored a 1 for vividness because it included several evaluations, and a 0 for emotionality because no emotions were mentioned:

> We went to the Karaoke with my brother, sister (Jenny) and I. We ate sushi or Chinese beforehand and we went there with the money that mum gave us. The place kinda smelt like... an old building and there were lots of different coloured disco lights. We sang Korean pop songs and other songs that we can think of in English. One memorable part was when we sang a cutesy Korean girl group song into a death metal version. That was hilarious that I thought we should video record this and upload it on YouTube. We only had one hour to play because we only had twenty dollars at the time. My brother did most of the dancing as we just had fun acting like idiots. It was a good stress reliever. I drove home afterwards from Eastwood. We went straight to sleep since it was tiring. It was fun though.

The following event scored a 2 for vividness because it included emotions, evaluations and intensifiers but no direct quotes or anything that constituted a scene and a 3 for emotionality because emotions were described in great detail:

> … It was our second night in Fiji at The Outrigger on the Coral Coast near Sigatoka. We were having dinner at the Sundowner which was our favourite restaurant while we were in Fiji. We had all had a lovely dinner, I remember everyone being in a really good mood because everyone was really happy to be in Fiji and having such a good time. We were right next to the ocean so I could smell that and I could also smell the great food from the kitchen. We had a really nice dinner and were having a few cocktails and a really fun time. We decided to surprise Michael, my brother, by asking the staff and the man singing to everyone while they dined if they could sing happy birthday to Michael. Michael was sitting with his back facing the restaurant so he didn't see who they were singing to when they started singing happy birthday. He began singing too and clapping his hands, and as he turned around he saw them coming towards him. At first he looked confused, then surprised, happy and embarrassed. The singing ladies gave him a string of flowers and a kiss. They gave him a piece of chocolate cake. After dinner everyone got up and had a dance to the man singing while everyone ate. I remember my grandfather being really happy and having a great time. Everybody was so happy to be Fiji and having such a great holiday.

Finally, the following event scored a 3 for vividness because it included emotions, evaluations, intensifiers, and direct quotes, and a 2 for emotionality because it mentioned several emotions but didn't describe any in detail:

> I had to work the day me and my boyfriend was celebrating my birthday, but he picked me up from work and took me to In Situ in Manly. We had a beer, but he felt sick so we had to go home. It was something awkward about him, but I couldn't really figure out what it was. I came in through the door and the

> apartment smelled of smoke. My boyfriend doesn’t smoke, so I shouted out "have you been smoking in here?" What I didn’t know was that my friends were hiding in the living room and of course some of them had been smoking. I was on my way to the bathroom when I saw the balloons and the lights turned on and I had finally someone to blame for the smoke. I was so surprised and happy that all my friends were there for me. Jay taped the whole thing, while I was hugging everyone and got cake and a crown with my name on. I went to put on something nicer, before we drank some more beers. A guy named Alex had a glass of red wine on the table. Mads sat on the table, and the wine glass fell (somehow) on the floor. That was out first red stain on the carpet floor of our new apartment. All of a sudden our neighbour was in our living room. The music stopped and everyone froze. Especially me. I sank down in the sofa, and was so embarrassed. She eventually kicked us out, and everything was fine. I had some trouble getting everyone out though... We got down to [pub], and met some other Norwegian people, before we went to have some pie on our way home.

These coding rules followed those developed by Habermas, Diel, and Heberer (2009) and Habermas, Diel, Mahmoudi, et al. (2009).

LIWC analysis. I analysed the recall of each event using LIWC software (Pennebaker et al., 2007) to calculate the use of certain types of words as a proportion of the whole text. The LIWC categories I used were three personal pronouns: “I”, “we”, and “you”; and positive and negative emotion. “I” included all first person singular pronouns, such as “I”, “me”, and “mine”. “we” included all first person plural pronouns, such as “we”, “us”, and “our”. “you” included all second person pronouns, such as “you”, “your”, and “yours”. Positive emotion words included words with positive connotations such as “happy”, “love”, and “nice”, and negative emotion words included words with negative connotations such words as “hurt”, “ugly”, and “crying”.

Results

I separated analysis into six main sections: (1) length of recall output, (2) collaboration style, (3) relationships between length of recall output and collaboration style, (4) memory quality, (5) relationship between memory quality and length of recall output, and (6) the relationship between memory quality and collaboration style. In sections 1 and 4, I compared collaborative dyads with individuals to determine the effect of collaboration. I also compared strangers, friends, and siblings to determine the effect of relationship, and the interaction between collaborative condition and relationship. In sections 2, 3 and 5, I analysed collaborative dyads' recall only, and compared strangers, friends, and siblings.

Length of Recall Output

The number of words dyads and individuals typed for each event ranged from 34 to 664 words (see Table 4.1 for means). Using a 2 x 3 (collaborative condition x relationship) ANOVA, I found that individuals typed more words per event than collaborative dyads, $F(1, 105) = 7.98$, $p = .006$, $\eta_p^2 = .07$. Although I found no main effect of relationship, $F(2, 105) = 1.03$, $p = .359$, it interacted significantly with collaborative condition, $F(2, 105) = 4.41$, $p = .014$, $\eta_p^2 = .08$. By comparing collaborative dyads with individuals separately for each relationship, I found that individuals typed more words than dyads only if they were strangers, $F(1, 36) = 15.02$, $p < .001$, $\eta_p^2 = .29$. Therefore, strangers' recall was hindered by collaboration in terms of how many words they typed when recalling the events, consistent with previous findings in the literature of collaborative inhibition (Rajaram, 2011; Rajaram & Pereira-Pasarin, 2010). However friends' and siblings' recall did not show the same costs. Therefore, there was something about the way that friends and siblings recalled shared events that protected them from the negative effects of collaboration that strangers recalling unshared events suffered.

Table 4.1

Mean Word Count for Each Event by Collaborative Condition and Relationship

Relationship	Individuals	Dyads	Total
Strangers	328.52 (131.19)	188.69 (66.61)	281.91 (131.08)
Friends	273.87 (108.09)	263.19 (115.02)	270.31 (109.04)
Siblings	242.48 (103.61)	233.35 (61.42)	239.44 (90.96)
Total	281.62 (118.94)	228.41 (87.93)	263.88 (112.06)

Note. Standard deviations appear in parentheses.

Collaboration Style

In order to understand what protected friends and siblings from the costs of collaboration suffered by strangers, I analysed collaborative dyads' transcribed conversations during recall for the number of words they said to each other during the task, how many turns they took during the conversation, and the mean length of the turns. The number of words dyads said while typing each event ranged from 58 to 1433 words, the number of turns they took ranged from 11 to 239 turns, and the mean number of words they said per turn ranged from 3.47 to 13.74 words (see Table 4.2 for means). I found a significant effect of relationship on the number of words dyads said, $F(2, 28) = 7.12$, $p = .003$, $\eta_p^2 = .34$, and the number of spoken turns they took while typing each event, $F(2, 28) = 9.08$, $p = .001$, $\eta_p^2 = .39$, but not the mean words they said per turn while typing each event, $F(2, 28) = 1.10$, $p = .348$. Friends and siblings said more words and had more turns than stranger dyads, $p = .001$ and $p < .001$, respectively. I found similarities in the number of words said or turns taken while typing each event by friends and siblings, $p = .665$, and $p = .700$, respectively. Strangers, unlike friends and siblings, had not experienced the events together, which most likely limited how much the dyad member who did not experience the event said and how much they discussed the events as they typed them.

Table 4.2

Means for Collaboration Style by Relationship

Relationship	Words Spoken	Turns	Words Per Turn
Strangers	490.68 (240.30)	66.86 (30.46)	7.32 (1.85)
Friends	816.56 (267.25)	125.83 (40.48)	6.49 (0.92)
Siblings	865.91 (247.66)	119.73 (34.29)	7.30 (1.17)
Total	718.44 (297.69)	102.74 (43.31)	7.07 (1.40)

Note. Standard deviations appear in parentheses.

Relationship Between Collaboration Style and Length of Recall Output

I found no significant correlations between the number of words dyads typed for each event and the number of words they said, turns they took, or the length of their turns, all rs < .23, all ps > .068. I also found no significant correlations between collaboration style and number of words typed when I performed the same correlations separately for each relationship, all rs < .45, all ps > .226, although statistical power was limited in this analysis (for each correlation, the sample size ranged from nine to eleven). Therefore, the amount that dyads said, the number of turns they took, and the length of the turns they took while typing the events did not translate into how much they typed for each event. In other words, the process of collaboration did not appear to directly influence the product of dyads' recall, possibly due to the fact that product was typed and process was verbal.

Memory Quality

Global quality. *Level of detail.* The level of person, place, and time details all ranged from 0 to 3 (see Table 4.3 for means). Using a separate 2 x 3 (collaborative condition x relationship) ANOVA for each type of detail, I found Collaborative dyads typed less person detail than individuals, $F(1, 105) = 5.37$, $p = .022$, $\eta_p^2 = .05$. I found no significant effects of collaboration on place or time detail, both *F*s < 2.86, both *p*s > .093. Thus, collaboration reduced the amount of person detail only, and did not affect place and time detail.

Table 4.3

Mean Level of Detail per Event by Collaborative Condition and Relationship

Relationship	Individuals	Dyads	Total
	Person Detail		
Strangers	1.75 (0.41)	1.62 (0.58)	1.71 (0.47)
Friends	1.79 (0.57)	1.50 (0.50)	1.69 (0.56)
Siblings	1.77 (0.53)	1.46 (0.48)	1.67 (0.53)
Total	1.77 (0.50)	1.53 (0.51)	1.69 (0.52)
	Place Detail		
Strangers	1.54 (0.68)	1.50 (0.58)	1.53 (0.64)
Friends	1.60 (0.68)	1.50 (0.50)	1.56 (0.62)
Siblings	1.29 (0.62)	1.42 (0.40)	1.33 (0.61)
Total	1.47 (0.66)	1.47 (0.49)	1.47 (0.62)
	Time Detail		
Strangers	1.94 (0.77)	2.58 (0.53)	2.15 (0.75)
Friends	1.38 (0.77)	1.23 (0.75)	1.33 (0.76)
Siblings	1.38 (0.82)	1.65 (0.69)	1.47 (0.78)
Total	1.57 (0.82)	1.82 (0.86)	1.65 (0.84)

Note. Standard deviations appear in parentheses.

I found a significant effect of relationship on the level of time detail, $F(2, 105) = 14.06$, $p < .001$, $\eta_p^2 = .21$. Using planned Helmert contrasts that compared friends and siblings combined with strangers, and then friends with siblings, I found that friends and siblings had lower levels of time detail than strangers, $p < .001$, but friends and siblings had similar levels of time detail to each other, $p = .299$. I found no significant effects of relationship on the level of person or place detail, both Fs < 1.47, both ps > .235. Thus friends and siblings provided less contextual details than strangers, but only for time.

Collaborative condition did not significantly interact with relationship in terms of person, place or time detail, all Fs < 2.88, all ps > .060. Thus, strangers provided more time detail than friends and siblings regardless of collaborative condition, and individuals provided more person detail than dyads, regardless of their relationship. The first of these effects may have been due to strangers' frequent choice of their own eighteenth birthday as their significant event, which would be given a maximum score of 3 for time detail. The second of these effects may have occurred because individuals provided more person detail for the experimenter's sake. Collaborative dyads, on the other hand, may have provided this detail to their collaborative partner verbally instead of typing it. Thus collaboration may have changed the goals of typed recall; whereas individuals' goal was to include all relevant information in the typed recall, collaborative dyads may not have been as focused on this goal, as they could explain or discuss information verbally. Successful collaborative recall, therefore, may have differed from successful individual recall in this context.

Vividness and Emotionality. The vividness ratings based on the Habermas coding schemes for each event ranged from 0 to 3 (see Table 4.4 for means). Using a 2 x 3 (collaborative condition x relationship) ANOVA, I found that events recalled by collaborative dyads were less vivid and marginally less emotional than those recalled by individuals, $F(1, 105) = 5.58$, $p = .019$, $\eta_p^2 = .05$, and $F(1, 105) = 3.76$, $p = .055$, respectively. I found no significant effect of relationship on vividness or emotionality of typed events, both Fs < 1.24, both ps > .294. Collaborative condition significantly interacted with relationship for vividness and emotionality $F(2, 105) = 5.56$, $p = .006$, $\eta_p^2 = .10$, and $F(2, 105) = 3.61$, $p = .030$, $\eta_p^2 = .06$, respectively. Comparing collaborative dyads and individuals by each relationship separately using a Bonferroni correction ($\alpha = .0167$), I found that dyads only had less vivid and less emotional typed memories than individuals if they were strangers, $t(36) = 3.35$, $p =$

.002, d = 1.31, and $t(36)$ = 3.60, p = .001, d = 1.41, respectively. Thus, stranger dyads typed their events less vividly and less emotionally than individual strangers, but friends' and siblings' typed events did not show the same costs of collaboration.

Table 4.4

Mean Level of Vividness and Emotionality Per Event by Collaborative Condition and Relationship

Relationship	Individuals	Dyads	Total
	Vividness		
Strangers	2.04 (0.47)	1.54 (0.56)	1.87 (0.55)
Friends	1.90 (0.68)	1.73 (0.56)	1.85 (0.64)
Siblings	1.63 (0.50)	1.77 (0.56)	1.68 (0.52)
Total	1.86 (0.57)	1.68 (0.56)	1.80 (0.57)
	Emotionality		
Strangers	2.06 (0.75)	1.08 (1.00)	1.73 (0.95)
Friends	1.50 (0.80)	1.15 (0.77)	1.38 (0.80)
Siblings	1.38 (0.80)	1.58 (0.61)	1.45 (0.74)
Total	1.65 (0.83)	1.27 (0.82)	1.52 (0.84)

Note. Standard deviations appear in parentheses.

Memory quality summary. Collaborative dyads had less person detail in their typed events than individuals. Relationship changed the effects of collaboration on the vividness and emotionality of the typed events. Friends and siblings, who knew each other and had experienced the events together expressed emotions as often and recalled the events as vividly when they recalled with each other as when they recalled individually. They also included less time detail than strangers, regardless of their collaborative condition. Strangers, on the other hand, recalled the events with less emotion, less vividness, and more time detail when they recalled their unshared events with an unknown person than when they recalled alone.

LIWC. ***Pronouns "I", "we" and "you".*** LIWC scores ranged from 0 to 18.29 for "I", from 0 to 10.17 for "we", and from 0 to 9.39 for "you" (see Table 4.5 for means). Using a separate 2 x 3 (collaborative condition x relationship) ANOVA for each pronoun, collaborative dyads typed "I" less, $F(1, 105) = 27.69$, $p < .001$, $\eta_p^2 = .21$, and "you" more than individuals, $F(1, 105) = 7.37$, $p = .008$, $\eta_p^2 = .07$; there was no difference between dyads' and individual's use of "we", $F(1, 105) = 0.09$, $p = .768$. I found a significant effect of relationship on the use of "I", $F(2, 105) = 28.52$, $p < .001$, $\eta_p^2 = .35$, "we" $F(2, 105) = 21.97$, $p < .001$, $\eta_p^2 = .30$, and "you", $F(2, 105) = 6.66$, $p = .002$, $\eta_p^2 = .11$. Friends and siblings typed "I" less, "we" more, and "you" less than strangers, all ps < .001. Friends typed "we" more than siblings, $p = .017$, but I found no difference in friends' and siblings' use of "I" and "you", both ps > .184. Collaborative condition did not interact with relationship for "I", or "we", both Fs < 0.85, both ps > .434. However, I found a significant interaction between collaborative condition and relationship for use of "you", $F(2, 105) = 7.17$, $p = .001$, $\eta_p^2 = .12$. Collaborative dyads only typed "you" more than individuals if they were strangers, $F(2, 36) = 8.13$, $p = .007$, $\eta_p^2 = .31$. Thus, collaborative dyads typed "I" less than individuals, in all relationships, and "you" more if they were strangers. Friends and siblings typed "I" less, "we" more and "you" less than strangers, and friends typed "we" the most out of the three relationships. These differences in pronoun use indicate that friends and siblings had stronger shared identity than strangers, and friends had the strongest of the three relationships. Strangers typed "you" more than friends and siblings because the non-memory owner often typed on behalf of the memory owner.

Table 4.5

Mean LIWC Scores for pronouns by collaborative condition and relationship

Relationship	Individuals	Dyads	Total
	"I"		
Strangers	7.00 (2.73)	5.55 (4.54)	6.52 (3.45)
Friends	3.61 (2.20)	0.67 (0.69)	2.63 (2.30)
Siblings	4.53 (2.76)	2.51 (3.58)	4.20 (3.27)
Total	4.99 (2.71)	4.40 (2.38)	4.79 (2.61)
	"We"		
Strangers	1.69 (1.07)	1.42 (1.60)	1.60 (1.26)
Friends	4.57 (2.38)	4.51 (2.02)	4.55 (2.24)
Siblings	3.12 (1.90)	3.70 (1.78)	3.31 (1.86)
Total	3.13 (2.19)	3.21 (2.20)	3.15 (2.18)
	"You"		
Strangers	0.07 (0.14)	1.14 (1.88)	0.43 (1.18)
Friends	0.12 (0.29)	0.03 (0.06)	0.09 (0.24)
Siblings	0.07 (0.14)	0.18 (0.39)	0.11 (0.26)
Total	0.09 (0.20)	0.45 (1.19)	0.21 (0.72)

Note. Standard deviations appear in parentheses.

Positive and negative emotion. LIWC scores for positive emotion ranged from 0 to 10.69, and for negative emotion ranged from 0 to 4.90 (see Table 4.6 for means). Using separate 2 x 3 (collaborative condition x relationship) ANOVAs for each type of emotion, I found that collaborative dyads and individuals had similar positive and negative emotion, $F(1, 105) = 1.55$, $p = .215$, and $F(1, 105) = 1.96$, $p = .164$. I found a significant effect of relationship on positive emotion, $F(2, 105) = 6.48$, $p = .002$, $\eta_p^2 = .11$, but not for negative emotion, $F(2, 105) = 0.59$, $p = .556$. Friends and siblings had lower positive emotion than strangers, $p = .002$, but similar positive emotion to each other, $p = .107$. I found no significant interaction between collaborative condition and relationship for positive emotion, $F(2, 105) = 1.36$, $p = .262$, but I found a marginally significant interaction between collaborative condition and relationship for negative emotion, $F(1, 105) = 2.88$, $p = .061$. There was a trend towards individual typing less negative emotion than dyads for friends, but it was not significant using a Bonferroni correction of $\alpha = .017$, $F(1, 32) = 5.64$, $p = .024$. Thus, for both individuals and collaborative dyads, friends and siblings typed fewer positive emotion words in their recall of the events than strangers.

Table 4.6

Mean LIWC Scores for Positive and Negative Emotion by Collaborative Condition and Relationship

Relationship	Individuals	Dyads	Total
	Positive Emotion		
Strangers	4.42 (1.99)	4.57 (1.76)	4.47 (1.89)
Friends	3.95 (2.25)	3.09 (1.31)	3.66 (2.01)
Siblings	3.24 (1.76)	2.43 (1.28)	2.97 (1.65)
Total	3.87 (2.04)	3.36 (1.69)	3.70 (1.94)
	Negative Emotion		
Strangers	1.31 (0.65)	1.12 (0.76)	1.25 (0.68)
Friends	1.07 (1.10)	1.41 (0.77)	1.18 (1.00)
Siblings	1.19 (0.65)	1.39 (0.72)	1.23 (0.67)
Total	1.19 (0.82)	1.30 (0.74)	1.23 (0.80)

Note. Standard deviations appear in parentheses.

Relationship between aspects of memory quality. Correlating global memory quality with LIWC variables, I found that in individuals only, the use of “I” was positively associated with vividness and emotionality (see Table 4.7). Individuals’ use of “we” was negatively associated with time detail, and their use of “you” was negatively associated with vividness. Individuals’ positive emotion was positively associated with time detail and vividness, and their negative emotion was positively associated with vividness and emotionality. For dyads, however, none of the above correlations were significant. In fact, using a Bonferroni correction of $\alpha = .025$ to compensate for performing separate correlations for individuals and dyads, the only significant correlation I found for collaborative dyads was between their use of "you" and time detail, which were positively associated.

Therefore for individuals only, more vivid events contained more "I" and more positive and negative emotion words. More emotional events contained more "I" and more positive and negative emotion words. The fact that use of "I" was associated with more vividly and emotionally recalled events in individuals but not in dyads indicates that individual identity was important for individual recall but not for dyads. Thus, recalling with another person makes individual identity less important for successful recall. In dyads, events that contained more time detail also contained more "you" pronouns. This correlation may have occurred because stranger dyads typed "you" and included more time detail than friend and sibling dyads, meaning the same dyads had high levels of both due to their lack of acquaintance prior to the experiment.

Relationship Between Memory Quality and Length of Recall Output

Correlating memory quality and typed word count, I found that a higher typed word count was positively associated with person and place details, vividness, and emotionality (see Table 4.8). Thus, dyads and individuals who typed more for each event gave more contextualising details and recounted the events more vividly and emotionally. No other aspects of memory quality measured by LIWC correlated with typed word count.

Table 4.7

Correlations Between Aspects of Global Memory Quality and LIWC

	"I"		"We"		"You"		Positive Emotion		Negative Emotion	
Variable	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*
Individuals										
Person Detail	.09	.436	-.06	.635	.01	.902	.28	.013*	.26	.020*
Place Detail	-.09	.414	.05	.672	.14	.232	.01	.936	-.08	.501
Time Detail	.13	.251	-.29	.010*	.08	.473	.29	.011*	-.07	.564
Vividness	27	.015*	-.13	.245	-.32	.004*	.18	.110	.38	.001*
Emotionality	.42	<.001*	-.30	.008*	-.02	.853	.28	.012*	.49	<.001*
Collaborative Dyads										
Person Detail	-.21	.195	-.03	.865	-.02	.927	-.27	.099	-.05	.786
Place Detail	.12	.486	.12	.457	.33	.041	.16	.333	-.32	.045
Time Detail	.34	.032	-.28	.087	.36	.025*	.32	.047	-.26	.114
Vividness	.02	.894	.20	.217	.11	.494	.00	.992	.17	.312
Emotionality	.25	.128	.19	.250	-.06	.716	.19	.240	.26	.105

*$p < .025$ (Significant at $\alpha = .05$ with Bonferroni correction)

I then performed the same analysis separately for collaborative dyads and individuals, given that individuals typed more words in each event than dyads. The positive correlations between typed word count and global quality (person and place details, vividness, and emotionality) remained significant for individuals, but only vividness remained significantly positively correlated with word count for dyads. I also found a significant positive correlation between word count and use of "we" pronouns and a significant negative correlation between word count and positive emotion words in dyads only.

Table 4.8

Correlations Between Memory Quality and Length of Recall Output

	Word Count					
	Individuals		Dyads		All Participants	
Variable	*r*	*p*	*r*	*p*	*r*	*p*
Person detail	.21	.009**	.19	.104	.24	<.001*
Place detail	.27	.001**	.02	.835	.20	<.001*
Time detail	.10	.243	-.10	.370	.01	.892
Vividness	.41	<.001**	.45	<.001**	.43	<.001*
Emotionality	.39	<.001**	.19	.092	.36	<.001*
"I"	.15	.077	-.14	.217	.13	.060
"we"	.00	.971	.29	.011**	.08	.252
"you"	.15	.065	-.07	.556	-.04	.538
Positive emotion	-.06	.467	-.33	.004**	-.10	.125
Negative emotion	.156	.056	.09	.412	.12	.068

*$p < .05$

**$p < .025$ (Bonferroni correction for collaborative dyads and individuals)

Relationship Between Memory Quality and Collaboration Style

Correlating memory quality and collaboration style for collaborative dyads only, I found that the only memory quality variable that correlated significantly with the number of words dyads said while typing the events were time detail and use of “I”, both of which correlated negatively (see Table 4.9). Time detail and use of “I” also correlated negatively with the number of turns dyads took. I found no other correlations between memory quality and collaboration style. Thus, dyads who discussed the events more while they typed provided less time detail and were less likely to narrate the typed event from a first person singular perspective.

Table 4.9

Correlations Between Memory Quality and Collaboration Style

	Words Spoken		Turns		Words Per Turn	
Variable	*r*	*p*	*r*	*p*	*r*	*p*
Person Detail	-.15	.253	-.13	.308	-.05	.691
Place Detail	-.14	.439	-.21	.251	-.00	.993
Time Detail	-.58	.001*	-.61	<.001*	.08	.681
Vividness	.01	.932	-.04	.746	.10	.428
Emotionality	-.01	.942	-.02	.851	.09	.484
“I”	-.44	.013*	-.55	.001*	.29	.109
“We”	.10	.608	.15	.429	-.07	.699
“You”	-.21	.260	-.24	.187	.09	.642
Positive Emotion	-.30	.105	-.33	.073	.23	.210
Negative Emotion	.01	.931	.10	.579	-.19	.315

*$p < .05$

Discussion

In strangers, but not friends and siblings, collaboration decreased word count, increased the amount of time detail, and decreased the vividness and emotionality of the typed events. Friends and siblings did not show these same costs of collaboration, as they said more, took more turns, typed less time detail, typed “I” and “you” less and “we” more, and had more emotional memories than strangers. In all three relationships, collaborative dyads typed “I” less than individuals. Events with a higher word count were more vividly and emotionally expressed, contained more person and place detail, and had a marginally lower use of “I” and words associated with negative emotion than events with a lower word count.

Process Findings: Quality of Collaboration

Friends and siblings were more resilient to the costs of collaboration that strangers experienced in their recall of autobiographical events. Whereas collaboration reduced the vividness of the events and the amount of words that strangers used to describe the events, collaborative friend and sibling dyads’ typed events were similar in word count, vividness, and other measures of memory quality. One reason for this may be that friends and siblings discussed the events more during collaboration; they said more words and took more turns than stranger dyads. However, I found no aspect of collaboration style significantly accounted for what friend and sibling dyads typed. I suspect that the measures of collaboration style I used in this experiment did not adequately capture the variation in what friend and sibling dyads said during recall. Typing thus appeared to have a disruptive effect on collaboration, as I explain below.

In this experiment, dyads, especially friends and siblings, took many short turns while they typed the events. The following extract is a typical example of a friend dyads’ conversation while typing the event. This extract contains short turns interspersed with typing. B provided most of the details, as she dictated and corrected A’s spelling while A typed. This dyad did not discuss the event in much detail, concentrating on typing the event:

B: Great Barrier Reef.

A: Alright. (typing)

B: Um.

A: (typing)

B: Got on the bus.

A: (typing)

B: Your spelling is horrible. (both laugh)

A: How do you spell it?

B: A R D. (laughs)

A: Ten minutes. (typing) (both laugh) (typing)

B: Um we sat,

A: I didn’t go into detail.

B: We sat on the boat.

A: Well first we, oh yeah. (typing)

B: Oh yeah we filled those forms out.

A: Yeah. (typing)

For comparison, the following extract is from the beginning of a transcript of a sibling dyad recalling a New Years Eve celebration. This dyad had some longer turns than the friend dyad in the previous extract, and also had a collaboration style that relied less on dictation. However A told B to stop talking so she could type, demonstrating how typing the events interrupted the natural flow of the conversation during recall:

B: We went there with our cousin and her boyfriend and their friends.

A: (typing) Shut up. I've got to, (typing)

B: Cousin's daughter.

A: (typing) Daughter, her boyfriend, and (typing) and his Robert (both laugh). Wearing. What were you wearing?

B: Um I had a polka dot dress. You had on jeans and that cream top with the leopard print on it and your blazer.

A: (typing) That enough? Do you want colours?

B: Cream top with leopard print.

A: (typing)

B: And blue blazer.

A: (typing) Blue blazer. Um what about, what's her name?

B: Angelica?

A: Yeah. She had a pink dress on. (typing) And her boyfriend had a black suit with a red shirt. (typing)

The dyad above was not the only one whose typing interrupted the natural flow of recall. In the following extract a friend dyad typed about a day trip to Newcastle. They started by recalling the event verbally, without typing, and then had to stop talking in order to type what they had just recalled. Then they took on the same collaboration style as the first friend dyad, and B dictated to A while A typed:

A: Yeah I said like last night like the last minute tickets, drove up, missed our turn off, (both laugh)

B: Yeah! I was like, we got lost, had to circle around a few times to find a parking spot then we had to go in, and kill time, so we went, left and lost our parking spot again,

A: I didn't include that, but um, … yeah,

B: Type! (both laugh loudly)

A: Want to type exactly the same thing!

B: Yeah,

A: (typing) Newcastle… Um. (laughs)

B: Just be like, 'decided to buy tickets at last minute'

A: (typing)

B: For Disney Live,

A: (typing)

B: 'Cause we were intending to take a road trip, I don't know,

A: (typing)

For stranger dyads, recall was quite different from friend and sibling dyads, because only one dyad member had experienced the event. However, because I asked stranger dyads to read each other's events in Phase 1, both dyad members were able to provide input when they collaborated in Phase 2. The following extract is from a stranger dyad recalling B's birthday. Although B was the only dyad member who experienced the event, A, who was typing the event, was able to provide some information. However, because A did not experience the event, she could only reproduce what B had previously typed, and her focus was more on accurately reproducing B's original typed event than in providing an account of the event itself. A addressed B often as she typed the event, referring to her as "you". In the typed recall she used "I" rather than "you", as though it was B who was typing. Other dyads chose to type "you", as though the non-memory owner was addressing the memory owner in the typed event, which may be why strangers had more "you" pronouns in their typed recall than friends and siblings:

A: (typing) Yep so you can correct me.

B: There's no,

A: You, you had thongs on.

B: Yeah thongs on and my sister had to come and give them to me.

A: (typing) So, your friends couldn't…

B: I was wearing thongs so my sister had to come and give me my shoes.

A: Your sister?

B: Yeah.

A: (typing)

B: And then um, my friends were 15 minutes late.

A: That's right I thought you said 20 minutes late. You should know, so.

B: Yeah.

A: (typing)

B: Umm.

A: (typing)

B: It was raining slightly.

A: You walked in the rain?

B: Um, it was drizzling.

Although typing memories is a common method in collaborative recall experiments (see for example Harris, Barnier, & Sutton, 2012, 2013; Meade & Gigone, 2011; Pereira-Pasarin & Rajaram, 2011) and individual autobiographical memory research (see for example Barnier et al., 2007; Rubin, Schrauf, & Greenberg, 2004; Talarico, LaBar, & Rubin, 2004), in the context of collaboration, it appeared to have a disruptive effect. Thus, my findings regarding process highlight the limitations of using a typing method in this kind of experiment. Even though audio recoding and transcribing participants' verbal recall is far more time consuming than analysing the typed product of recall, it is a far more fruitful method for investigating the effects of collaboration on autobiographical memory recall. Thus, in the next experiment, I used this more fruitful method. In Chapter 5, I report another experiment on strangers', friends', and siblings' individual and collaborative autobiographical recall when recall (and thus both product and process) was verbal. And I incorporated collaborative process coding similar to the one I used in Chapters 2 and 3 to better capture the links between product and process.

Product Findings: Memory Quality

Stranger dyads' typed memories were less vivid than friend and sibling dyads' typed memories. In stranger dyads, the non-memory owner could only help the memory owner to recall what they had previously typed in Phase 1. Therefore, the task that strangers did was different from the task friends and siblings did. Whereas friends and siblings recalled the event they had experienced together, stranger dyads recalled the event as typed in Phase 1. This may be why stranger dyads were differentially affected by collaboration compared to friends and siblings in terms of how much they typed and how vividly and emotionally they described the events. In Phase 2, stranger dyads' typed events were often summaries of what they typed in Phase 1 (see Table 4.10 for a comparison of a stranger dyads' typed event from Phase 2 and the original Phase 1 individual typed event). In Phase 2 the dyad collaborated to produce a list of the main facts of the event that was expressed as a long paragraph in Phase 1. This meant that the event was reproduced in terms of bare facts, but the vividness of the original expression was lost. Stranger dyads sometimes even appeared to aim to reproduce the Phase 1 typed event word for word. Friends and siblings on the other hand, had two versions of each event from Phase 1, and so recalled the event itself.

Friends and siblings typed "I" less and "we" more than strangers, as I predicted. This suggested they had a shared identity but strangers did not. However, this effect may have been partly because I asked friends and siblings to recall events they had shared together but asked strangers to recall events without specifying anyone they had shared them with. The different instructions may have impacted the use of "I" and "we". First, friends and siblings may have recalled events that were important to their relationship, or were more obviously shared. A higher use of "we" and lower use of "I" would be expected in these events. Second, recalling the event in the presence of someone who also experienced the event may have highlighted the "sharedness" of the event. Thus, the social context and the current goal to recall the event with a friend or sibling may have enhanced the salience of their relationship and perhaps biased recall towards aspects of the event that were more shared, as I predicted in Chapter 1 (Conway, 2005). In contrast, strangers, recalled their own most recent birthday and any significant event. These events may have been more significant to them as individuals than were friends' and siblings' events, which may have highlighted the individual aspects of the event.

Table 4.10

Comparison Between Strangers' Individual Phase 1 Recall and Dyad Phase 2 Recall

Phase 1 Individual	Phase 2 Collaborative
I was at the Head of the River, the largest and final rowing meet in the GPS competition. It was a Saturday in summer, and it was hot, around 30 degrees in the middle of the day. Usually our school has the small section on the far right hand side of the hill, looking out right over the finish line. My school, [School's name], were the favorites for the final race, the 1st VIII, and one of my best friends was the stroke (captain) of the boat. We hadn't had a good day with the rest of the races, losing many that we should have won, or at least were the favorites to do so. But as the boats came around the final bend and into the last stretch, we could see that our crew were out in front, winning by only half a boat length. They maintained that lead, and ended up winning in a record time. The feeling of the crowd; all jumping and yelling as one, the sheer volume of the screaming was almost deafening, and everyone jumping on top of each other, was simply amazing. As we crossed the line, all the other schools fell silent, but we kept cheering, and as we did the victory war cry, it was one of the happiest moments of my life, everything the rowers had worked towards had come true, and in their final race for the school, the guys in the 1st VIII pulled off an amazing win. The next week, everyone walked around school with huge smiles on their faces, nothing was able to bring down our school spirit after that.	Summer 2010 Hot - 30 degrees Head of the River Rowing last race of the GPS competition [School] were the favorites Won Set a record Lost some races that should have been won Usually sit on the far right side Looking over the finish line Best friend was the captain of the crew Deafening screaming and yelling Jumping on top of each other Other schools fell silent as they crossed the line School spirit Middle of the day One of the happiest days The hard work of the rowers paid off Were leading by half a boat length around the final bend

Collaborative dyads also typed "I" less than individuals. Collaborative dyads' events, especially collaborative friends' and siblings' events, were authored by two people. Dyads were aware that typing the pronoun "I" was ambiguous, and so avoided it in favour of first names. Strangers replaced some of the "I" pronouns with "you". In these cases, the dyad member who did not experience the event typed "to" the dyad member who had experienced the event. The following extract from a typed event demonstrates this use of "you":

> Went clubbing in Kings Cross for the first time. Went to world bar with your Best Friend and brothers. You felt excited and nervous because you didn't know what to expect or how to act. You had your first shot, but you didn't know what it was...it was gross. There [were] four levels in the club, all with genres of music. Then your cousins turned up and bought you a famous teapot [cocktail], which tasted of pineapple and coconut. You danced all night and found it amusing how many men came up to you for a random chat. Danced some more...then it was time to leave. You parked in a back street.

Product Findings: Collaborative Success

According to Barnier, Sutton, Harris, and Wilson (2008), transactive memory theory does not just predict benefits of collaborating with intimate others in terms of the amount recalled, but also in terms of the quality of what is recalled. In this experiment I found that friends and siblings recalling events they had experienced together collaborated more successfully in terms of producing higher quality recall than strangers recalling events they had not experienced together. This finding reflects those of Harris et al. (2013), who found that friends and strangers who shared the encoding of a word list showed lesser costs of collaboration than friends and strangers who encoded the word list individually. Possible reasons for my findings may be that friends and siblings have a prior relationship and both experienced the event, and so could help each other to recall the event more vividly than strangers could. Harris et al. (2013) found that relationship had less of an effect on collaborative success than shared encoding did. Thus, a more likely reason than their prior relationship may be that friends and siblings experienced the event together, whereas strangers did not. The fact that I asked strangers to read each other's typed memories in Phase 1 so that they could have some basis for discussing the event together may also have contributed to their poorer collaborative performance. This instruction appeared to change the task demands from recalling the event together to recalling what the participant who experienced the event typed in Phase 1. Giving strangers some knowledge about the event therefore did not allow them to collaborate more successfully when recalling it. For this reason, in Experiment 4, I gave strangers no information about each other's events prior to collaboration, although they could see the cues given to the memory owner during recall.

As noted above, typing the events appeared to impede many dyads' recall of the events, especially friends and siblings. The dual task demands of discussing the event together and typing the event interrupted the natural flow of dyads' conversations. Some dyads dealt with the dual task demands by having one dyad member type while the other dictated or gave suggestions. Other dyads, especially friends and siblings, attempted to recall the event verbally to begin with, but were forced to stop recalling the event so that they could type what they had just recalled. For this reason, in Experiment 4 I asked dyads to recall the events verbally, which I audio recorded and transcribed.

I found that the amount dyads said to each other and their collaboration style did not relate to what they typed. One potential benefit of asking dyads to type the event while they discussed it was that it could have allowed me to disentangle the product of recall (what they typed) from the process of recall (what they said while they typed). However this was not what I found. Instead it appears that in recall of autobiographical events, product and process cannot be neatly separated. In addition, when recalling such rich, episodic information, dyads may not necessarily type all that they recall verbally, or type it as vividly as they recall it verbally. Thus, typed recall may not adequately capture the rich quality of autobiographical remembering. For these reasons, in Experiment 4, I asked participants to recall verbally. As the product and process of collaborative recall of autobiographical memories were more closely tied together, I then analysed dyads' conversations using the collaborative process coding I used in Experiments 1 and 2, adapted to autobiographical memory recall. In this experiment, the product and process of collaborative recall of autobiographical memories were separated into typed product and verbal processes. Thus, the change to verbal recall in Experiment 4 may clarify the relationship between the product and process of collaborative recall of autobiographical memories.

This experiment was the first to compare the collaborative recall of autobiographical memories in strangers, friends, and siblings. I analysed both the product of recall, in terms of the word count and memory quality of typed events, and the process of recall, in terms of collaboration style. In doing so, I found that friends and siblings were more successful collaborators than strangers, at least in terms of the quality of what they remembered. However, the relationship between the product and process of collaborative recall of autobiographical memories remains unclear. Thus, in Experiment 4, I changed some aspects of the method and more thoroughly examined collaborative processes to explore more deeply the effects of relationship and collaboration on recall of autobiographical memories.

CHAPTER FIVE

Experiment 4:
Strangers', Friends, and Siblings' Verbal Recall of Autobiographical Memories

My aim for this experiment was to determine the effects of relationship and collaboration on the verbal recall of shared and unshared events. In this experiment I aimed to determine: (1) whether recalling an autobiographical event with another person influenced how it is remembered, (2) whether the relationship between remembering partners and whether they experienced the recalled event together influenced how it was remembered, and (3) whether their conversation during recall influenced how they remember the event. I aimed to explore the process of collaboration in more depth than in Experiment 3, with the addition of collaborative process coding to participants' verbal recall. Verbal recall meant that I could better determine the influences of the natural flow of dyads' recall conversations on the product of their recall. I was interested in how the combination of intimacy and shared versus unshared experience influenced the costs and benefits of verbally recalling an event with another person. In addition, I was interested in the use of specific collaborative processes by strangers, friends, and siblings and whether these processes influenced the product of verbal recall.

As I noted in Chapter 4, typing or writing responses during collaborative word list recall has been widespread in collaborative recall experiments (Harris et al., 2012, 2013; Meade & Gigone, 2011; Pereira-Pasarin & Rajaram, 2011). Typing or writing autobiographical memories also has been widespread in experiments on individual autobiographical memory (Barnier et al., 2007; Rubin et al., 2004; Talarico et al., 2004). However, experiments involving dyadic or group recall of autobiographical memories largely have used verbal interviews, which are audio recorded and transcribed (Barnier et al., 2014; Bohanek, Fivush, & Duke, 2009; Fivush, Marin, McWilliams, & Bohanek, 2009; Harris et al., 2011; Sheen et al., 2001). In Experiment 3, I found that none of the process variables to assess collaboration style clearly influenced the quantity or quality of typed recall, likely because typing impaired dyads' fluent recall of autobiographical memories. Collaboratively typing autobiographical events was unlike the kind of remembering dyads would do in everyday contexts, and this method obscured the process of collaboration. Thus, free-flowing conversation is the most appropriate method for dyadic recall of this kind of rich, episodic information. For these reasons, I aimed to make the tasks in this experiment as close as possible to a natural conversation for all participants to clarify the effects of relationship and collaboration. To do so, I made four major changes to the method of Experiment 3.

The first major change I made was the kinds of events recalled. In Experiment 3, each individual or dyad recalled two events: a recent birthday celebration and a significant event of their choice. Friends and siblings recalled the same shared events regardless of whether they recalled as two individuals or as a dyad. I imposed no further restrictions on the events recalled by those participating as strangers. Thus, the events recalled by strangers potentially were qualitatively different to those recalled by friends and siblings. In this experiment, each individual or dyad recalled six events chosen from eight events I had elicited from them a week prior. For this chapter, I analysed the first three of these events for each dyad or individual. I imposed no restrictions on the type of events they could choose, except that they must have been shared with a particular friend or sibling. Friends and siblings recalled events they experienced with the friend or sibling participating with them in the experiment. Strangers chose a particular friend or sibling and recalled events they experienced with them. I made this change to ensure that the kinds of events recalled by strangers were as similar as possible to those recalled by friends and siblings. Therefore, changing the kinds of events recalled meant I could better compare friends and siblings with strangers to uncover the costs and benefits of recalling shared versus unshared events with a friend or sibling versus a stranger.

The second major change I made was the method of eliciting the events. In Experiment 3, I elicited the events immediately before participants recalled them in Elicitation/Recall 1. This method of elicitation meant that I did not know what the events were until after I had finished running the session. In this experiment, I elicited eight events from each participant individually in Session 1 and selected three events from each individual in a dyad to be recalled one week later in Session 2. This change meant that I could better control the events they recalled.

The third major change I made was the method of recalling the events. In Experiment 3, all participants typed the events while I audio recorded collaborative dyads' conversations. As noted previously, this method interrupted the natural flow of recall in collaborative dyads because they were forced to stop discussing the event to type the details they had just recalled. In this experiment, I gave them three minutes to describe the event aloud. This method meant that there was nothing to interrupt the natural flow of recall during collaborative dyads' conversations.

The final major change was that I analysed dyads' collaborative processes using a similar coding scheme to the one I used in Chapters 2 and 3. I added this coding to determine the costs and benefits of collaborative processes on the product of recall, in terms of both the quantity of recall and the quality of the recalled events. I also coded the distribution of words and turn taking in a similar way to Experiment 3, adapted for verbal recall.

Based on my findings in Experiment 3, I predicted that compared to recalling the events individually, recalling the events with a friend or sibling would increase the length of recall output in the three-minute time limit. I predicted that strangers would show fewer benefits of collaboration compared to friends and siblings because of their lack of prior acquaintance and because they recalled unshared events. I predicted that changing the method of recall to verbal instead of typed would clarify the costs and benefits of process on the product of recall. Specifically, I predicted that a more shared collaboration style, in terms of having more and shorter turns, an equal distribution of words between dyad members, and more collaborative processes, would benefit the product of their recall, in terms of the length of recall output and memory quality. Memory quality included the types of details they recalled, how vividly and emotionally they recalled the events, the emotional valence of the event, and the kinds of personal pronouns they used when recalling the events. I predicted that the relationship between dyad members and whether they recalled the events as individuals or dyads would influence memory quality. More specifically, I predicted that friends and siblings would collaborate to produce more vivid memories, with fewer contextual details, and fewer "I" and more "we" personal pronouns. I predicted that collaboration would increase the use of "you" pronouns. I predicted that strangers would show fewer benefits of collaboration compared to friends and siblings, and include more contextual detail to explain the event someone who did not experience it.

Method

Participants

I tested the same participants as in Experiment 2. These were 140 participants from Macquarie University. Strangers were 42 females and four males, with mean age 22.44 years (*SD* = 6.89). Friends were 24 females and 12 males, with mean age 19.29 years (*SD* = 2.25). Siblings were 32 females and 16 males, with mean age 21.67 years (*SD* = 6.27), and included seven twin dyads (for more detail, see Chapter 3). Unlike in Experiment 2, I analysed those who participated as nominal dyads as individuals. I made this decision for the same reason as in Experiment 3. Pooling two friends' or two siblings' recall of a shared event was difficult, and pooling two strangers' recall of two unshared events was not possible. Therefore, in this experiment the participants were: 11 collaborative stranger dyads (as in Experiment 2) and 24 individual strangers (12 nominal stranger dyads from Experiment 2 separated into two individuals); 12 collaborative friend dyads and 22 individual friends; and 12 collaborative sibling dyads and 24 individual siblings.

Research Design

The study was a 2 x 3 between subjects design, with collaborative condition (collaborative dyads versus individuals) and relationship (strangers, friends, and siblings) as independent variables. Collaborative dyads elicited the events individually in Session 1 and recalled them collaboratively in Session 2. Individuals elicited the events individually in Session 1 and recalled them individually in Session 2. They were treated as individuals (as opposed to nominal dyads) for the purposes of this chapter.

Materials

Audio recording. I audio recorded the experiment using Macbook Pro internal microphones and Audacity software.

Questionnaires. Participants completed the same questionnaires as in Experiment 2. These were a demographic questionnaire that asked friends and siblings how often they saw each other and asked friends how long had known each other; the Personal Assessment of Intimacy in Relationships (PAIR) Inventory (Schaefer & Olson, 1981), and the Positive and Negative Affect Scale (PANAS; Watson et al., 1988) at the beginning (PANAS 1) and end (PANAS 2) of Session 2.

Procedure

I ran the study in two sessions, approximately one week apart.

Session 1. In the first session, participants were interviewed individually, one-on-one either by myself or another experimenter. They completed the demographic questionnaire and I asked them to elicit eight events. I adapted the event elicitation procedure Addis et al. (2009) and Barnier et al. (2014). Before eliciting events from strangers, I asked them, “can you choose a friend or sibling that you have experienced at least eight events with?” I then asked them to write their friend or siblings’ first name on a piece of paper and to indicate whether they were a friend or sibling. For friends and siblings, I asked them to elicit eight events they had experienced with the friend or sibling participating in the experiment with them. I told each participant

> I would like you to think of eight events that you and [friend or sibling’s name] have experienced together. The events may be positive or negative, or both, but try to choose ones that are not upsetting to you or [friend or sibling’s name]. They could be from any time in your life. In fact try and think of both recent and more distant events, if possible. Try to avoid events that blend into other similar events. For example, if you’re thinking of a general scenario of going out to dinner, try instead to focus on one particular evening that you remember. Be

specific. If you recall something that happened over an extended period, for example, a three week holiday that you took, try to report just one of the mini specific events that occurred while on the holiday. Try to restrict the events you discuss to ones that occurred on one specific day. Events must be ones that you and [friend or sibling's name] personally experienced together and there must have been at least one other person present – they don't have to be as involved in the event as you and [sibling's name], and they don't have to be someone you know, but you need to name a specific person who was also there. For each event, I will ask you to: very briefly describe the event so I can be sure it's specific in time and place; provide the year that event happened; identify another person who was involved in the event other than you and [friend or sibling's name]; identify the main location of the event, and be specific, for example say café in Paris, rather than France; identify a physical object that featured in the event, for example, it could be an item of clothing, a piece of furniture, a particular food or animal); and come up with a brief and specific title for the event – make sure it distinguishes this event from other events. If you get stuck, I have a list of cues to help you think of more events. After each event you describe, I will briefly ask you to rate how vivid, emotional, and personally significant the event was.

If participants had difficulty thinking of events, I showed them a cue list of 71 possible events (e.g., "a wedding", "getting in trouble", "receiving HSC results"). After they gave me all the required details for each event, I asked them to rate the event using the following five-point Likert scales: "how detailed or vivid is your memory for the event, on a scale from 1 if it is not at all vivid, to 5 if it is extremely vivid?"; "how emotional do you feel when thinking about the event, on a scale from 1 if it is not at all emotional to 5 if it is extremely emotional?"; and "how personally significant is the event to you, on a scale ranging from 1 if it is not at all significant to 5 if it is extremely significant?".

Session 2. In the second session, one week after Session 1, participants completed the list based recall tasks reported in Experiment 2 (see Chapter 3). They completed the following autobiographical memory task at the beginning of Recall 1.

Event recall. After Encoding/Elicitation, described in Chapter 3, I continued to interview participants in nominal dyads individually, and brought both participants in collaborative dyads into the same room with two experimenters. Event recall occurred at the beginning of Recall 1.

I asked participants to recall six of the events elicited in Session 1. The procedure followed Addis et al. (2009) as closely as possible. I told collaborative friends and siblings

> Now I will ask you to recall together some of the events that you told me about in the last session involving the both of you. For each event I want you to describe, I will provide the person, location, and object of that event on a PowerPoint slide. These will be the exact details that one of you gave us in Session 1. Half of the events will be from [Participant A's name]'s interview and some will be from [Participant B's name]'s interview. For each event, please try to work together as much as possible to recall the event. The example slide here asks you to recall an event that involves a person named Richard, located at Richard's house, and the physical object involved in this event are balloons. In brackets after the name, location and object reads engagement party, which is the brief title that has been given to the event. After I show you the slides with one of your memories, I want you to take up to a minute to think about the event and make sure you both have the same event in mind. Then, I will give you three minutes to tell me in as much detail as you can, everything you can remember about the event including what you were doing, thinking, feeling, etc. In doing so, I want you to make sure you include all three details on the slide in your description. After the three minutes is up, I will ask you to rate out loud how vivid, emotional, and personally significant the event was.

I gave collaborative strangers the same instructions, except that I removed the words, "involving the both of you" and after the fourth sentence added "as a reminder, [Participant A's name], your events were shared with your friend/sibling [friend/sibling's name] and [Participant B's name]'s your events were shared with your friend/sibling [friend/sibling's name]."

I gave individual friends and siblings the same instructions as collaborative friends and strangers, without the words, "For each event, please try to work together as much as possible to recall the event." I gave individual strangers the same instructions as for individual friends and siblings, without the words, "Half of the events will be from [Participant A]'s interview and half will be from [Participant B]'s interview."

Following the three minutes, both members of collaborative friend or sibling dyads rated each event using the three Likert scales described above. Collaborative strangers only rated their own events.

Post-experimental interview and debrief. Finally, I asked participants individually about their experience of the experiment and debriefed participants individually before they left.

Coding

I audio recorded and transcribed all of what dyads said during the three minutes of event recall. Due to the labour intensive and in depth nature of the coding, I coded the first three of the six events recalled in Session 2. Although the memory owner alternated between dyad members throughout the task, such that one dyad member had elicited Events 1, 3, and 5; and the other dyad member had elicited Events 2, 4, and 6; the order of the events from each memory owner was randomized across the task. The first three events and the last three events had similar participant ratings for vividness, emotion, and personal significance, with any differences between them being less than 0.2 on the scales from 1 to 5. Thus, the first three events were adequately representative of recall across the experiment.

I took two approaches to coding the transcripts. The first approach was for collaboration style, and for this I only coded collaborative transcripts. I coded collaboration style in two ways: (1) distribution of words and turn taking, and (2) collaborative process coding. The former was similar to the coding I used in Experiments 1, 2, and 3. The latter was similar to the coding I used in Experiments 1 and 2. The second approach was for memory quality, and for this I coded both collaborative dyads' and individuals' transcripts. I coded memory quality in the same two ways as in Experiment 3: (1) global quality of the memories, using a coding scheme similar to that used by Habermas and Diel (2013); and (2) analysis of the transcripts using Linguistic Inquiry and Word Count (LIWC) software (Pennebaker et al., 2007).

Collaboration style. ***Distribution of words and turn taking.*** I used three measures of the distribution of words and turn taking between dyad members' event recall: turns, words per turn, and the proportion of words said by the memory owner. I defined a turn as starting when one dyad member started speaking and finishing when the next dyad member started speaking. I did not count brief back-channelling utterances by the listener, such as "yeah", or "mmm", as turns. I calculated the mean number of words per turn for each transcript using this definition of a turn.

I defined the memory owner as the dyad member who originally elicited the event in Session 1. When both members of a friend or sibling dyad elicited the same event in Session 1, I used one dyad member's set of cues (person, location, object, and title), and I classed that member as the owner. In stranger dyads, the memory owner was always the stranger who experienced the event. I arranged the events such that the memory owner alternated between the dyad members with each event.

Collaborative process coding. The collaborative process coding I used in this experiment was similar to the coding I used in Experiments 1 and 2. In this experiment I removed category use, group strategy use, and individual strategy use because they were specific to list recall. This left two Factor 1 collaborative processes, unsuccessful cues and corrections and disagreements, and two Factor 2 collaborative processes, successful cues and mirrored repetitions. I also added another Factor 2 collaborative process, co-constructed sentences. I included this process to capture dyads' joint remembering of events. I defined co-constructed sentences to be instances in which one dyad member finished or added to the other dyad member's sentence. The following is an example of a co-constructed sentence from a friend dyad:

> N: So P came to my house and we had another one of our friends there who has no idea how to do make-up so,
>
> P: It took us like an extra hour to get her ready.

I counted the instances of each variable occurring in the first three events recalled by each collaborative dyad. Thus, each dyad had scores for five codes across three events: (1) the number of successful cues, (2) the number of mirrored repetitions, (3) the number of co-constructed sentences, (4) the number of unsuccessful cues, and (5) the number of corrections and disagreements (see Appendix C for the collaborative process coding scheme for autobiographical memories).

Memory quality coding. ***Global quality.*** I coded all events using a global quality coding scheme by Habermas and colleagues (Habermas & Diel, 2013; Habermas, Diel, & Heberer, 2009; Habermas, Diel, Mahmoudi, et al., 2009), which I translated from German to English for this thesis. As in Experiment 3, the codes I used were person detail, place detail, time detail, vividness, and emotionality, which meant each event had five scores for global quality that each ranged from 0 to 3.

LIWC Analysis. I analysed the recall of each event using LIWC software (Pennebaker et al., 2007) to calculate the usage of certain types of words as a proportion of the whole text. I used the same LIWC categories as in Experiment 3: the pronouns "I", "we", and "you", and positive and negative emotion words.

Results

I separated analysis into five main parts: (1) length of recall output for each event, (2) collaboration style, (3) relationship between length of recall output (product) and collaboration style (process), (4) memory quality, and (5) the relationship between memory quality (product) and collaboration style (process). In parts 1 and 4 I compared collaborative dyads with individuals; strangers, friends, and siblings; and the interaction between collaborative condition and relationship. In parts 2, 3, and 5 I analysed collaborative dyads' recall only, and compared strangers, friends, and siblings. In analysis of memory quality I included participant ratings immediately following the three-minute recall and the age of the memory in years since the event occurred, in addition to the global quality and LIWC analysis as described above.

Length of Recall Output

The number of words that dyads and individuals said for each event ranged from 85 to 720 words (see Table 5.1 for means). Using a 2 x 3 (collaborative condition x relationship) ANOVA, I found that collaborative dyads' memories were longer than individuals', $F(1, 98) = 15.30$, $p < .001$, $\eta_p^2 = .14$. Although I found no main effect of relationship, $F(2, 98) = 0.11$, $p = .899$, collaborative condition significantly interacted with relationship, $F(2, 98) = 4.51$, $p = .013$, $\eta_p^2 = .08$. Follow-up tests comparing collaborative dyads with individuals separately for each relationship (using a Bonferroni correction of $\alpha = .017$), indicated that collaborative dyads said more than individuals only if they were siblings, $t(34) = 4.22$, $p < .001$, $d = 1.45$.

Thus, collaboration increased the amount siblings said about shared events, but not the amount strangers said about unshared events and friends said about shared events. Individual siblings' memories appeared to be shorter than individual strangers' and friends' memories and sibling dyads' memories appeared to be longer than stranger and friend dyads' memories (see Table 5.1). These findings suggest that collaborative siblings' higher word count did not occur just because they had two speakers instead of one. Instead, siblings were especially sensitive to the benefits of recalling collaboratively and the costs of recalling individually compared to strangers and friends.

Table 5.1

Mean Number of Words Said Per Event by Collaborative Condition and Relationship

Relationship	Individuals	Dyads	Total
Strangers	367.77 (104.42)	416.18 (51.30)	383.43 (92.71)
Friends	384.74 (100.45)	415.25 (103.86)	395.51 (101.17)
Siblings	300.50 (113.11)	475.67 (125.82)	358.89 (142.81)
Total	349.78 (111.05)	436.26 (101.09)	378.88 (114.90)

Note. Standard deviations appear in parentheses.

Collaboration Style

Distribution of words and turn taking. Two stranger dyads recalled the events with no input from the memory owner's partner, and recalled all three events as uninterrupted monologues. I excluded these two dyads from the analysis of the distribution of words and turn taking so that they would not skew the results. For the remaining dyads, the number of turns dyads took during each event ranged from 7 to 76 turns, the mean number of words they said per turn ranged from 5.35 to 57 words, and the proportion of words said by the memory owner ranged from 0.12 to 0.98 (see Table 5.2 for means).

Using separate univariate ANOVAs for each variable, I found a significant effect of relationship on the number of turns dyads took to recall each event, $F(2, 30) = 9.69$, $p < .001$, $\eta_p^2 = .39$, the mean words they said per turn, $F(2, 30) = 23.50$, $p < .001$, $\eta_p^2 = .61$, and the proportion of words said by the memory owner, $F(2, 30) = 92.00$, $p < .001$, $\eta_p^2 = .86$. Using planned Helmert contrasts, I found that friends and siblings took more turns, took shorter turns and had a lower proportion of words said by the memory owner than stranger dyads, all *p*s < .001. I found similarities in the number of turns, mean words per turn, or proportion of words said by the memory owner in friends and siblings, all *p*s > .158. Thus, friend and sibling dyads, who recalled shared events, had a similar collaboration style. Strangers recalled unshared events, leading to less interactive collaboration, in which the memory owner recounted the event to the other dyad member. This pattern of results demonstrates how shared knowledge and history influence recall of shared events.

Table 5.2

Mean Distribution of Words and Turn Taking

Relationship	Turns	Words Per Turn	Proportion of Words Said by Memory Owner
Strangers	20.11 (6.98)	26.80 (8.86)	.86 (.05)
Friends	42.36 (12.51)	10.57 (1.89)	.53 (.05)
Siblings	43.11 (16.73)	12.80 (5.29)	.49 (.09)
Total	36.57 (16.34)	15.81 (8.84)	.61 (.17)

Note. Standard deviations appear in parentheses.

Collaborative processes. ***Harris et al.'s Factor 1 processes.*** The number of unsuccessful cues in each event ranged from 0 to 4 and the number of corrections and disagreements ranged from 0 to 18 (see Table 5.3 for means). Using separate univariate ANOVAs for each process, I found that strangers, friends, and siblings had a similar number of unsuccessful cues in each event, $F(2, 102) = 2.07$, $p = .131$, but I found a significant effect of relationship on the number of corrections and disagreements, $F(2, 102) = 5.81$, $p = .004$, $\eta_p^2 = .19$. Using planned Helmert contrasts, I found that friends and siblings had more corrections and disagreements than strangers, $p = .002$, but had a similar number of corrections and disagreements to each other, $p = .244$. Thus, having a prior relationship and recalling shared events increased the number of corrections and disagreements.

Harris et al.'s Factor 2 processes. The number of turns in each event that were successful cues ranged from 0 to 13, the number of mirrored repetitions ranged from 0 to 12 and the number of co-constructed sentences ranged from 0 to 24 (see Table 5.3 for means). Using separate univariate ANOVAs for each process, I found that strangers, friends, and siblings had a similar number of successful cues in each memory, $F(2, 102) = 0.63$, $p = .535$. However, I found a significant effect of relationship on the number of mirrored repetitions, $F(2, 102) = 13.72$, $p < .001$, $\eta_p^2 = .21$, and the number of co-constructed sentences, $F(2, 102) = 12.20$, $p < .001$, $\eta_p^2 = .19$. Using planned Helmert contrasts, I found that friends and siblings had more mirrored repetitions and co-constructed sentences than stranger dyads, both ps < .001, and had a similar number of mirrored repetitions and co-constructed sentences to each other, both ps > .294. Thus, having a prior relationship and recalling shared events increased the number of mirrored repetitions and co-constructed sentences.

Collaborative processes summary. Although friends and siblings had similar rates of successful and unsuccessful cues to strangers, they had more corrections and disagreements, mirrored repetitions, and co-constructed sentences. Therefore, these collaborative processes appear to depend on shared history and knowledge, whereas cuing may depend on many other factors. I discuss this in detail in Chapter 7.

Table 5.3

Mean Number of Collaborative Processes Per Event

Relationship	Unsuccess-ful Cues	Corrections and Disagreements	Successful Cues	Mirrored Repetitions	Co-Constructed Sentences
Strangers	0.48 (0.58)	0.33 (0.33)	3.36 (2.54)	1.42 (1.43)	0.36 (0.46)
Friends	0.94 (0.57)	2.00 (2.33)	4.03 (2.68)	3.72 (2.00)	3.61 (1.82)
Siblings	0.92 (0.81)	2.86 (2.81)	3.22 (2.90)	4.58 (2.43)	3.97 (2.70)
Total	0.79 (0.68)	1.77 (2.33)	3.54 (2.66)	3.30 (2.37)	2.71 (2.47)

Note. Standard deviations appear in parentheses.

Relationship between aspects of collaboration style. Correlating collaborative processes and the distribution of words and turn taking, I found that dyads who took more turns took shorter turns and had a lower proportion of words said by the memory owner (see Table 5.4). Dyads who took longer turns had a higher proportion of words said by the memory owner. Thus, some dyads recalled the events in a more collaborative, interactive, and shared manner than other dyads.

Dyads who had more mirrored repetitions had more successful cues, co-constructed sentences, and unsuccessful cues. Dyads who had more corrections and disagreements also had more unsuccessful cues. These results largely support the factors revealed by Harris et al. (2011).

All collaborative processes except successful cues correlated positively with the number of turns and negatively with the length of turns. All collaborative processes except successful cues correlated negatively with the proportion of words said by the memory owner. Thus, dyads who took more, shorter turns used more collaborative processes. When the memory owner dominated recall the dyad used fewer collaborative processes except for successful cues. Thus, a more shared collaboration style involved more collaborative processes.

Separating the analysis by relationship, with a Bonferroni correction of $\alpha = .017$, I found that turns significantly negatively correlated with words per turn for strangers, friends, and siblings, $r = -.80$, $p = .003$, $r = -.69$, $p = .013$, and $r = -.76$, $p = .004$, respectively. Thus, dyads in all three relationships who took shorter turns took more turns. However, the proportion of owner words said by the memory owner only positively correlated with turns and words per turn for strangers, $r = -.93$, $p < .001$, and $r = .81$, $p = .002$, respectively. Thus, in strangers only, dyads whose recall was more dominated by the memory owner took fewer and longer turns.

Strangers who took more turns had more successful cues and mirrored repetitions, $r = .74$, $p = .009$, and $r = .83$, $p = .001$, respectively. I found similar relationships between turns and successful cues, and turns and mirrored repetitions for siblings, $r = .77$, $p = .003$, and $r = .83$, $p = .001$, respectively. However, friends who took more turns had more unsuccessful cues, $r = .70$, $p = .012$. Thus cuing and mirrored repetitions appeared to contribute to turn taking differently for friends compared to strangers and siblings. The correlations I found between collaborative processes did not hold for each relationship separately, all rs $< .56$, all ps $> .061$, except for marginally significant positive correlations between unsuccessful cues and mirrored repetitions for strangers and between successful cues and mirrored repetitions for siblings, $r = .69$, $p = .020$, and $r = .63$, $p = .027$, respectively.

Table 5.4

Correlations Between Aspects of Collaboration Style

Variable	Unsuccessful Cues		Corrections and Disagreements		Successful Cues		Mirrored Repetitions		Co-Constructed Sentences		Turns		Words Per Turn	
	r	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*
Corrections and Disagreements	-.02	.854												
Successful Cues	.28	.004*	-.02	.854										
Mirrored Repetitions	.28	.004*	.16	.107	.21	.030*								
Co-Constructed Sentences	.05	.636	.12	.206	-.04	.694	.30	.002*						
Turns	.39	<.001*	.46	<.001*	.43	<.001*	.67	<.001*	.51	<.001*				
Words Per Turn	-.21	.033*	-.16	.113	-.27	.005*	-.32	.001*	-.22	.027*	-.48	<.001*		
Proportion Of Words Said By Memory Owner	-.22	.022*	-.24	.012*	-.08	.432	-.46	<.001*	-.40	<.001*	-.56	<.001*	.46	<.001*

*Significant at $\alpha = .05$

Collaboration style summary. Across all three relationships, dyads who had more collaborative processes recalled their events in a more interactive and shared manner than dyads with fewer collaborative processes. Thus, although Harris et al. (2011) found that some collaborative processes were costly and others were beneficial for collaboration, I found benefits for all collaborative processes. These benefits did not necessarily hold for each relationship separately, indicating that, with the exception of strangers taking longer monologues than friends and siblings, the type of relationship dyads shared did not necessarily lead them to take a particular collaboration style.

Relationship Between Collaboration Style and Length of Recall Output

Correlating collaboration style and word count, I found that dyads with more turns had a higher word count (see Table 5.5). However, words per turn and proportion of words said by the memory owner did not correlate with word count. Word count correlated positively with all collaborative processes. Thus, all collaborative processes contributed to the number of words spoken by dyads in each event, but the distribution of words and length of turns did not contribute to the length of recall.

Separating the analysis by relationship, with a Bonferroni correction of $\alpha = .017$, I found that the only significant correlation for strangers was a positive correlation between successful cues and word count, $r = .75$, $p = .008$. For friends, the only significant correlation was a positive correlation between the number of turns and word count, $r = .84$, $p = .001$. For siblings, I also found a significant positive correlation between turns and word count, $r = .87$, $p < .001$, and successful cues and word count, $r = .75$ $p = .005$. For siblings, mirrored repetitions also positively correlated with word count, $r = .79$, $p = .002$. No other correlations were significant, all *r*s < .63, all *p*s > .029. Thus, only friend and sibling dyads who took more turns had a longer recall output. The fact that strangers often took few turns with long monologues is the most likely reason for the fact that the number of turns they took did not translate into longer recall output. Most of the correlations between most collaborative processes and length of recall output did not hold for each relationship separately. Successful cues contributed the most consistently to the length of recall output, except for friends, whereas mirrored repetitions only contributed to the length of recall output for siblings. Thus, each collaborative process appeared to influence dyads' recall output differently for each relationship.

Table 5.5

Correlations Between Collaboration Style and Length of Recall Output

	Word Count	
	r	*p*
Turns	.57	<.001*
Words Per Turn	-.12	.208
Proportion of Words Said by Memory Owner	-.07	.501
Successful Cues	.39	<.001*
Mirrored Repetitions	.20	.037*
Co-Constructed Sentences	.32	.001*
Unsuccessful Cues	.20	.037*
Corrections and Disagreements	.36	.001*

*Significant at $\alpha = .05$

Memory Quality

Global quality. ***Level of detail.*** Dyads' mean scores for person, place, and time detail ranged from a minimum of 0 to a maximum of 3 (see Table 5.6 for means). Using separate 2 x 3 (collaborative condition x relationship) ANOVAs for each type of detail, I found dyads and individuals had similar scores for person, place, and time details, all Fs < 1.74, all ps > .189. I found a significant effect of relationship on person and place details, $F(2, 306) = 3.44$, $p = .033$, $\eta_p^2 = .02$, and $F(2, 306) = 4.03$, $p = .019$, $\eta_p^2 = .03$, respectively. Using planned Helmert contrasts comparing friends and siblings combined to strangers, and then friends and siblings to each other, I found that friends and siblings had lower scores for person and place detail than strangers, $p = .009$ and $p = .012$, respectively. Friends and siblings had similar scores for person and place detail to each other, $p = .887$ and $p = .196$, respectively.

Table 5.6

Mean Level of Detail Per Event by Collaborative Condition and Relationship

Relationship	Individuals	Dyads	Total
	Person Detail		
Strangers	2.17 (0.80)	2.36 (0.70)	2.24 (0.77)
Friends	1.95 (0.77)	2.06 (0.79)	1.99 (0.78)
Siblings	1.99 (0.70)	2.06 (0.79)	2.01 (0.73)
Total	2.04 (0.76)	2.15 (0.77)	2.08 (0.77)
	Place Detail		
Strangers	1.70 (0.69)	1.97 (0.77)	1.78 (0.73)
Friends	1.48 (0.79)	1.53 (0.88)	1.50 (0.82)
Siblings	1.69 (0.82)	1.61 (0.73)	1.67 (0.79)
Total	1.63 (0.77)	1.70 (0.81)	1.65 (0.78)
	Time Detail		
Strangers	1.29 (0.88)	1.58 (0.83)	1.38 (0.87)
Friends	1.42 (0.86)	1.39 (0.96)	1.41 (0.89)
Siblings	1.28 (0.98)	1.06 (0.86)	1.20 (0.94)
Total	1.33 (0.91)	1.33 (0.91)	1.33 (0.91)

Note. Standard deviations appear in parentheses.

I found no significant effects of relationship on scores for time detail, $F(2, 98) = 1.87$, $p = .159$. Collaborative condition did not significantly interact with relationship in terms of person, place, and time details, all Fs < 1.88, all ps > .157. Thus, friends' and siblings' events had less precise person and place details than strangers' events, regardless of whether they were recalled by individuals or dyads. Unlike in the typed events in Experiment 3, in which I found more person detail in individuals' events than dyads' events, collaboration did not affect the level of any type of detail in verbal events. Also, whereas in the typed events, friends and siblings had less precise time detail than strangers, in the verbal events, friends and siblings had less precise person and place detail than strangers.

Vividness and emotionality. Dyads' mean scores for vividness and emotionality scores for each event ranged from a minimum of 0 to a maximum of 3 (see Table 5.7 for means). Using a 2 x 3 (collaborative condition x relationship) ANOVA, I found that collaborative dyads' events were more vivid than individuals' events, $F(1, 306) = 4.48$, $p = .035$, but were less emotional than individuals' events, $F(1, 306) = 4.51$, $p = .034$, $\eta_p^2 = .01$. Strangers', friends', and siblings' events had similar scores for vividness, $F(2, 306) = 1.17$, $p = .313$, and emotionality, $F(2, 306) = 0.27$, $p = .762$. Collaborative condition did not significantly interact with relationship for either vividness or emotionality, both Fs < 1.64, both ps > .196. Recalling events with another person benefited the vividness of recall, even when participants recalled the events with a stranger who did not experience the event. Even though emotionality contributed to vividness scores (Habermas, Diel, Mahmoudi, et al., 2009), recalling events with another person meant that dyads recalled them less emotionally, even when they recalled with friend or sibling who experienced the event with them. Thus, unlike for the typed events in Experiment 3, in which I found costs of collaboration in terms of both vividness and emotionality for strangers but not for friends and siblings, for verbal events, collaboration produced benefits for vividness but costs for emotionality in all three relationships.

Table 5.7

Mean Level of Vividness and Emotionality Per Event

Relationship	Individuals	Dyads	Total
		Vividness	
Strangers	2.03 (0.54)	2.15 (0.76)	2.07 (0.62)
Friends	2.17 (0.60)	2.25 (0.65)	2.20 (0.61)
Siblings	1.92 (0.82)	2.22 (0.64)	2.02 (0.77)
Total	2.03 (0.67)	2.21 (0.68)	2.09 (0.68)
		Emotionality	
Strangers	1.59 (1.10)	0.97 (1.13)	1.39 (1.14)
Friends	1.32 (1.14)	1.22 (1.20)	1.28 (1.16)
Siblings	1.24 (1.12)	1.11 (0.89)	1.19 (1.05)
Total	1.38 (1.13)	1.10 (1.07)	1.29 (1.11)

Note. Standard deviations appear in parentheses.

Global quality summary. Recalling the events with a stranger meant the memory owner provided more precise information about the location and people involved in the events than friends or siblings. Collaborative dyads recalled events more vividly and less emotionally than individuals. Thus, recalling the events with another person had benefits for vividness but costs for emotionality. These costs and benefits held regardless of relationship between dyad members. Whereas I found effects of collaboration on level of person detail in typed events, in verbal events this effect disappeared. In typed events, relationship affected time details, but in verbal events, relationship affected person and place details. These differences confirm how different verbal recall of autobiographical memories is from typed recall.

LIWC. ***Pronouns "I", "we" and "you".*** LIWC scores for personal pronouns ranged from 0 to 13.86 (see Table 5.8 for means). Using separate 2 x 3 (collaborative condition x relationship) ANOVAs for each pronoun, I found that collaborative dyads used "I" marginally less, $F(1, 306) = 3.34$, $p = .068$, and used "you" more than individuals, $F(1, 306) = 142.08$, $p < .001$, $\eta_p^2 = .32$, similar to the typed events in Experiment 3. I found no significant difference between dyads' and individuals' use of "we", $F(1, 306) = 1.98$, $p = .161$, and I found no significant effect of relationship, all *F*s < 1.45, all *p*s > .237, and collaborative condition did not significantly interact with relationship for any pronoun, all *F*s < 1.88, all *p*s > .154. Thus, regardless of relationship, events recalled by collaborative dyads contained more instances of "you" and fewer instances of "I" than events recalled by individuals. Thus, recalling the events with another person meant participants focused less on themselves and more on their collaborating partner. Unlike in the typed events, in which I found that friends and siblings used "I" less, "we" more, and "you" less than strangers, in the verbal events these differences disappeared. Also, unlike in the typed events, collaborative dyads used "you" more than individuals in all three relationships, not just if they were strangers. These differences may have been caused by the different modalities or by the fact that, unlike in Experiment 3, in this experiment I asked strangers to recall events they had experienced with a particular friend or sibling.

Table 5.8

Mean LIWC Scores for Pronouns.

Relationship	Individuals	Dyads	Total
	"I"		
Strangers	5.14 (2.50)	4.76 (2.07)	5.01 (2.36)
Friends	4.69 (2.68)	4.04 (2.13)	4.46 (2.51)
Siblings	5.12 (2.94)	4.43 (2.85)	4.89 (2.91)
Total	4.99 (2.71)	4.40 (2.38)	4.79 (2.61)
	"We"		
Strangers	3.67 (2.17)	2.93 (1.77)	3.43 (2.07)
Friends	4.15 (2.26)	3.49 (2.15)	3.92 (2.24)
Siblings	3.31 (1.98)	3.64 (2.21)	3.42 (2.05)
Total	3.70 (2.15)	3.37 (2.06)	3.59 (2.13)
	"You"		
Strangers	0.32 (0.45)	1.36 (0.94)	0.66 (0.81)
Friends	0.47 (2.26)	1.56 (1.03)	0.86 (0.90)
Siblings	0.22 (0.40)	1.66 (1.73)	0.70 (1.25)
Total	0.33 (0.47)	1.53 (1.29)	0.74 (1.01)

Note. Standard deviations appear in parentheses.

Positive and negative emotion. LIWC scores for positive and negative emotion ranged from 0 to 9.60 (see Table 5.9 for means). The mean LIWC score per event for positive emotion was 3.10 (SD = 1.57), and for negative emotion was 0.85 (SD = 0.72). Using separate 2 x 3 (collaborative condition x relationship) ANOVAs for each emotion, I found no effect of collaborative condition on positive or negative emotion, both Fs < 1.47, both ps > .229. I found a significant effect of relationship on positive emotion, $F(2, 306) = 4.10$, $p = .017$, η_p^2 =

.03, but not for negative emotion, $F(2, 306) = 2.06$, $p = .129$. Friends and siblings had less positive emotion than strangers, $p = .016$, but I found no difference in the positive emotion used by friends and siblings, $p = .137$. I also found no significant interaction between collaborative condition and relationship for positive or negative emotion, both $F < 2.09$, both $p > .126$. Thus, regardless of whether they recalled the events as individuals or collaborative dyads, friends and siblings used fewer positive emotion words in their recall of the events than strangers. The effects of collaboration and relationship on positive and negative emotion were the same for both typed and verbal events.

LIWC summary. Collaborative dyads said “I” less and “you” more than individuals, regardless of their relationship. Friends and siblings recalled events with fewer positive emotion words than strangers, regardless of whether they collaborated or not. Thus, collaboration took the focus off recall of the self and on to the collaborative partner. Friends and siblings, who either recalled the events with someone with whom they had shared the events, or who had a friend or sibling recalling the same event in another room, focused less on the positive aspects of the events than strangers, who were always the sole narrators of their events.

Table 5.9

Mean LIWC Scores for Positive and Negative Emotion.

Relationship	Individuals	Dyads	Total
	Positive Emotion		
Strangers	3.31 (1.51)	3.50 (1.51)	3.37 (1.51)
Friends	3.44 (1.35)	2.74 (1.24)	3.19 (1.35)
Siblings	2.77 (1.94)	2.74 (1.35)	2.76 (1.76)
Total	3.16 (1.65)	2.98 (1.40)	3.10 (1.57)
	Negative Emotion		
Strangers	0.90 (0.72)	0.59 (0.54)	0.80 (0.68)
Friends	0.96 (0.76)	0.95 (0.74)	0.95 (0.75)
Siblings	0.80 (0.77)	0.80 (0.61)	0.80 (0.72)
Total	0.88 (0.75)	0.79 (0.65)	0.85 (0.72)

Note. Standard deviations appear in parentheses.

Participant ratings. Ratings for how detailed/vivid, emotional, and personally significant participants found the events immediately after recalling them ranged from a minimum of 1 to a maximum of 5 (see Table 5.10 for means). Using aseparate 2 x 3 (collaborative condition x relationship) ANOVA for each rating, I found no significant effects of collaborative condition, relationship, or interactions between them, all Fs < 2.34, all ps > .099. Therefore, despite the costs and benefits of collaborative condition and relationship I found on the length of recall output, level of detail, and vividness of events, participants gave similar ratings of how detailed or vivid the events were in their mind. Also, despite the cost of collaboration on the emotionality of the events, and the effect of relationship on the positive emotion words used in the events, participants gave similar ratings of how emotional and how personally significant the events were. These findings suggest that participant ratings of the events did not reflect the product of recall.

Age of memory. I calculated the age of the events by determining the number of years between when the event occurred and when they were recalled. The age of the memories ranged from less than one year to 32 years (see Table 5.10 for means). Using a 2 x 3 (collaborative condition x relationship) ANOVA, I found no effect of collaborative condition on age of memory, $F(1, 306) = 0.37$, $p = .545$. I found a significant effect of relationship on the age of memory, $F(2, 306) = 5.73$, $p = .004$, $\eta_p^2 = .04$. Friends recalled events that occurred significantly more recently than strangers and siblings, both $p = .013$. I found no difference in the age of strangers' and siblings' memories, $p = 1.00$. Collaborative condition did not significantly interact with relationship, $F(2, 306) = 0.36$, $p = .695$.

The age of friends' memories reflected their shorter acquaintance ($M = 7.47$ years, $SD = 3.56$) than siblings. Although half of the strangers recalled events they shared with friends and half recalled events they shared with siblings, overall, the age of strangers' memories was more similar to siblings' than friends'. Thus, any differences in the age of memories recalled were only due to the length of time friends and siblings had known each other.

Memory quality summary. Collaborative dyads recalled events more vividly and less emotionally than individuals, and said "you" more and "I" less than individuals. Friends and siblings included less precise person and place detail and lower levels of positive emotion in their memories than strangers. Participant ratings given immediately following recall of each event did not reflect these differences in memory quality. Friends' events were more recent than strangers' and siblings'.

Table 5.10

Mean Participant Ratings and Age of Memory in Years Since the Event Occurred

Relationship	Individuals	Dyads	Total
	Detailed/Vivid		
Strangers	3.64 (0.89)	3.76 (0.90)	3.68 (0.89)
Friends	3.36 (1.05)	3.57 (0.99)	3.44 (1.03)
Siblings	3.40 (0.97)	3.58 (1.00)	3.46 (0.98)
Total	3.47 (0.97)	3.63 (0.96)	3.52 (0.97)
	Emotional		
Strangers	2.84 (0.92)	2.91 (1.31)	2.86 (1.05)
Friends	3.06 (1.11)	2.90 (1.16)	3.00 (1.12)
Siblings	3.01 (1.18)	2.99 (0.99)	3.00 (1.12)
Total	2.97 (1.07)	2.93 (1.15)	2.96 (1.10)
	Personally Significant		
Strangers	3.09 (1.13)	3.12 (1.36)	3.10 (1.21)
Friends	2.86 (1.18)	3.10 (1.25)	2.95 (1.20)
Siblings	3.28 (1.06)	3.40 (1.11)	3.32 (1.08)
Total	3.08 (1.13)	3.21 (1.24)	3.12 (1.17)
	Age of Memory		
Strangers	4.74 (5.28)	4.61 (3.66)	4.70 (4.80)
Friends	3.15 (2.79)	2.14 (1.88)	2.79 (2.54)
Siblings	4.64 (6.16)	4.75 (5.94)	4.68 (6.06)
Total	4.20 (5.02)	3.81 (4.32)	4.07 (4.79)

Note. Standard deviations appear in parentheses.

Relationship Between Collaboration Style and Memory Quality

I performed correlations between collaboration style variables and memory quality variables to establish the costs and benefits of the process of collaboration on the product of recall. Correlating memory quality and distribution of words and turn taking, I found that participant ratings and the age of memory did not correlate with any distribution of words and turn taking variables (see Table 5.11). A higher proportion of words said by the memory owner and longer turns were associated with higher scores for person detail, and longer turns were also associated with higher scores for place detail. These findings were likely to have occurred because friends and siblings had shorter turns and a more equal distribution of words between dyad members than strangers, and also had lower scores for person and place details.

The more turns dyads took in each event and the fewer words per turn they said, the more they used "you" pronouns. The more recall was dominated by the memory owner, the higher dyads' use of "I", the lower their use of "we", and the more positive emotion words they used. Thus dyads with a more shared, interactive collaboration style used more "you" and "we" pronouns, fewer "I" pronouns, and fewer positive emotion words.

Separating the analysis by relationship, with a Bonferroni correction of $\alpha = .017$, I found that siblings who took more turns recalled their events more emotionally, $r = .71$, $p = .010$. Strangers who took more turns, took shorter turns, and had a more equal share of words between the memory owner and the non-memory owner used more "you" pronouns, $r = .75$, $p = .007$, $r = -.87$, $p = .001$, and $r = -.87$, $p = .001$, respectively, which most likely reflected the non-memory owner cuing the memory owner by asking questions about the event. Siblings who took more turns also used more "you" pronouns, $r = .71$, $p = .010$, indicating that siblings who referred to each other more also took more turns. I found no other significant correlations between the distribution of words and turn taking and memory quality, all *r*s < .61, all *p*s > .048, except for a marginally significant negative correlation between time details and the number of turns in strangers, $r = -.67$, $p = .026$. Thus, the distribution of words and turn taking influenced strangers' memory quality more than friends' and siblings'.

Table 5.11

Correlations Between Memory Quality and Distribution of Words and Turn Taking

	Turns		Words Per Turn		Proportion of Words Said by Memory Owner	
	r	*p*	*r*	*p*	*r*	*p*
Person Detail	-.11	.247	.24	.014*	.21	.030*
Place Detail	-.04	.664	.21	.030*	.18	.064
Time Detail	-.07	.501	.14	.142	.19	.057
Vividness	.07	.507	.10	.328	.10	.316
Emotionality	.09	.347	.07	.456	.10	.335
“I”	-.04	.705	.15	.119	.20	.041*
“We”	.07	.483	-.12	.233	-.20	.044*
“You”	.38	<.001*	-.23	.017*	-.12	.238
Positive Emotion	-.12	.230	.04	.706	.24	.012
Negative Emotion	.07	.508	.02	.842	-.15	.135
Detail/Vividness	.03	.793	.05	.638	.10	.336
Emotion	-.03	.797	.03	.769	.02	.823
Personal Significance	.02	.864	.13	.174	-.03	.789
Age of Memory	-.11	.256	.10	.329	.12	.211

*Significant at $\alpha = .05$

Correlating memory quality and collaborative process, I found that having more co-constructed sentences was associated with higher emotionality, fewer “I” and more “we” pronouns, and higher participant ratings for detail/vividness (see Table 5.12). Thus, co-constructed sentences lessened the costs of collaboration on the emotionality of events, were associated with more focus on the dyad than the self, and benefited participants’ perceptions of how vividly they recalled the event. High rates of unsuccessful cues and corrections and disagreements were associated with more “you” pronouns and lower participant ratings for detail/vividness, validating their Factor 1 status (although in Harris et al. (2011) it was the absence of unsuccessful cues that hindered collaboration on personal list recall in older couples). More mirrored repetitions also was associated with more “you” pronouns, indicating that “you” pronouns could be indicative of both costs and benefits of collaboration. I found no other significant correlations between collaboration style and memory quality.

Separating the analysis by relationship, with a Bonferroni correction of $\alpha = .017$, I found that the more co-constructed sentences strangers had, the less vivid their recall was, $r = -.71$, $p = .015$, indicating that co-constructed sentences produced costs of collaboration in unacquainted dyads recalling an event only one dyad member had experienced. The more co-constructed sentences friends had, the more person details they provided, $r = .69$, $p = .014$, indicating that for friends, co-constructed sentences had a more positive impact on friends’ memory quality than strangers. I found that collaborative processes were associated with siblings’ pronoun use. Siblings who used more “I” pronouns had more unsuccessful cues and corrections and disagreements, $r = .74$, $p = .006$, and $r = .71$, $p = .009$. Thus, siblings who used more Factor 1 collaborative processes recalled their shared events with a more individual focus. Siblings who used more “you” pronouns had more corrections and disagreements and mirrored repetitions, $r = .83$, $p = .001$, and $r = .68$, $p = .016$. Thus, paradoxically, siblings’ references to each other were associated with both disagreeing with and mirroring each other, indicating the complexity of siblings’ collaborative remembering.

Table 5.12

Correlations Between Memory Quality and Collaborative Processes

	Successful Cues		Mirrored Repetitions		Co-Constructed Sentences		Unsuccessful Cues		Corrections And Disagreements	
	r	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*
Person Detail	-.09	.353	.06	.516	.08	.434	-.09	.357	-.11	.253
Place Detail	.11	.257	-.02	.849	-.08	.446	.02	.883	.06	.514
Time Detail	-.03	.765	-.09	.382	-.07	.462	.02	.812	.10	.290
Vividness	-.05	.594	-.11	.279	.06	.546	-.17	.088	.13	.197
Emotionality	-.01	.911	.02	.856	.21	.029*	-.13	.204	.09	.350
"I"	-.06	.543	-.08	.423	-.23	.017*	.14	.147	.24	.013*
"We"	-.02	.845	-.01	.960	.20	.040*	-.02	.811	-.06	.579
"You"	.14	.145	.28	.004*	-.06	.559	.29	.003*	.56	<.001*
Positive Emotion	-.13	.191	-.06	.514	-.03	.781	-.13	.187	-.04	.720
Negative Emotion	-.07	.463	.08	.448	.10	.328	.05	.603	.09	.344
Detail/ Vividness	.04	.708	.11	.274	.23	.019*	-.22	.021*	-.20	.037*
Emotion	.02	.858	-.04	.702	.19	.107	-14	.145	-.18	.065
Personal Significance	-.05	.594	.14	.161	.11	.284	-.15	.136	-.15	.140
Age of Memory	-.17	.092	-.17	.086	-.06	.567	-.009	.929	.08	.428

*Significant at $\alpha = .05$

Summary. A more interactive collaboration style was associated with less precise contextual detail, higher use of “we” pronouns and lower use of “I” pronouns. Collaborative process use was associated with dyad members addressing each other. Co-constructed sentences was the most beneficial collaborative process, as it increased the emotionality of the event, was associated with a focus on the dyad as a “we” rather than as two individuals, and increased subsequent beliefs of how detailed or vivid the event was in participants’ minds. Factor 1 collaborative processes led to costs of collaboration in terms of subsequent ratings of detail/vividness and a more individually focused recounting of the event. These findings validate the notion that a genuinely shared collaboration style is beneficial for recall of autobiographical memories.

Discussion

This experiment was the first to directly compare stranger, friend, and sibling dyads and individuals recalling shared and unshared autobiographical memories, with a comprehensive analysis of collaboration style and memory quality. I found that the costs and benefits of collaboration depended on relationship and changed depending on the outcome variable. Siblings benefited the most from collaboration in terms of length of recall output, but all relationships benefited from collaboration in terms of the vividness of their recall, and all relationships showed costs of collaboration in terms of the emotionality of their recall. I found that friends and siblings recalling shared events collaborated with a more equal, shared style than strangers recalling events only one had experienced. I found that collaboration style influenced the product of autobiographical memory recall in various ways. In particular, the number of co-constructed sentences dyads used during recall improved memory quality more than other collaborative processes. Events with higher rates of co-constructed sentences were more emotional, contained more “we” and less “I”, and subsequently were rated as more detailed or vivid by participants. Thus, co-constructed sentences was the most beneficial collaborative process.

Collaborative dyads had longer recall than individuals in the three minutes they were given to recall each event. They also recalled the events more vividly and less emotionally than individuals, and used the pronoun “you” more than individuals. Siblings showed greater benefits of collaboration on the length of recall output than strangers and friends, partially due to siblings showing more costs of individual recall than strangers and friends.

One reason why siblings said so little when they recalled shared events individually could be that siblings’ events occurred further in the past than friends’. However, I found no difference in the age of strangers’ and siblings’ memories, even though half of the strangers recalled events shared with friends and the other half with siblings. In addition, age of memory did not correlate with the length of recall output. Therefore, the age of siblings’ memories cannot explain why individual siblings said so little. Instead, siblings’ shared events may be more difficult to recall individually than friends’ shared events.

Process Findings: Quality of Collaboration

Friends and siblings adopted a collaboration style that included more frequent turn-taking and fewer monologues than strangers, with more mirrored repetitions, co-constructed sentences, and corrections and disagreements. Friends and siblings recalled events that they experienced together, whereas strangers recalled events that only one member of the dyad experienced. This difference meant that friends and siblings could discuss the events on more equal footing than strangers, and both could contribute to recall. In contrast, strangers recalled the event with longer monologues from the memory owner, with their partner asking questions or commenting but not contributing to recall. Below is an extract from a transcript typical of sibling dyads. This dyad of sisters was representative in terms of their collaboration style and memory quality, except that they had fewer corrections and disagreements and more “we” pronouns than other collaborative sibling dyads. In the example below, they had two successful cues, three instances of mirrored repetition, and two instances of co-constructed sentences. Like most sibling dyads, they had many short turns and the narration was equally shared between the two sisters.

A: (laughs) Okay um we had lunch, we went to Oporto and had that for lunch.

R: Yeah we got Oporto's.

A: Oporto's for lunch.

R: And we ate at the park.

A: And we also had,

R: And we had um,

A: Wow Cow.

R: (laughs) Wow Cow.

A: That's sounds funny but,

R: (laughs) It's just a frozen yoghurt place. It's called Wow Cow. We had that as well. There were,

A: How many of us?

R: Three, five of us.

A: Yep. And I had my niece and nephew as well. We had our niece and nephew with us. Um. What did we do?

R: The kids, they had a, they were playing in the park so they had a good time.

Friends and siblings also had higher rates of Factor 1 processes than strangers, particularly corrections and disagreements. Below is an extract from the transcript of a friend dyad with a high number of corrections and disagreements. In the three minutes, they had eighteen instances of corrections and disagreements, mostly concerning the exact location in A's backyard where each was standing when the event occurred. In this extract, which occurred at the beginning of the transcript, the disagreement was temporarily resolved then revisited. In this extract there is one instance of a co-constructed sentence and three instances of corrections and disagreements. They had a higher than average word count for each event, with a higher than average number of turns, and their events were scored higher than average on vividness and emotionality. All three of their events had the highest possible vividness score of three. Thus, their high number of corrections and disagreements was not detrimental to their collaborative recall of the events.

A: We were playing in the…

S: In your backyard.

A: Yeah. No we were in the cubby house. I remember…

S: No we were on the trampoline.

A: Well we were alternating between the cubby house and the trampoline. Um. I think, I don't know, I think I was closer because I remember you looked at me and I didn't know what was going on because then you blamed it on me.

S: (laughs) It had to be coming from behind me so,

A: Well okay so.

S: You probably were behind me.

A: The guy next door came out of the house and…

S: I thought he was just standing behind the fly screen.

A: Okay well he, okay anyway he came out of the house and belched.

In contrast, among strangers, the memory owner's monologues occurred at the beginning of the three minutes, and the dyad member who did not experience the event asked questions at the end. The following extract shows an example of this collaboration style. In this extract S followed up X's monologue with two successful cues and one unsuccessful cue. In recalling this event, S and X had a typical number of turns, words per turn, and proportion of words said by the memory owner relative to other stranger dyads, with 18 turns, 27 words per turn and 88% of the words said by the memory owner.

X: [first half of monologue omitted]… And um and that was the first time I tasted white wine um because all the, um I was probably about 17 or 18 at that time and the um and everyone else kind of had a glass of white wine so I thought I would, you know, "because I'm over the legal age", so I would've been 18, um "I'll try it". So they poured me a really huge glass and then I had the first sip and spat it out, like the whole thing. It was just, I thought it was gross and I, and from then on I've never tried white wine again.

S: Okay. What was the reaction of the people around you? Do you?

X: They kind of all just looked at me and went "oh". Um, yeah and um, so and my grandfather was sitting next to me and he kind of copped the majority of the wine.

S: Um was he happy with you?

X: Oh not really no.

S: How did your brother feel about this?

X: Um well my brother was in the same room but he was at the kids table, so we had like a table for the kids so he probably didn't see it, but he probably heard the whole, like the whole table reacting to it.

In fact, in all but two dyads, the stranger who did not experience the event attempted to contribute to the discussion, especially by asking questions to cue the memory owner. Below is an extract from the transcript of a stranger dyad who attempted to discuss the events from the beginning of the three minutes, rather than waiting until the memory owner finished their monologue about the event. This stranger dyad had the highest number of Factor 2 collaborative processes of the stranger dyads, with a mean of nine successful cues, three mirrored repetitions, and one co-constructed sentence per event. Like most stranger dyads, this dyad had very few Factor 1 collaborative processes in the three events, with only one unsuccessful cue in one event and no corrections and disagreements. This dyad also had the highest uses of "you", the most turns, the shortest turns, and the most equal distribution of words out of the stranger dyads. In the example below, V successfully cued C three times and had one instance of mirrored repetition. In this example, two of the three cues contained "you", highlighting the important role this pronoun played in collaboration. Despite the high rate of Factor 2 collaborative processes, the extract below is quite different to the extracts above from friends and siblings. For instance, whereas friends and siblings used "you" throughout the transcript, these strangers only used "you" in cues. The collaboration style was more of a series of questions and answers rather than a discussion in which both contributed to recalling the event. Thus, even when strangers recalled without monologues, the recall itself was always provided by the memory owner.

C: It was sort of a grand entrance when she came in. We tried to make it a bit grand 'cause being her 90^{th} birthday, it was something quite huge.

V: Yep. Can you describe the entrance?

C: Yep, ah we had out two youngest nephews escort her in. And so pull out the chair for her and give her, give her a bouquet of flowers.

V: Oh and what were the flowers? Or do you remember the colours of the flowers?

C: Yeah they were red. Not too sure what flowers they were, probably roses, but they were red.

V: Yeah and um, did she receive anything else on the night?

C: Yeah lots of hugs.

V: Lots of hugs?

C: Yeah.

Product Findings: Memory Quality and Collaborative Success

Regardless of whether they recalled the events as dyads or individuals, friends and siblings gave less contextualising detail and positive emotion words than strangers. Strangers were obliged to provide more contextual details to explain the places and people involved to their partner, as they did not share this knowledge. Collaborative friends and siblings on the other hand experienced the events together and so knew all of the people and places involved in the events, which meant they did not need to provide these details. However, individual friends and siblings also had fewer contextualising details in recalling the events than individual strangers. One reason for this finding may be because I asked strangers to think of a friend or sibling who they experienced the events with to ensure their events were as similar to those of friends and siblings as possible. Friends and siblings always participated with the person they experienced the events with. Even if they recalled the events individually, they knew that their friend or sibling was recalling the same events in a different room. In contrast, the friend or sibling that strangers experienced the events with was unknown to me as the experimenter. This may have led to strangers providing more person details than friends and siblings, even when they recalled the events individually. For instance strangers tended to refer to the friend or sibling they experienced the events with as “my little sister”, or “my best friend”, both of which would be given a rating of two for person detail, whereas friends and siblings knew that I or the other experimenter had met their friend or sibling, so tended to refer to them by name, which would be given a score of one for person detail.

Individual friends and siblings may have given less precise place detail than strangers because of the PowerPoint cues I showed participants before they recalled each event. Strangers always recalled events they had elicited, from the cues they had elicited. On the other hand, for friends and siblings, half of the events and cues were elicited by them and the other half by their friend or sibling. Being provided with a location cue elicited by a friend or sibling may have led individual friends and siblings to merely restate the location given on the slide. Thus they may have provided less precise place details than they would have if they had generated the place details themselves.

Friends and siblings also used fewer positive emotion words as assessed by LIWC software than strangers, regardless of whether they recalled as dyads or individuals. In collaborative dyads, strangers may have been more motivated to present their events as more positive than friends and siblings, because they were recalling the event with someone they had never met before. Friends and siblings, on the other hand, may have been less concerned with making a good impression, and so did not recall the events using as many positive emotion words as strangers. It also could be the case that being reminded of the event immediately prior to recall, instead of a week prior, caused friends and siblings to use fewer positive emotion words in recalling events their friend or sibling had chosen than in events they had elicited themselves a week prior.

In future studies I would need to disentangle the reasons why friends' and siblings' event recall differed from strangers' regardless of collaborative condition. For instance instead of recruiting strangers as a separate group, I could recruit friend and sibling dyads only, but change their collaborating partner. In addition to either recalling the events as individuals or with the friend or sibling they participated with, they could also recall the events with another person participating as a friend or sibling with someone else. In all conditions, half of the events would be elicited by the participant themselves and half elicited by their friend or sibling. This method would potentially eliminate the differences in place detail and positive emotion between strangers, and friends and siblings.

In this experiment, the relationship between the members of collaborative dyads was confounded with whether they experienced the events together. Thus, I could not determine whether the effects of relationship I found here were due to the relationship itself, or the fact that friends and siblings experienced the events together, whereas strangers had not. One way to separate the effects of relationship from the effects of having experienced the events together would be to compare friends' and siblings' collaborative recall of events they had experienced together and events only one had experienced. That method would allow me to determine whether having a relationship prior to the experiment would benefit collaborative recall of events, over and above the benefits of recalling events a dyad had experienced together.

In this experiment, I directly compared the verbal recall of events by dyads and individuals of strangers, friends, and siblings. I found that collaboration was particularly beneficial to siblings, and found costs and benefits of collaboration style in terms of the quantity and quality of the recall product. I found that simply engaging in collaborative processes allowed dyads to say more, and that friends and siblings were resistant to any negative impact that corrections and disagreements may have had.

CHAPTER SIX

Are Twins Special?
A Re-Analysis and Case Study of Siblings and twins

In this chapter, I investigated claims by various twin researchers that twins share a special bond that siblings do not have (Bryan, 1992; Klein, 2003; Pogrebin, 2009; Segal, 1999). I outlined these claims in detail in Chapter 1. One of the original aims of my thesis was to investigate whether twins were different from siblings in terms of their shared remembering. In Experiments 1 to 4, I intended to compare strangers, friends, siblings, and twins. However, due to difficulties in recruiting adequate numbers of twins, I was unable to test them as a separate group. Instead, I analysed siblings' and twins' data as one group, which I called 'siblings' and compared them to strangers and friends. Therefore, in the current chapter I compared siblings' and twins' shared remembering. First, I re-analysed their collaborative recall in Experiments 1 to 4 to probe for differences in siblings' and twins' collaborative recall of word lists, self-generated lists, and autobiographical memories. Then, I performed a case study of the shared remembering of a pair of twins and a sibling from the same family. I took a more descriptive approach to their relationships and shared remembering in different dyads and as a triad. In this chapter, I use the term 'siblings' to refer to non-twin siblings only.

Re-Analysis of Experiments 1 to 4

In this section, I tested whether there were any differences in siblings' and twins' collaborative recall in Experiments 1 to 4. If twins have a special bond and a closer shared history than other siblings, this is likely to impact on their shared remembering. They may be able to use collaborative processes more effectively, which may increase their collaborative recall performance relative to siblings'. Given my hypothesized links between shared identity and shared autobiographical memory, twins' shared identity, if it exists, should be apparent in their collaborative remembering of shared autobiographical events. Their shared remembering might be more vivid, detailed, fluent and emotional than their individual remembering of the same events or other siblings' collaborative remembering. I compared siblings' and twins' performance on each of the collaborative recall tasks across all four experiments. Although I only tested a small number of twins on each task, twins out-performing siblings across the tasks may indicate that twins' interdependence fosters their ability to remember together.

Method

Participants

I used the sibling and twin participants from Experiments 1 to 4. They were 22 sibling dyads (twelve nominal and ten collaborative) and four twin dyads (one nominal and three collaborative) from Experiments 1 and 3, and 16 sibling dyads (eight nominal and eight collaborative) and eight twin dyads (four nominal and four collaborative) from Experiments 2 and 4. Thus, across both experiments I tested 22 female-female sibling dyads, 4 male-male sibling dyads, and 12 male-female dyads. I tested four female-female monozygotic twin dyads, 3 female-female dizygotic twin dyads, 1 male-male monozygotic twin dyad, and 4 male-female twin dyads.

Procedure

The sibling and twin dyads from Experiments 1 and 3 (Chapters 2 and 4) completed a 24-item categorized word list, a self-generated list of mutual friends and acquaintances, and a self-generated list of shared holidays in Experiment 1. They also completed the autobiographical memory task in Experiment 3. The events in the autobiographical memory task were the most recent birthday celebration of one of the siblings or both twins, and a significant event of their choice. In Experiments 1 and 3, participants typed their recall and I audio-recorded and transcribed collaborative dyads’ conversations during each task.

The sibling and twin dyads from Experiments 2 and 4 (Chapters 3 and 5) completed a 48-item categorized word list, a self-generated list of each sibling’s or twin’s social circle, and a self-generated list of news events in Experiment 2. They also completed the same autobiographical memory task as in Experiment 4. The events in the autobiographical memory task were events of their choice that they had shared. In Experiments 2 and 4, they said their recall aloud, which I audio-recorded and transcribed for both collaborative and nominal dyads.

Coding

I based my analysis on the same product and process coding that I used in Experiments 1 to 4, as reported in Chapters 2 to 5. In Experiments 1 and 2, I compared collaborative dyads with nominal dyads, using the collaborative recall paradigm to assess their recall of three lists. In Experiments 3 and 4, I compared collaborative dyads with individuals to assess their recall of shared autobiographical events. For the purposes of this chapter, first I re-analysed siblings' and twins' PAIR Inventory data to determine whether twins had greater intimacy than siblings. I aimed to answer the question: are twin relationships special? To do so, I used the same dyad PAIR scores from Experiments 1 and 2, which I created by summing the two dyad members scores on each subscale. Thus, I created five dyad scores ranging from 12 to 60 for emotional intimacy, social intimacy, intellectual intimacy, recreational intimacy, and conventionality.

I then re-analysed the data from the recall tasks to answer the question: is twins' collaborative recall special? I present recall data in two sections: (1) list data from Experiments 1 and 2, and (2) autobiographical memory data from Experiments 3 and 4. The list data from Experiments 1 and 2 included amount recalled, distribution of words and turn taking, and collaborative process coding of the word list and self-generated lists. The autobiographical memory data from Experiment 3 included number of words typed, distribution of words and turn-taking, global quality coding, and LIWC analysis for the typed autobiographical memories. The autobiographical memory data from Experiment 4 included number of words said, distribution of words and turn-taking, collaborative process coding, global quality coding, and LIWC analysis for the spoken autobiographical memories from Experiment 4. I tested for potential differences between siblings and twins, and where applicable (and keeping in mind the relatively small and uneven numbers of 12 twin dyads and 38 sibling dyads), whether this interacted with collaborative condition.

Results

Relationship

Using a (5) x 2 (subscale x relationship) ANOVA, I found that twins were higher on intimacy overall, $F(1, 48) = 6.39$, $p = .015$, $\eta_p^2 = .12$ (see Table 6.1 for means). I also found a significant main effect of subscale, $F(4, 192) = 8.93$, $p < .001$, $\eta_p^2 = .16$, and a significant interaction between subscale and relationship, $F(4, 192) = 4.60$, $p = .001$, $\eta_p^2 = .09$. Comparing siblings and twins on each subscale separately, I found that twins rated themselves higher on the social intimacy and recreational intimacy subscales of the PAIR inventory than siblings, $F(1, 48) = 15.29$, $p < .001$, $\eta_p^2 = .24$, and $F(1, 48) = 7.90$, $p = .007$, $\eta_p^2 = .14$, respectively. I found no other significant differences in siblings' and twins' self-rated intimacy, all Fs < 2.93, all ps $> .094$. Thus, twins were higher in intimacy than siblings overall but this effect was largely driven by the social and recreational intimacy subscales.

Table 6.1

Siblings' and Twins' PAIR Inventory Subscale Scores in Experiments 1 and 2 Combined

Intimacy Subscale	Siblings	Twins	Total
Emotional	38.56 (12.09)	46.50 (9.17)	41.21 (11.64)
Social	34.75 (12.79)	47.88 (9.69)	39.13 (13.23)
Intellectual	38.50 (12.08)	46.63 (9.65)	41.21 (11.78)
Recreational	39.88 (12.63)	49.88 (8.10)	43.21 (12.13)
Conventionality	33.81 (11.53)	43.50 (10.57)	37.04 (11.93)
Total	39.27 (9.29)	46.78 (7.83)	41.07 (9.46)

Note. Standard deviations appear in parentheses.

Experiment 1 and 2 Lists

Product. I found similarities in the product of siblings' and twins' list recall (see Table 6.2 for means). Using separate 2 x 2 (collaborative condition x relationship) ANOVAs for each task, I found no significant differences between twin and sibling dyads in terms of any of the tasks from Experiment 1, or Experiment 2, all Fs < 1.06, all ps > .315. Being in a twin or sibling relationship did not interact with collaborative condition for any task, all Fs < 0.96, all ps > .340. Thus, I found no evidence that the product of twins' collaborative recall of lists was special.

Table 6.2

Siblings' and Twins' List Recall in Experiments 1 and 2 by Task and Collaborative Condition

	Siblings			Twins		
Task	Nominal	Collaborative	Total	Nominal	Collaborative	Total
			Experiment 1			
Word List	18.90 (3.31)	17.27 (3.43)	18.05 (3.40)	16.67 (4.93)	16.00 (0.00)	16.50 (4.04)
People List	0.19 (0.27)	0.33 (0.38)	0.26 (0.33)	0.10 (0.07)	0.09 (0.00)	0.10 (0.06)
Event List	0.03 (0.13)	0.10 (0.19)	0.07 (0.17)	-0.02 (0.14)	-0.05 (0.00)	-0.03 (0.12)
			Experiment 2			
Word List	20.25 (7.27)	21.13 (7.49)	20.69 (7.14)	21.00 (9.09)	23.00 (9.09)	22.00 (8.48)
Social Circle List	-0.06 (0.16)	-0.25 (0.11)	-0.16 (0.17)	-0.04 (0.09)	-0.18 (0.21)	-0.11 (0.17)
News Event List	0.30 (0.17)	0.09 (0.30)	0.20 (0.26)	0.58 (0.27)	0.09 (0.62)	0.33 (0.51)

Note. Standard deviations appear in parentheses.

Process. Using separate Chi Square analyses to compare the rates of siblings' and twins' category use, individual strategy use, and group strategy use in each task, I found siblings and twins used all three strategies at similar rates across tasks in each experiment, all χ^2s < 2.00, all *p*s > .157 (see Table 6.3).

Table 6.3

Number and Percentage of Collaborative Sibling and Twin Dyads Using Strategies in Experiments 1 and 2 by Task

	Category Use		Individual Strategy Use		Group Strategy Use	
Task	Siblings	Twins	Siblings	Twins	Siblings	Twins
			Experiment 1			
Word List	6 (60.0%)	2 (66.7%)	5 (50.0%)	2 (66.7%)	9 (90.0%)	2 (66.7%)
People List	10 (100%)	3 (100%)	0 (0%)	0 (0%)	8 (80.0%)	2 (66.7%)
Event List	7 (70.0%)	3 (100%)	2 (20.0%)	0 (0%)	5 (50.0%)	2 (66.7%)
			Experiment 2			
Word List	6 (75.0%)	4 (100%)	7 (87.5%)	4 (100%)	1 (12.5%)	2 (50.0%)
Social Circle List	8 (100%)	4 (100%)	0 (0%)	1 (25.0%)	5 (50.0%)	3 (75.0%)
News Event List	5 (50.0%)	3 (75.0%)	1 (12.5%)	0 (0%)	0 (0%)	0 (0%)

Using separate univariate ANOVAs for each process variable in each task, I found that siblings' and twins' collaborative process use was similar in all tasks across both experiments (see Table 6.4 for means). I found similarities between siblings and twins in terms of distribution of words and turn-taking and the number of collaborative processes in any task in either experiment, all *F*s < 2.30, all *p*s > .160. However, I found a trend towards siblings having more unsuccessful cues than twins in the people list in Experiment 1, which involved recalling mutual friends and acquaintances, $F(1, 11) = 4.25$, $p = .064$. I also found a trend towards twins having more corrections and disagreements in the word list in Experiment 2, $F(1, 10) = 3.88$, all $p = .077$. Therefore, across Experiments 1 and 2, there was little evidence for twins' collaborative recall of lists learnt in the laboratory or self-generated lists differing from siblings'. Any potential differences in the process of siblings and twins' collaborative recall were inconclusive and inconsistent across tasks.

Table 6.4

Collaborative Siblings' and Twins' Collaborative Processes in Experiments 1 and 2 by Task

	Unsuccessful Cues		Corrections and disagreements		Successful Cues		Mirrored Repetitions	
Task	Siblings	Twins	Siblings	Twins	Siblings	Twins	Siblings	Twins
				Experiment 1				
Word List	2.60 (1.84)	3.00 (2.00)	5.50 (5.52)	8.00 (6.08)	2.00 (2.21)	1.33 (1.53)	4.70 (3.97)	4.33 (2.08)
People List	3.40 (1.90)	1.00 (1.00)	7.30 (7.13)	10.33 (11.37)	5.00 (2.62)	4.33 (1.15)	8.20 (4.26)	9.33 (1.53)
Event List	3.30 (2.36)	2.33 (0.58)	11.00 (11.20)	9.67 (8.62)	5.80 (3.61)	7.00 (2.20)	6.60 (4.40)	5.67 (2.08)
				Experiment 2				
Word List	4.75 (2.55)	4.25 (4.03)	2.00 (1.51)	6.00 (5.60)	2.63 (2.45)	4.00 (1.82)	5.75 (2.19)	5.75 (4.35)
Social Circle List	1.00 (1.20)	0.75 (0.50)	1.13 (1.73)	3.00 (2.94)	2.50 (3.25)	2.25 (2.06)	4.25 (6.25)	4.00 (2.83)
News Event List	2.25 (2.31)	1.25 (0.96)	2.25 (2.86)	5.50 (4.65)	1.75 (2.76)	1.00 (1.41)	2.00 (1.85)	1.75 (0.50)

Note. Standard deviations appear in parentheses.

Experiment 3 and 4 Autobiographical Memories

Product. ***Length of Recall Output.*** I found widespread similarity in the product of siblings' and twins' autobiographical memory recall (see Table 6.5 for means). Using separate 2 x 2 (collaborative condition x relationship) ANOVAs for each experiment, I found that collaborative sibling and twin dyads recalled verbal events with significantly more words than individuals in Experiment 4, (1, 104) = 35.16, $p < .001$, $\eta_p^2 = .25$. However, I found no other significant effects of collaborative condition, relationship, or interaction between them in terms of the length of recall output, all Fs < 1.32, all ps > .254. Thus, siblings and twins showed the same benefits of collaboration in terms of the length of verbal recall, and showed similarities in terms of the length of their recall output.

Table 6.5

Mean Length of Siblings' and Twins' Recall Output by Collaborative Condition and Experiment

Collaborative Condition	Siblings	Twins	Total
	Experiment 3		
Individuals	236.88 (107.33)	309.75 (135.04)	242.48 (109.88)
Dyads	233.00 (79.67)	234.50 (21.62)	233.34 (70.13)
Total	235.74 (99.42)	264.60 (88.59)	239.44 (98.04)
	Experiment 4		
Individuals	282.92 (90.67)	335.67 (162.64)	300.50 (120.99)
Dyads	488.08 (145.97)	450.83 (110.36)	475.67 (134.71)
Total	351.31 (147.75)	374.06 (155.70)	358.89 (150.10)

Note. Standard deviations appear in parentheses.

Memory Quality. Using separate 2 x 2 (collaborative condition x relationship) ANOVAs for each global quality variable in each experiment, I found no differences in the global quality of siblings' and twins' memories due to collaborative condition, relationship, or the interaction between them in Experiment 3, all *F*s < 1.99, all *p*s > .163, and in Experiment 4, all *F*s < 2.87, all *p*s > .093. Thus, the global quality of siblings' and twins' typed and verbal autobiographical memories were similar (see Table 6.6 for means).

Table 6.6

Mean Global Quality of Siblings' and Twins' Autobiographical Memories by Collaborative Condition and Experiment

	Siblings			Twins		
Variable	Individuals	Dyads	Total	Individuals	Dyads	Total
			Experiment 3			
Person Detail	1.77 (0.69)	1.35 (0.59)	1.65 (0.69)	1.75 (0.50)	1.83 (0.41)	1.80 (0.42)
Place Detail	1.29 (0.77)	1.45 (0.76)	1.34 (0.77)	1.25 (0.50)	1.33 (0.82)	1.30 (0.67)
Time Detail	1.31 (1.15)	1.70 (1.22)	1.43 (1.18)	2.25 (0.50)	1.50 (1.22)	1.80 (1.03)
Vividness	1.65 (0.64)	1.80 (0.70)	1.69 (0.65)	1.50 (1.00)	1.67 (0.52)	1.60 (0.70)
Emotionality	1.39 (1.06)	1.55 (0.89)	1.44 (1.01)	1.25 (0.96)	1.67 (0.52)	1.50 (0.71)
			Experiment 4			
Person Detail	1.97 (0.76)	2.08 (0.78)	2.01 (0.76)	2.00 (0.59)	2.00 (0.85)	2.00 (0.68)
Place Detail	1.65 (0.81)	1.58 (0.72)	1.62 (0.78)	1.79 (0.50)	1.67 (0.78)	1.75 (0.81)
Time Detail	1.40 (1.03)	1.04 (0.86)	1.28 (0.98)	1.04 (0.86)	1.08 (0.90)	1.06 (0.86)
Vividness	1.85 (0.85)	2.21 (0.65)	1.97 (0.80)	2.04 (0.75)	2.25 (0.62)	2.11 (0.71)
Emotionality	1.27 (1.16)	1.13 (0.95)	1.22 (1.09)	1.17 (1.04)	1.08 (0.79)	1.13 (0.96)

Note. Standard deviations appear in parentheses.

I found similarities and differences in siblings' and twins' pronoun use, and positive and negative emotion as measured by LIWC (see Table 6.7 for means). Using separate 2 x 2 (collaborative condition x relationship) ANOVAs for each LIWC variable in each experiment, I found that in Experiment 3 twins typed "we" more, $F(1, 74) = 5.11$, $p = .027$, $\eta_p^2 = .06$ (see Table 6.7). I found that individuals used more "I" pronouns than dyads, as I found in all relationships in Experiment 3, $F(1, 74) = 9.30$, $p = .003$, $\eta_p^2 = .11$. In Experiment 4, I found that twins said "I" less than siblings, $F(1, 104) = 6.67$, $p = .011$, $\eta_p^2 = .06$. Twins used more positive emotion words than siblings in both Experiment 3, $F(1, 74) = 12.12$, $p = .001$, $\eta_p^2 = .14$, and Experiment 4, $F(1, 104) = 6.34$, $p = .013$, $\eta_p^2 = .06$. In Experiment 3, individuals used more positive emotion words than dyads, $F(1, 74) = 18.92$, $p < .001$, $\eta_p^2 = .20$, and collaborative condition interacted significantly with relationship for positive emotion, $F(1, 74) = 13.84$, $p < .001$, $\eta_p^2 = .16$. Comparing individuals and dyads for each relationship separately, with a Bonferroni correction of $\alpha = .025$, I found that individuals used more positive emotion words than dyads only if they were twins, $t(8) = 4.11$, $p = .003$, not siblings, $t(66) = 0.83$, $p = .408$, $d = 2.96$. I found no other significant effects for pronoun use or emotion in Experiment 3, all Fs < 3.03, all ps > .086. In Experiment 4, I found a marginally significant interaction between collaborative condition and relationship in terms of negative emotion, $F(1, 104) = 3.73$, $p = .056$, $\eta_p^2 = .04$. Comparing individuals and dyads for each relationship separately, with a Bonferroni correction of $\alpha = .025$, I found no significant differences between individuals and dyads in either relationship, all ts < 1.82, all ps > .078, although there was a trend towards dyads using more negative emotion words in twins only.

Table 6.7

Mean Global Quality of Siblings' and Twins' Autobiographical Memories by Collaborative Condition and Experiment

	Siblings			Twins		
Variable	Individuals	Dyads	Total	Individuals	Dyads	Total
			Experiment 3			
"I"	4.62 (2.95)	1.41 (2.53)	3.68 (3.18)	3.50 (1.78)	0.93 (1.11)	1.96 (1.87)
"We"	2.92 (2.21)	3.56 (2.08)	3.08 (2.17)	5.45 (2.72)	4.47 (2.65)	4.86 (2.65)
"You"	0.08 (0.22)	0.23 (0.65)	0.12 (0.40)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Positive Emotion	2.87 (1.98)	2.46 (1.55)	2.75 (1.86)	7.60 (3.01)	2.31 (0.97)	4.42 (3.32)
Negative Emotion	1.27 (1.08)	1.39 (1.01)	1.30 (1.06)	0.27 (0.41)	1.39 (0.63)	0.94 (0.78)
			Experiment 4			
"I"	5.87 (3.00)	4.71 (2.81)	5.49 (2.97)	3.60 (2.16)	3.86 (2.96)	3.69 (2.41)
"We"	3.04 (1.96)	3.47 (2.46)	3.19 (2.13)	3.85 (1.93)	3.99 (1.62)	3.90 (1.81)
"You"	0.18 (0.41)	1.84 (2.01)	0.73 (1.43)	0.29 (0.35)	1.30 (0.94)	0.63 (0.77)
Positive Emotion	2.44 (1.50)	2.45 (1.31)	2.44 (1.43)	3.43 (2.51)	3.33 (1.27)	3.40 (2.16)
Negative Emotion	0.85 (0.86)	0.65 (0.46)	0.78 (0.75)	0.69 (0.53)	1.10 (0.79)	0.83 (0.64)

Note. Standard deviations appear in parentheses.

Using separate 2 x 2 (collaborative condition x relationship) ANOVAs for each participant rating of the events in Experiment 4, I found a significant interaction between collaborative condition and relationship for how emotional the events were, $F(1, 104) = 3.98$, $p = .049$, $\eta_p^2 = .04$. However, I found no other significant effects for participant ratings. Comparing individuals and dyads for each relationship separately, with a Bonferroni correction of $\alpha = .025$, I again found no significant differences between individuals and dyads in either relationship, all *t*s < 1.72, all *p*s > .095, although there was a trend towards dyads rating their events as less emotional than individuals in twins only, $t(34) = 2.20$, $p = .035$. Thus, I found some differences in siblings' and twins' pronoun use, positive and negative emotion words, and emotional ratings of events, but they were inconsistent and inconclusive, especially with the small, unequal numbers of siblings and twins.

Process. Using separate univariate ANOVAs for each collaboration style variable in each experiment, using collaborative siblings and twins only, I found no significant differences between siblings and twins in terms of the distribution of words and turn taking or collaborative processes in any tasks in either experiment, all *F*s < 2.76, all *p*s > .106 (see Table 6.8 for means). The only exception was that twins had marginally fewer successful cues in Experiment 4 than siblings, $F(1, 34) = 4.11$, $p = .051$. Thus, I found little evidence that the process of twins' collaborative recall of autobiographical memories was special.

Table 6.8

Siblings' and Twins' Collaboration Style in Experiments 3 and 4

Variable	Siblings	Twins
	Experiment 3	
Transcript Words	856.50 (235.47)	908.25 (374.12)
Turns	115.61 (29.02)	138.25 (60.65)
Words Per Turn	7.46 (1.37)	6.62 (0.65)
	Experiment 4	
Turns	46.71 (19.27)	35.92 (16.40)
Words Per Turn	11.43 (4.75)	15.56 (8.51)
Proportion of Words Said by Memory Owner	.51 (.11)	.46 (.17)
Unsuccessful Cues	1.00 (1.18)	0.75 (1.14)
Corrections and Disagreements	2.54 (4.03)	3.50 (3.21)
Successful Cues	4.04 (4.10)	1.58 (1.08)
Mirrored Repetitions	5.08 (3.37)	3.58 (2.61)
Co-Constructed Sentences	3.42 (3.37)	5.08 (7.03)

Note. Standard deviations appear in parentheses.

Discussion

In this re-analysis of my sibling and twin data from Experiments 1 to 4, I found no evidence that twins' collaborative recall was superior to siblings' collaborative recall. However, I did find that twins' relationships were higher on social and recreational intimacy than siblings, suggesting that twins had more mutual friends and spent more time together doing shared recreational activities than siblings. I also found that twins' pronoun use was different from siblings' pronoun use when recalling events they had experienced together and that twins recalled events they had experienced together more positively than siblings. Given the current consensus regarding twins' special relationship, the lack of differences I found is surprising. However, these data only go so far in answering the question of whether twins remember together in different ways to siblings and are limited by the small size of the sample. Further research with larger samples is required to answer these questions more conclusively.

Also, siblings' and twins' family of origin may make a difference to their shared remembering, given that family memory and identity are so closely intertwined, as I outlined in Chapter 1 (Bietti, 2010; Bohanek et al., 2006; Hirst et al., 1997; Hirst et al., 2003; Kellas, 2005). Thus, comparing twin and sibling dyads from the same family may provide more insight into whether siblings and twins remember together in different ways. Also, much of the work on twins' special relationship was based on interview data (e.g. Pogrebin, 2009; Segal, 1999). Therefore, investigating siblings' and twins' relationships and shared remembering using a combination of quantitative and descriptive analysis may make this special closeness more apparent. This method would allow me to draw more substantial connections between siblings' and twins' relationships and their shared remembering, and allow me to compare twins' and siblings shared remembering more thoroughly. Thus, I conducted an in-depth case study on the shared remembering of autobiographical events by a pair of female twins and their older brother, examining their relationships with each other in greater detail than I did in Experiment 1 to 4.

Case Study

In this case study, I sought to investigate further whether twins' shared remembering differed from siblings'. I did so by comparing the relationships and shared remembering of shared events between different dyads and a triad made up of different combinations of a pair of twins and their brother. These different combinations allowed me to compare twins' shared remembering with that of siblings' while keeping constant any effects of family style or identity. Neither the twins nor their brother had participated in any of my previous experiments.

The case study method meant that I could see in detail how subtle differences in the relationships between each dyad were reflected in their shared remembering. However, it also meant that the results of this study may be idiosyncratic to these three siblings. Their uniqueness, based on a constellation of factors such as their ages and birth order, gender, culture, and personalities made this pair of twins and their brother interesting. However, it also meant that my findings from this case study may not apply to other twins and their siblings. Nevertheless, my findings from this study may offer an interesting framework with which to study other twins and their siblings.

I combined quantitative and descriptive analyses of different aspects of their relationships and shared remembering to gain a thorough understanding of how different aspects of their relationships influenced the way they recalled events together. I measured their relationships in four ways. First, I gave them the PAIR Inventory in reference to each sibling, to assess their levels of intimacy across the five intimacy subscales. Second, I gave them the Inclusion of Other in the Self (IOS) Scale (Aron, Aron, & Smollen, 1992) in reference to each sibling, to assess their level of shared identity. This scale is designed to measure the degree to which individuals perceive an overlap between themselves and a particular close other. It presents a series of 7 pictures, which each contain two circles, one labelled "self" and the other labelled "other" (see Figure 6.1). Third, I asked them to list the three main activities they usually did with each sibling. This question assessed whether they had shared one-on-one interests or instead spent time with their family as a whole. Finally, I interviewed each person individually about their relationships with their siblings, using a semi-structured interview technique. I assessed shared remembering by asking the siblings to recall events they experienced together in dyads with each sibling and then as a triad. Thus, there were two sibling dyads, one twin dyad, and one triad of the brother and the twins. Thus, I could determine how their relationships influenced their shared remembering and whether this changed when all three of them recalled together. I also asked them about how they tended to remember together outside of this study to gain more insight into their shared remembering in everyday contexts.

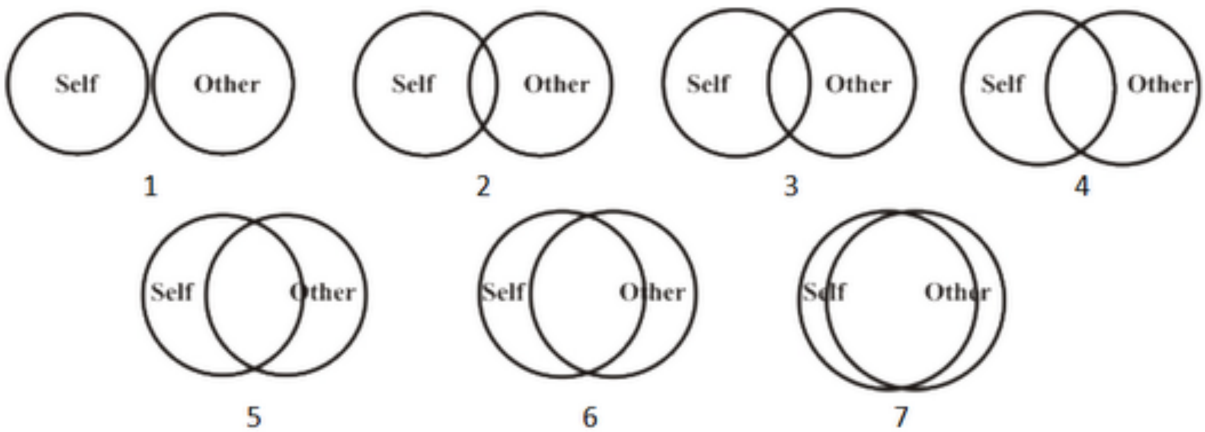

Figure 6.1. Inclusion of Other in the Self (IOS) Scale. Participants circle the diagram that best represents their relationship with a particular other.

Given twin researchers' consensus that twins' relationships are characterized by a special closeness (Bryan, 1992; Klein, 2003; Pogrebin, 2009; Segal, 1999), I predicted that the twins would have a stronger shared identity with each other than with their brother. Given my results from Experiments 1 to 4, I predicted that the twin dyad would be higher in social and recreational intimacy than both sibling dyads. In line with these predictions, I also expected that the activities the twins shared would indicate that they spent recreational time together away from the family. I expected the semi-structured interviews would mirror these findings and provide information about how their relationships developed from childhood until the present. I predicted that twins' shared remembering would be different to siblings' shared remembering especially in their use of personal pronouns and emotion. In particular, I predicted that the twin dyad might use "we" more and "I" less than the sibling dyads.

I predicted that the triad's shared remembering would mirror their self-reports in the semi-structured interview about how they tended to remember together. For instance, if they told me that their memories often conflicted, I predicted that they would have a high use of corrections and disagreements. I also predicted that the triad would say more about each event than the dyads and would have shorter turns because recalling as a triad may be more fluent than recalling as a dyad. The unique qualities of their one-on-one relationships may impact their shared remembering less when they recall as a triad, as they may revert to a family style of remembering, which I describe below. Based on the distribution of shared and unshared knowledge in intimate groups as predicted by transactive memory theory (Wegner, 1987; Wegner et al., 1991; Wegner et al., 1985), I expected that the triad would have more successful cues and fewer unsuccessful cues than the dyads because there would be two other family members who experienced the events to cue recall. I also predicted that in the triad, the three siblings would be less conscious of explaining the event to the experimenter and would be more involved in a conversation amongst themselves. Thus, I expected they would recall the events with less contextual detail and more vividness and emotion.

As the twin dyad was a female-female dyad, and the sibling dyads were both mixed-gender dyads, gender may have had an impact on their relationships and shared remembering. Research on intimacy in sibling relationships has shown that female sibling dyads tend to be closer than mixed gender sibling dyads, and have a closer shared identity on the IOS Scale (Herrick, 2008). In friend and sibling relationships, females value verbal behaviours as a form of intimacy more than males, and shared activities, often considered to be a form of male intimacy, are equally important to males and females (Floyd & Parks, 1995). There has not been a great deal of research on gender effects on peer dyads recalling together. When they recall individually, females have consistently been shown to recall longer, more elaborative, and more emotionally expressive memories than males (Bauer, Stennes, & Haight, 2003; Davis, 1999; Fivush, 2008, 2011a; Pasupathi & Hoyt, 2009; Pohl, Bender, & Lachmann, 2005; Thorne & McLean, 2002). In general, females tend to say “we” more than males, who tend to say “I” more (Pennebaker, 2011). Thus, females tend to orient themselves more interpersonally and males more independently. However, gender may influence recall to different degrees depending on contextual factors, life stage, and various individual differences. Thus far, gender’s influence on recall in a family context has focused mainly on parents and children, not siblings (Fivush & Buckner, 2003). Thus, it was unclear the extent to which gender may impact my findings from this case study. Nevertheless, gender was likely to have some impact.

Another factor that may have played a role is culture. The three siblings were all born in Australia to Chinese immigrant parents and spoke both English and Cantonese at home. Asian-American young adults’ early memories are less specific and more socially oriented than Caucasian-American young adults’ early memories (Wang & Ross, 2005). As young children, first-generation Chinese-Americans’ event recall has been shown to be less specific and lower in emotion than European Americans’ event recall (Wang, 2008). At least in the United States, Chinese immigrant mothers tend to focus less on the emotions of the child and focus more on the emotions of other people. They also talk less about the causes of emotions than European American families when they talk about the past with their young children (Wang, 2013). Although little research has been conducted that compares how these groups recall the past together as young adults, these childhood differences may have an impact. However, I could not make any cross-cultural comparisons in this study. Thus, these issues are important to keep in mind as factors that may influence the way these three siblings’ shared their remembering, but future research will be needed to disentangle cultural factors from other individual difference factors in such research.

By examining the way the siblings recalled together as a triad, I was able to explore the possibility of a family style of shared remembering. I searched for evidence of a coordinated, individual, or imposed perspective. I also searched for evidence of their shared remembering producing a shared rendering of the events they experienced together (Hirst et al., 1997; Hirst et al., 2003). In a coordinated perspective, I would find high rates of co-constructed sentences and mirrored repetitions, short turns, and an equal distribution of words between speakers. A coordinated perspective would indicate that they tended to value their family identity over their individual identities (Kellas, 2005). This perspective would produce a shared rendering of the events, in which each family member agreed with their joint account of the event and would produce this rendering of the event in future individual retellings (Hirst et al., 1997; Hirst et al., 2003). In an individual perspective, I would find more explicit cuing using questions, longer turns, and low rates of co-constructed sentences and mirrored repetitions. An individual perspective would indicate they tended to value their individual identities over a family identity (Kellas, 2005). In an imposed perspective, which Bohanek et al. (2006) found to be quite rare, I would find low rates of all collaborative processes except corrections and disagreements and one sibling dominating recall. Of course, without the parents' involvement, it was impossible to know whether the way that these three siblings recalled together was representative of how the family recounted the past together as a whole. Nevertheless, if they did have a strong family style, it would likely be apparent when the three adult siblings recalled together without their parents.

Method

Participants

I tested three siblings from the same family: one brother, aged 23 years, and a pair of identical twin sisters, aged 20 years. They all were born in Australia and spoke both English and Cantonese at home. The twins lived together with their parents and saw each other every day, but the brother lived away from their hometown and saw each twin at least once a week. I recruited the siblings through personal contacts, and I was previously acquainted with the brother. For the purposes of this chapter, I called the brother, "James" and the twins, "Sarah" and "Nat", although these were not their real names.

Materials

Audio recording. I audio recorded the experiment using Macbook Pro internal microphones and Audacity software.

Questionnaires. I gave the participants a demographic questionnaire asking for their date of birth, country of birth, and languages spoken at home. I also gave them a questionnaire asking about their relationship with each family member. They therefore had to answer two versions of this questionnaire, and each referenced a particular sibling. This questionnaire asked them how often they see each other, whether they live together, and to list the three main activities they do with each sibling. It also included the PAIR Inventory (Schaefer & Olson, 1981), and the IOS scale (Aron, Aron, & Smollen, 1992).

Procedure

I ran the study in two sessions, one week apart. In Session 1, I asked participants to elicit events to be recalled in Session 2, and interviewed each about their relationships. In Session 2, I asked them to recall together some of the events elicited in Session 1.

Session 1. In the first session, I interviewed participants individually, one after the other. They completed the demographic questionnaire, and I asked them to elicit events they had shared with each sibling. After the event elicitation, I asked them a few questions about their relationship with each sibling.

Event elicitation. I asked each participant to elicit two events that they had shared with each sibling participating in the study and two events involving all three of them together. In total, I elicited six events from each participant. To elicit each event, I used the same procedure as in Experiment 4, eliciting events from each sibling in turn. For each sibling in turn, I told each participant

> I would like you to think of two events that you and [sibling's name] have experienced together. The events may be positive or negative, or both, but try to choose ones that are not upsetting to you or [sibling's name]. They could be

from any time in your life. In fact, try to think of both recent and more distant events, if possible. Try to avoid events that blend into other similar events. For example, if you're thinking of a general scenario of going out to dinner, try instead to focus on one particular evening that you remember. Be specific: if you recall something that happened over an extended period, for example, a 3 week holiday that you took, try to report just one of the mini specific events that occurred while on the holiday. Try to restrict the events you discuss to ones that occurred on one specific day. Events must be ones that you and [sibling's name] personally experienced together, and there must have been at least one other person present – they don't have to be as involved in the event as you and [sibling's name], and they don't have to be someone you know, but you need to name a specific person who was also there. For each event, I will ask you to: very briefly describe the event so I can be sure it's specific in time and place; provide the year that event happened; identify another person who was involved in the event other than you and [sibling's name]; identify the main location of the event, and be specific, for example say café in Paris, rather than France; identify a physical object that featured in the event, for example, it could be an item of clothing, a piece of furniture, a particular food or animal; and come up with a brief and specific title for the event – make sure it distinguishes this event from other events. If you get stuck, I have a list of cues to help you think of more events. After each event you describe, I will briefly ask you to rate how vivid, emotional and personally significant the event was.

If they had difficulty thinking of events, I showed them a cue list of 71 possible events (e.g., "a wedding", "getting in trouble", "receiving HSC results"). All three participants referred to the cue sheet after eliciting half of their events. After they gave me all the required details for each event, I asked them to rate the event using the same five-point Likert scales as in Experiment 4. I asked them: “how detailed or vivid is your memory for the event, on a scale from 1 if it is not at all vivid, to 5 if it is extremely vivid?”; “how emotional do you feel when thinking about the event, on a scale from 1 if it is not at all emotional to 5 if it is extremely emotional?”; and “how personally significant is the event to you, on a scale ranging from 1 if it is not at all significant to 5 if it is extremely significant?”.

Relationship interviews. After I elicited the events, I conducted a semi-structured interview with the participant about their relationship with each of their siblings (see Table 6.9 for the interview questions I asked each participant). I asked James open-ended questions about having twins as sisters and his relationship with them. I asked each twin open-ended questions about their experience of being a twin and having an older brother. Although I asked each question outlined in Table 6.9, the interviews were semi-structured, so I followed up any unclear or interesting responses with additional questions as required in order to gain as complete a picture of their relationships as possible.

Table 6.9

Relationship Questions for Each Participant.

Relationship Questions to James	Relationship Questions to Sarah and Nat
Can you tell me about your experience of being a sibling, of having two younger sisters who are twins?	Can you tell me about your experience of being a twin?
How would you characterize your relationship with each of your sisters individually?	How would you characterize your relationship with your sister and with your brother?
Did your parents treat you the same or differently to each other?	Did your parents treat you the same or differently to each other? And with your brother?
Looking back over your life, were there any times when your relationship with either or both of your sisters changed?	Looking back over your whole life, were there any times when your relationship with either or both of them changed?
Do you expect that your relationship with either or both of your sisters will change in the future?	Do you expect that your relationship with either or both of them will change in the future?

Session 2. ***Event recall.*** I conducted Session 2 in four rounds. In the first three rounds, I interviewed participants in dyads. In the final round, I interviewed all three participants together. The rounds in order were: (1) James and Sarah, (2) James and Nat, (3) Sarah and Nat, and (4) James, Sarah and Nat. In each dyad round, I asked them to recall two events from the four I elicited involving the two of them in Session 1. In each dyad, one event was elicited by one sibling or twin, and the other event was elicited by the other. I used the same procedure as in Experiment 4, so I told each dyad

> Now I will ask you to recall together two of the events that you told me about in the last session involving the both of you. For each event I want you to describe, I will provide the person, location and object of that event on a PowerPoint slide. These will be the exact details that one of you gave us in Session 1. One of the events will be from [Participant A's name]'s interview, and the other will be

> from [Participant B's name]'s interview. For each event, please try to work together as much as possible to recall the event. The example slide here asks you to recall an event that involves a person named Richard, located at Richard's house and the physical object involved in this event are balloons. In brackets after the name, location and object it says "engagement party", which is the brief title that has been given to the event. After I show you the slides with one of your memories, I want you to take up to a minute to think about the event and make sure you both have the same event in mind. Then, I will give you three minutes to tell me in as much detail as you can, everything you can remember about the event including what you were doing, thinking, feeling, etc. In doing so, I want you to make sure you include all three details on the slide in your description. After the three minutes is up, I will ask you to rate out loud how vivid, emotional and personally significant the event was.

In the third round, I used the same procedure to ask all three siblings to recall three events elicited in Session 1 involving the three of them, one from each participant. The instructions were the same as in the dyad rounds, except that I asked them to recall "three of the events that you told me about in the last session involving the three of you", and that, "the events will be one from each of your interviews" (see Table 6.10 for a description of the events recalled).

Table 6.10

Description of the Events Each Group Recalled in Session 2

Group	Owner	Event Title	Event Description
James and Sarah	James	Sarah moving to [University]	The day Sarah moved into university accommodation
	Sarah	Cheap food find	Family holiday in Malaysia without Nat, went to a shopping mall and brother found cheap food
James and Nat	Nat	The vomit car incident	Brother gave Nat a lift home from a friend's birthday drinks
	James	Nat beating me at tennis	First time Nat beat her brother at tennis
Sarah and Nat	Sarah	GoPro in [town]	Went to the beach with friends and played with a GoPro
	Nat	Run Wollongong	Running in a 6km charity fun run
Triad	Sarah	Coldplay	A concert in Sydney with friends
	James	Working New Years Eve	Working in the family restaurant last New Years Eve
	Nat	Sarah on a rollercoaster	Visit to Hong Kong Disneyland with family

Post-Experimental Interview. At the end of the final round, I interviewed all three siblings together about their family memory practices. I used a semi-structured interview technique based on the following questions:

(1) Can you tell me about how you remember together as a family? How do you remember past events together?

(2) When you remember together, do you help each other?

(3) Do you use a diary, photos, or anything else to help you remember?

(4) Are there things that one person is better at remembering compared to other family members?

(5) Do you ever find that your memories for events conflict?

(6) Is there anything else about how you remember that you want to add?

Following the interview, I debriefed all three of them together before they left.

Coding

I analysed their shared remembering in the same way as in Experiment 4, with the addition of a descriptive analysis of their interview about how they remembered together in their everyday lives. I audio recorded and transcribed all of what the dyads and triad said during the three minutes of each event recall, and coded the transcripts of each dyad's and the triad's recall of events in in terms of the length of their research output, collaboration style, and memory quality. I coded collaboration style in two ways: (1) distribution of words and turn-taking, and (2) collaborative process coding. I also coded memory quality in two ways: (1) global quality of the memories, using a coding scheme similar to that used by Habermas and Diel (2013), and (2) analysis of the transcripts using LIWC software (Pennebaker et al., 2007). Thus, I used the coding schemes I used in Experiment 4 in order to keep my analysis as consistent as possible, given the similar procedures in both studies. Where applicable, I included Experiment 4 means in tables in this case study as a comparison.

Collaboration style. I separated data on collaboration style into distribution of words and turn taking, and collaborative process coding. I used the same three measures of the distribution of words and turn taking between group members' event recall: turns, words per turn, and the proportion of words spoken by the memory owner. The collaborative process coding in this experiment was similar to the one I used in Experiment 4. I counted the instances of each variable occurring in each event recalled by each group. Thus, each group had scores for five codes across each event: (1) the number of successful cues, (2) the number of mirrored repetitions, (3) the number of co-constructed sentences, (4) the number of unsuccessful cues, and (5) the number of corrections or disagreements (see Appendix C for the collaborative process coding scheme for autobiographical memories).

Memory quality. I separated analysis of memory quality coding into global quality, LIWC analysis, and participant ratings. For global quality I coded all events using the same coding scheme as in Experiments 3 and 4 (Habermas & Diel, 2013; Habermas, Diel, & Heberer, 2009; Habermas, Diel, Mahmoudi, et al., 2009). The codes I used were ratings from 0 to 3 for person detail, place detail, time detail, vividness, and emotionality. I performed the same analysis using LIWC software (Pennebaker et al., 2007) as in Experiments 3 and 4. The LIWC categories I used were three personal pronouns ("I", "we", and "you"), and positive and negative emotion.

I created dyad and triad participant ratings of detail/vividness, emotion and significance by averaging each dyad or triad member's individual ratings on each rating from Session 2. This yielded a dyad or triad score for each event they recalled for how detailed or vivid the event was in their mind, how emotional they felt when they thought about the event, and how personally significant the event was to them.

Results

I separated my analysis of the data into three parts: (1) quantitative and descriptive analysis of their relationship, (2) quantitative analysis of their shared remembering, and (3) descriptive analysis of their shared remembering.

Relationships

I separated the data on their relationships into two parts: (1) their shared identity, intimacy, and shared activities, and (2) their relationship interviews. In Part 1, I present the data for each dyad from the three relationship questionnaire measures I gave the participants. These were the IOS Scale to assess their shared identity, the PAIR inventory to assess their intimacy, and the three main activities they shared in their everyday lives. In Part 2, I presented a descriptive analysis of their relationship interviews, including quotes.

Shared identity, intimacy and shared activities. James and Sarah had the lowest overall PAIR ratings (see Table 6.11), and rated each other as having the lowest overlap on the IOS of the three dyads (see Table 6.12). According to James, the three main activities they shared were working in the family restaurant, dinner, and movies. According to Sarah, the two main activities they shared were watching TV and eating dinner. She was unable to generate a third main activity that she shared with her brother. Most of these activities were ones shared with the family as a whole, instead of one-on-one recreational activities. Thus, James and Sarah were the least intimate, had the weakest shared identity of the three dyads, and shared activities that were based on being members of the same family rather than having a one-on-one sibling relationship.

James and Nat had the highest overall PAIR ratings (see Table 6.11) and they rated each other as having a higher overlap on the IOS than James and Sarah (see Table 6.12). According to James, the three main activities they shared were tennis, working in the family restaurant, and dinner. According to Nat, the three main activities they shared were playing tennis, watching sport, and driving places. These activities suggested they shared a common interest in tennis and shared more one-on-one activities than James and Sarah, and may have engendered their intimacy.

The twins' PAIR ratings were high on both social intimacy and recreational intimacy, but low on the other subscales, making them less intimate than James and Nat but much more intimate than James and Sarah (see Table 6.11). Their intimacy varied more across the subscales than both sibling dyads'. The twins rated each other as having the highest overlap on the IOS of the three dyads (see Table 6.12). According to Sarah, the three main activities she shared with Nat were socialising with friends, eating, and shopping. According to Nat, they were hanging out with friends, shopping, and eating. Thus, unlike with James, the twins generated the same three main shared activities as each other. These three activities were less family oriented than those they shared with their brother and suggested a friend-like relationship between the twins. Thus, the twins had the strongest shared identity, but varying levels of intimacy, and reported shared activities based on a common group of friends.

Table 6.11

PAIR Inventory ratings on each subscale for each relationship by participant

Rater	Emotional	Social	Intellectual	Recreational	Conventionality	Total
			James and Sarah			
James	16	22	17	19	13	87
Sarah	21	17	15	19	14	86
Dyad Score	*37*	*39*	*32*	*38*	*27*	*173*
			James and Nat			
James	21	23	20	25	18	107
Nat	22	22	26	26	21	117
Dyad Score	*43*	*45*	*46*	*51*	*39*	*224*
			Sarah and Nat			
Sarah	20	28	17	28	17	110
Nat	15	27	17	26	20	105
Dyad Score	*35*	*55*	*34*	*54*	*37*	*215*

Table 6.12

IOS Scale ratings for each relationship by participant

Rater	James and Sarah	James and Nat	Sarah and Nat
James	3	3	-
Sarah	2	-	5
Nat	-	4	5
Mean	2.5	3.5	5

Relationship interviews. All three siblings described their relationships as changing from an argumentative relationship in childhood to a more understanding and respectful relationship in late adolescence. According to James

> When we were little, we used to fight a lot but now that we're a bit more mature, it's like, they're family… well in high school we lived together, obviously. Then I moved away for uni, and I probably didn't see them for my two or three years at uni, I didn't see them both all that much. But then I lived with Nat for one year. Actually, I see Nat more 'cause I lived with her for a year, and I haven't lived with Sarah for a while…. Yeah, it's changed. When we were little we used to fight a lot. And now we're just very understanding of each other, we basically matured and help each other.

According to Sarah, "in primary school, he'd be a big brother by like picking on us and stuff. But now he, he's older and yeah." According to Nat

> There was a year when he stopped being mean to us. I'm just, I couldn't pinpoint to which year, probably when he went to u- no before then. When he like started senior school, so it'd be like year eleven [aged 16 to 17]. Whenever he started year eleven, I think he just wasn't mean to us anymore. I don't know how to put it, like, grew up, and we just had a better relationship between the three of us. Help each other out more.

Thus, when asked about their relationship as a triad, both twins spoke about how their older brother's behaviour changed towards them as he matured. James on the other hand said that the change occurred because all three of them had matured. He suggested that he was closer to Nat than Sarah because they had lived together more recently, which appeared to be in tension with the fact that his ratings for both of his sisters on the IOS was the same. However, it did reflect his PAIR inventory scores and shared activities with each sister.

I also asked each sibling about their relationships with each of their siblings on an individual level. When asked specifically about his relationship with Sarah, James said

> We challenge each other… She's kind of, you know, dissimilar to us, in a way. So we have different views on things. While me and Nat have the same view on one thing, she'll have a different view, so in that capacity we kind of tend to lead to, well I'm not going to say arguments but different points of view, based on that.

Sarah echoed her brother's conception of each other's dissimilarity, "he's different to us, I find. He's very straight-headed and like, he wasn't really much of an older brother, he was just very smart. I don't know what else to say, we didn't have a lot in common in terms of hobbies and stuff [in childhood]." These quotes mirrored the quantitative data above, suggesting James and Sarah were not particularly close and did not have many common interests or activities. They both suggested that they were closer to Nat than to each other.

When asked specifically about his relationship with Nat, on the other hand, James said, "we're understanding of each other… Nat and I are very similar, in terms of hobbies, personalities, et cetera. That's why we, that's why basically I get along with her easier [than with Sarah]." Nat said, "well he lives in Sydney now, but like when we're all down in [home town], like together, we'll hang out and like, we get along I think." Thus, James had a closer relationship with Nat than with Sarah, based on similarities in shared interests and activities. Their descriptions of their relationship reflected the fact that this dyad had the highest overall PAIR scores, and their shared activities were based on a shared interest in tennis.

Sarah and Nat had a similar change in their relationship from childhood to late adolescence. According to Sarah

> When I was younger, we didn't get along, like in primary school up to like year 10 [at age 15 to 16] in high school. I don't know why, like a lot of people say twins always get along but we didn't, like it was more of the, if one person was

> happy then the other one wasn't really? I don't know it sounds really weird, but that was how it felt. Or like it was kind of, it was competitive. And yeah like it was just really bad, like when you're in like primary school and high school and stuff, like you get into like different sorts of crowds, different groups and stuff, so yeah I didn't really fit into my groups, so like, it wasn't very fun. Like, yeah no it was alright. I survived. But like after year 10, like I just moved into a different crowd, and it was like closer with Nat's group and we started hanging out more 'cause we went to the same things and, then by like year 12 we were like, a lot closer. And now we're like, we hang out with the same group of people so like, it's good.

Nat said about their relationship

> We weren't very close up until year 11 or 12 [last 2 years of high school], so we kept to ourselves, had our own friends, did our own thing. And then we got a lot closer and did things together because it was really handy just having someone at home who had the same interests as you, the same age… It's a good relationship, like even if we fight we get over it, like it's unconditional love…. we were definitely treated as twins. Like she'd be pink, I'd be yellow. But then we got separated in year one, or year two… I guess [our relationship changed] when she moved to [university] in 2012. That was the first time we actually lived apart. And we got closer 'cause I'd go up and see her all the time, like I'd make an effort to drive up there for the weekend and hang out, like it, was nice to go up there and hang out, see her friends and see where she's living 'cause she's not living with parents or anything up there. It was a lot of fun. So yeah it, the relationship changed in a good way, like, got closer.

Thus, the twins' relationship changed from being quite competitive and argumentative to one based on a shared group of friends, interests and recreational activities. However, neither twin mentioned a change to a more emotionally intimate relationship. Thus, their relationship interviews reflected their PAIR subscale data, which showed they were low on emotional and intellectual intimacy but high on social and recreational intimacy.

Relationship summary. James and Sarah did not report being particularly close, as shown by their low ratings on the IOS and PAIR Inventory. Their lack of closeness was also apparent in the fact that they struggled to think of shared activities and described each other as being "different" to themselves and their other sibling. James had a much closer relationship with Nat, with a higher rating on the IOS and the highest overall PAIR Inventory ratings. Their activities were based on mutual interests, which James highlighted in his interview. Unlike James and Sarah, they "get along". The twins' relationship with James changed from antagonism to respect in his late adolescence. The twins' relationship changed in a similar way at a similar age. At present, their relationship was quite close, as shown by their high ratings on the IOS and social and recreational subscales of the PAIR Inventory. Yet they were still not emotionally or intellectually close, and their relationship was mostly based on having a shared group of friends.

Recall

Length of recall output. I found that the number of words that the groups said for each event was quite high compared to Experiment 4 (see Table 6.13). As I predicted, the triad said more for each event than both dyad types, most likely because of the additional speaker. James and Sarah said far fewer words per event than the other dyads. Therefore, it appeared that the quality of the relationship itself had a greater influence on how much they said than whether they were siblings or twins.

Table 6.13

Mean Length of Recall Output Per Event for Each Sibling, Twin, and Triad Group, and Experiment 4 Collaborative Dyads

Group	Word Count
Case Study	
James and Sarah	412.00 (20.00)
James and Nat	604.50 (84.10)
Sarah and Nat	611.50 (101.10)
Triad	686.67 (63.81)
Mean	578.67 (117.17)
Experiment 4	
Strangers	416.18 (51.30)
Friends	415.25 (103.86)
Siblings	488.08 (142.53)
Twins	450.83 (97.03)
Mean	436.26 (101.09)

Note. Standard deviations appear in parentheses.

Collaboration style. ***Distribution of words and turn taking.*** The pattern across the dyads for the number and length of turns was very similar to the pattern I observed for word count (see Table 6.14). The triad took the most and the shortest turns of the groups. James and Sarah took the least and the shortest turns, reflecting their low word count. James and Nat took the longest turns of the dyads and took slightly fewer turns than the twin dyad. All of the groups had a roughly equal distribution of words between the memory owner and the other group members. Therefore, the original elicitor of the events did not dominate recall.

Table 6.14

Mean Distribution of Words and Turn Taking Per Event for Each Sibling, Twin, and Triad Group, and Experiment 4 Collaborative Dyads.

Group	Turns	Words Per Turn	Proportion of Words Said by Memory Owner[a]
	Case Study		
James and Sarah	45.00 (8.49)	9.28 (1.31)	.53 (.12)
James and Nat	52.00 (21.21)	12.32 (3.41)	.53 (.06)
Sarah and Nat	57.00 (4.24)	10.82 (2.58)	.49 (.12)
Triad	93.00 (7.94)	7.38 (0.12)	.39 (.04)
Mean	61.89 (24.94)	10.56 (3.78)	.46 (.10)
	Experiment 4		
Strangers	16.76 (9.73)	73.52 (104.36)	.89 (.07)
Friends	42.36 (12.51)	10.57 (1.89)	.53 (.05)
Siblings	46.71 (17.40)	11.43 (3.80)	.51 (.07)
Twins	35.92 (14.70)	15.56 (7.32)	.46 (.13)
Mean	34.57 (17.86)	31.12 (63.74)	.63 (.19)

Note. Standard deviations appear in parentheses.

[a]The proportion of owner words in the dyads is .50 and in the triad is .33 if the words are shared equally between speakers.

Collaborative process coding. I found a very low rate of unsuccessful cues and a high rate of corrections and disagreements in this case study (see Table 6.15). Only the twin dyad and James and Sarah had unsuccessful cues, and the other two groups had few unsuccessful cues. The pattern of corrections and disagreements suggested that this collaborative process was not indicative of dysfunction in these young adult siblings because the most intimate dyads had the most corrections and disagreements. Instead, like in the comparison between strangers' and siblings' corrections and disagreements in Experiment 4, this collaborative process may instead reflect a stronger relationship that can withstand temporary discord. The triad had fewer corrections and disagreements than most of the dyads suggesting that the presence of a third sibling may have helped prevent conflict.

The pattern of successful cues across the sibling, twin, and triad groups was quite different from the patterns of the other collaborative processes (see Table 6.15). The triad had more mirrored repetitions and co-constructed sentences, but not more successful cues than the dyads. The twin dyad had fewer successful cues and more mirrored repetitions and co-constructed sentences than the sibling dyads. Although the two sibling dyads had very similar rates of mirrored repetitions and co-constructed sentences, James and Nat had far more successful cues than James and Sarah. Therefore, the relationship between dyad members appeared to influence their Factor 2 collaborative processes and recalling as a triad increased the non-cuing Factor 2 collaborative processes.

Memory quality. ***Global quality.*** Person detail was quite low in this case study, and there was little to no difference in the amount of person detail each group provided (see Table 6.16). Thus, amongst these family members, there was little need to give details about the other people involved in the events, except a small amount of detail for the experimenter's sake. Both place detail and time detail were quite high, especially for the triad. The patterns for place and time detail amongst the three dyads were almost entirely opposite to each other. James and Nat had the highest place detail but the lowest time detail of the three dyads. It is unclear whether this effect was due to their relationship or the nature of the events they recalled.

Table 6.15

Mean Collaborative Processes Per Event for Each Sibling, Twin, and Triad Group, and Experiment 4 Collaborative Dyads

Group	Unsuccessful Cues	Corrections and Disagreements	Successful Cues	Mirrored Repetitions	Co-constructed Sentences
			Case Study		
James and Sarah	1.50 (2.12)	5.00 (5.66)	4.50 (0.71)	5.00 (7.07)	3.50 (4.95)
James and Nat	2.50 (3.54)	3.50 (4.95)	5.00 (5.66)	3.50 (0.71)	5.00 (2.83)
Sarah and Nat	0.50 (0.71)	6.00 (7.07)	1.00 (1.41)	9.50 (0.71)	8.50 (3.54)
Triad	0.00 (0.00)	5.00 (6.93)	2.67 (1.53)	12.67 (1.53)	12.67 (4.73)
Mean	1.00 (1.80)	4.89 (5.11)	3.22 (2.73)	8.22 (4.79)	8.00 (5.17)
			Experiment 4		
Strangers	0.48 (0.48)	0.33 (0.33)	3.36 (2.54)	1.42 (1.43)	0.36 (0.46)
Friends	0.94 (0.97)	2.00 (2.33)	4.03 (2.68)	3.72 (2.00)	3.61 (1.82)
Siblings	1.00 (0.84)	2.54 (3.18)	4.04 (3.22)	5.08 (2.56)	3.42 (1.78)
Twins	0.75 (0.83)	3.50 (2.13)	1.58 (1.13)	3.58 (2.11)	5.08 (4.10)
Mean	0.79 (0.68)	1.77 (2.33)	3.54 (2.66)	3.30 (2.37)	2.71 (2.47)

Note. Standard deviations appear in parentheses.

I found very different patterns of vividness and emotionality across the groups (see Table 6.16). The sibling, twin, and triad groups in this study recalled the events very vividly but with low emotion. The triad recalled their events the most emotionally, and James and Nat recalled their events the most vividly, scoring maximum vividness in both of their events. James and Sarah recalled their events the least vividly, perhaps reflecting their lack of closeness. Despite the twin dyad's highly vivid recall, they mentioned no emotions in either of their events. The lack of emotion in the twin dyads' recall was striking, considering they were more intimate than James and Sarah. The twins' stronger shared identity combined with their comparatively low emotional intimacy could have meant that, unlike when they recalled with their brother, they refrained from mentioning emotions when they recalled together. When they recalled in a triad, however, this lack of emotions disappeared, suggesting that the presence of their brother may have allowed them to broach more emotional topics.

LIWC. The patterns of use of “I”, “we” and “you” in this case study were very different across the different groups (see Table 6.17). The triad had the most balanced rates of the three pronouns compared to the other groups. James and Nat said “I” far more and “we” far less than the other groups and said “you” the most of the groups. I predicted that the high intimacy between James and Nat would be reflected in a higher use of “we” than “I”, but I found the opposite. One explanation for this dyad’s unexpected use of “I” and “we” could be that the events they recalled (see Table 6.10) were both events in which one sibling did something to or for the other, meaning they had separate roles in the event. The twin dyad said “we” more than “I”, as expected, but also said “you” at a far lower rate than the other groups, meaning that they either did not refer to each other or directed their references to each other to the experimenter, using each other’s names or ‘she’. Despite their low intimacy and shared identity, James and Sarah said “we” more than “I”, and said “you” at a moderate rate. As the events they recalled tended to be ones they shared with other family members, they may have used “we” to refer to a larger family group rather than the two of them. Thus, the use of pronouns may reflect the dyads’ shared identity, but also was likely influenced by factors such as how many people were involved in the events they recalled. In future research, more fine-grained coding for pronouns, which separates different pronoun referents may be required to understand how pronouns reflect shared identity.

Table 6.16

Mean Global Quality Per Event for Each Sibling, Twin, and Triad Group, and Experiment 4 Collaborative Dyads

Group	Person Detail	Place Detail	Time Detail	Vividness	Emotionality
			Case Study		
James and Sarah	1.50 (0.71)	1.50 (0.71)	1.50 (0.71)	2.00 (0.00)	1.00 (0.00)
James and Nat	1.50 (0.71)	2.50 (0.71)	2.00 (0.00)	3.00 (0.00)	1.50 (0.71)
Sarah and Nat	1.50 (0.71)	1.50 (0.71)	2.00 (1.41)	2.50 (0.71)	0.00 (0.00)
Triad	1.33 (0.58)	3.00 (0.00)	2.67 (0.58)	2.67 (0.58)	1.67 (1.53)
Mean	1.44 (0.53)	2.22 (0.83)	2.11 (0.78)	2.56 (0.53)	1.11 (1.05)
			Experiment 4		
Strangers	2.36 (0.48)	1.97 (0.59)	1.58 (0.40)	2.15 (0.56)	0.97 (0.69)
Friends	2.06 (0.53)	1.53 (0.54)	1.39 (0.68)	2.25 (0.38)	1.22 (0.89)
Siblings	2.08 (0.53)	1.58 (0.50)	1.04 (0.65)	2.21 (0.47)	1.13 (0.53)
Twins	2.00 (0.61)	1.67 (0.47)	1.08 (0.63)	2.25 (0.32)	1.08 (0.57)
Mean	2.15 (0.52)	1.70 (0.55)	1.33 (0.60)	2.21 (0.44)	1.10 (0.70)

Note. Standard deviations appear in parentheses.

All groups said more words associated with positive emotion than negative emotion, reflecting my findings from Experiments 3 and 4. However, the pattern of positive and negative emotion across the groups was quite different. James and Nat said by far the most words associated with positive emotion than the other dyads and the triad, whereas James and Sarah had the lowest rate of positive emotion words. I found a similar pattern of words associated with negative emotion to what I found for emotionality. Sarah and Nat said almost no words associated with negative emotion, followed by James and Sarah, and the triad said the most words associated with negative emotion. Thus, LIWC's measure of positive emotion reflected the dyads' overall intimacy, but the negative emotion more closely aligned to Habermas' (2009) emotionality score.

Table 6.17

Mean LIWC Score Per Event for Each Sibling, Twin, and Triad Group, and Experiment 4 Collaborative Dyads

Group	"I"	"We"	"You"	Positive Emotion	Negative Emotion
			Case Study		
James and Sarah	3.84 (0.46)	5.84 (0.02)	1.97 (1.13)	1.32 (0.88)	0.35 (0.49)
James and Nat	8.07 (0.78)	1.76 (0.72)	2.87 (1.27)	4.38 (2.15)	0.80 (0.37)
Sarah and Nat	3.74 (1.34)	5.00 (1.01)	0.55 (0.25)	2.51 (0.39)	0.10 (0.13)
Triad	3.68 (0.70)	3.85 (0.69)	2.40 (1.02)	2.81 (0.68)	1.48 (1.05)
Mean	4.70 (2.02)	4.08 (1.63)	2.00 (1.18)	2.76 (1.41)	0.77 (0.82)
			Experiment 4		
Strangers	4.76 (1.51)	2.93 (1.09)	1.36 (0.62)	3.50 (1.02)	0.59 (0.32)
Friends	4.04 (1.27)	3.49 (1.50)	1.56 (0.74)	2.74 (0.75)	0.95 (0.32)
Siblings	4.71 (2.46)	3.47 (1.88)	1.84 (1.55)	2.45 (1.09)	0.65 (0.34)
Twins	3.86 (2.21)	3.99 (0.75)	1.30 (0.45)	3.33 (0.76)	1.10 (1.43)
Mean	4.40 (1.74)	3.37 (1.40)	1.53 (0.92)	2.98 (0.99)	0.79 (0.37)

Note. Standard deviations appear in parentheses.

Participant ratings. The triad and the twin dyad rated their events as being high in detail/vividness, whereas both sibling dyads rated their events quite low in detail/vividness (see Table 6.18). The twins, who were not necessarily the most intimate but had the highest ratings on the IOS scale, rated their events to be the most detailed or vivid in their minds. Sarah and Nat, and James and Sarah rated their events as much less emotional than James and Nat and the triad. This pattern reflects the other measures of emotion, but it does not capture the subtle differences between the groups as fully as the other measures. The triad rated their events as the most personally significant and James and Sarah rated their shared events to be the least personally significant, with little difference between the other two dyads.

Table 6.18

Mean Participant Ratings Per Event for Each Group and Experiment 4 Collaborative Dyads

Group	Detailed/Vivid	Emotional	Personally Significant
	Case Study		
James and Sarah	3.75 (1.77)	2.75 (1.77)	2.50 (0.71)
James and Nat	3.00 (0.00)	3.00 (1.41)	2.75 (1.77)
Sarah and Nat	4.50 (0.00)	1.75 (0.35)	2.75 (0.35)
Triad	4.22 (0.51)	3.33 (0.58)	3.67 (0.33)
Mean	3.91 (0.89)	2.78 (1.06)	3.00 (0.87)
	Experiment 4		
Strangers	3.76 (0.63)	2.91 (0.82)	3.12 (0.87)
Friends	3.57 (0.59)	2.90 (0.81)	3.10 (0.99)
Siblings	3.48 (0.74)	3.23 (0.81)	3.54 (0.96)
Twins	3.79 (0.60)	2.50 (0.84)	3.12 (0.83)
Mean	3.63 (0.62)	2.93 (0.81)	3.21 (0.91)

Note. Standard deviations appear in parentheses.

Description of shared remembering. In this section, I present an in-depth treatment of extracts from the transcripts of each groups' shared remembering. I show how intimacy influenced each dyads' recall in terms of their collaboration style and memory quality by presenting transcripts from each dyad in turn.

James and Sarah. James and Sarah were the least intimate and had the weakest shared identity of the dyads, with few shared activities, interests or opinions. Their shared remembering reflected their lack of closeness. Their shared remembering was sparse in terms of how much they said, the number and length of the turns they took, the number of mirrored repetitions and co-constructed sentences, the vividness of their recall, and the amount of positive emotion their recall contained. The following extract shows the lack of vividness in their recall together:

J: So do you want to go first?

S: This was the time I moved to [University]. It would've been like,

J: Two thousand and twelve.

S: Yeah. Start of February.

J: And we,

S: About the start of February.

J: Mum and Dad drove us, with all,

S: We cargoed all my stuff.

J: All your stuff, clothes.

S: Nanna was there as well. We moved our stuff in,

J: To the Village.

S: One, one twenty-seven.

J: One twenty-seven. When we, when I first walked in there was this weird smell.

S: Yes it smelled like a campus.

J: Smelled like a campus.

S: Smelled a bit off.

J: And we went upstairs, and there was like one guy there already, but he wasn't, was he there at the time?

S: Yeah there was a Chinese guy, upstairs.

J: What was his name?

S: Patrick.

J: Patrick. (laughs) Your room was on the right.

S: Yeah.

J: And the other roommates weren't there, yeah?

S: Nup.

Although this extract contained several mirrored repetitions and successful cues, it was quite stilted and did not flow naturally. Neither sibling appeared to be particularly invested in this event, which mostly concerned Sarah; James was merely there as another family member. This event scored low on vividness compared to the other events, and unlike this family's more vividly recalled events, it contained no direct quotes. At the beginning of the extract, Sarah began to tell the event in a straightforward manner, with a few co-constructed sentences and mirrored repetitions provided by James. However, in the second half of the extract, James began to take over the story, cuing Sarah several times and providing information himself. Their recall was briefly revived by the description of the apartment's smell. However, after this point, Sarah appeared to be less committed to recalling the event. She replied to James with one-word responses three times at the end of the extract, forcing him to either cue her again or mirror what she said to fill the gap in the conversation. Apart from one instance of mirrored repetition ("smelled a bit off"), James provided all of the collaborative processes in this extract. Sarah's lack of collaborative processes demonstrated her lack of commitment to recalling the event with James and highlighted their lack of intimacy. James attempted to scaffold his younger sister's disinterested recall of the event. Although he was able to draw more information about the event from her, he was unable to cultivate enough interest to allow for a vivid recounting of the event.

In this extract, both siblings used “we” several times. However, there was little evidence in the transcript to suggest that “we” referred to just James and Sarah. Instead, it appeared to refer to a wider family group that may have included all or some of “Mum and Dad” and “Nan”. Thus, although the use of “we” often reflects a shared identity (Pennebaker, 2011), their use of “we” reflected a larger group identity with their family as a whole. All except one use of “I” and “you” referred to Sarah. This pattern of pronoun use confirmed that the event was mostly concerned with Sarah and that James did not consider himself fully involved in the event. Instead, his role in recalling the event was to support his sister.

James and Nat. James and Nat could not have been more different to James and Sarah, despite the fact that James was in both dyads. This dyad was the most intimate overall, with the most shared activities and interests. Their shared remembering was abundant in terms of how much they said, the length of the turns they took, the number of successful cues and corrections and disagreements, the preciseness of place detail, the vividness, the use of “I”, and positive and negative emotion. The following extract showed how successful their shared remembering was:

N: And then Lachlan came.

J: And Lachlan came, no yeah he didn’t come yet. After that, I was like, “Nat let’s play a proper set.”

N: Okay.

J: “Let’s have a proper set.”

N: (laughs) ‘Cause you were cut that I (laughs) I beat you.

J: Yeah I was really cut that I, she beat me. And then in the proper set I beat her what six love or six one?

N: Yeah something like that. (laughs)

J: And then Nat said to me (laughs) like "Oh, I can't, I can't play under pressure!"

N: It's true!

J: "I can only play when there's like nothing on the line."

N: I believe that 'cause I say that all the time 'cause I can't play under pressure.

J: Yeah.

N: As soon as there's a point score I start freaking out and I, I hit everything in the net.

J: And then Lachlan came, and he's like 'oh what are you guys doing" and we're like "oh we just played this tiebreak."

N: And I told him, I remember telling him that I beat you, I was like "Lachlan I just beat James in the super tiebreak!"

J: He just laughed at me.

N: Yeah.

J: The whole time.

N: Yeah (laughs) Yeah. Then it like, what was the weather, was it hot?

J: It was, oh no, no overcast.

N: It was, it wasn't too hot.

J: It was overcast.

N: Yeah, yeah, yeah. Yeah.

Although this extract contained fewer collaborative processes than the previous one involving James and Sarah, they were more evenly distributed between James and Nat. James mirrored and corrected his sister while Nat co-constructed James's sentences and successfully cued his recall. The conversation flowed freely, and both siblings showed interest in recalling the event, each providing direct quotes and their emotional states during the event. Unlike in the extract involving James and Sarah above, each sibling laughed several times throughout their recall, which showed they were comfortable engaging in recall together.

There were several instances in this extract in which James corrected Nat's recount of the event, or provided information that she did not necessarily recall. The first instance occurred when James corrected Nat's sequence of events in his first turn in the extract, to which her response was simply "okay". Another instance occurred when James provided a direct quote from Nat about her inability to perform under pressure. She stated she "believed" him because the quote fit with what she knew about herself, despite the fact that she did not show evidence of remembering having said so in the event itself. The final instance occurred at the end of the extract when Nat asked James whether the weather was hot, and he said, “It was, oh no, no, overcast". This was the only instance in which she showed evidence of recalling the information James provided. Nevertheless in each instance, Nat accepted that her brother's version of the event was correct without question, demonstrating her trust in his memory. Similarly, although James showed more trust in his own memory than his sister’s, both times he corrected her in this extract, he started to agree with her first and then corrected himself. Thus, although he did not accept her account, his initial instinct was to agree with her, again demonstrating their closeness.

Both siblings were equally involved in the event they recalled in this extract, which concerned a tennis match between the two of them. It concerned one of their three main shared activities, which they had both put at the top of the list. It was evidently an important tennis match to the two of them, being the first time that Nat beat James in a match. It appeared to be equally important to each sibling, as can be seen in the vividness with which they each recalled the event and their high engagement in recalling it.

Unlike in James's extract with Sarah above, this extract contained only two uses of “we”, reflecting the low LIWC score for this dyad. Both uses occurred in the same turn said by Nat, "and we’re like 'oh we just played this tiebreak,'" and both referred to James and Nat only. This extract showed that this dyads' pattern of pronoun use was at least partly due to the type of events they recalled. Until Lachlan arrived, they were the only two people involved in most of the extract, and the event was a competitive tennis match in which Nat beat James. Thus most of the extract involved recounting what each person individually did, said, or felt during the event. The two sibling dyads' contrasting use of "we" reflected the differences in their shared identity. Otherwise, the pattern of pronoun use reflected their pattern of pronoun use overall, with a very high rate of "I", and high rate of "you" relative to the other dyads. Although their shared identity was higher than that of James and Sarah, it was still quite low, which may have contributed to their low rate of "we" and high rate of "I". Thus, other than the different ways they used "we", the differences between the two sibling dyads' recall reflected their levels of intimacy and shared interests.

Twin dyad. The twins were less intimate overall than James and Nat, but they were higher in social intimacy and had a stronger shared identity. The events they recalled reflected these differences, involving various mutual friends rather than other family members. The following extract from their transcript recalling a charity fun run was typical of their recall:

> S: This was the morning that we woke up, and one of Angelica's housemates had um a guy over. (laughs)
>
> N: Oh yeah. (laughs)
>
> S: And his friend was,
>
> N: Out on the balcony, we didn't know who he was!
>
> S: He was still asleep so we just like, we were walking around the house.
>
> N: (laughs) Really quietly.
>
> S: And we saw a guy who was asleep on the veranda.
>
> N: Because her door was closed. Like her housemate's door was closed, so we didn't know what he was doing out of the room. (Both laugh)

N: But turns out there was another guy over, that was just his friend and he needed somewhere to stay. So that was funny.

S: (laughs)

N: Forgot about that.

S: But anyway, back to Run Wollongong. Um we got to the start early.

N: [same time as "early"] We got there on time.

S: Yeah, we went to Chifley.

N: Yeah well we met up, we went to Gel's work at Chifley.

S: Yeah.

N: 'Cause her work group was doing the Run Wollongong.

S: In a, as a team, kind of thing.

N: Yeah.

S: And they were dressed up. And so we went there, and then we got ready and then we,

N: Yeah they dressed,

S: Just went to the start line.

N: They dressed up as runaway brides, which was really funny. (laughs)

S: Yeah their theme was runaway brides, so they had to get old wedding, old, old, long ball gowns from Vinnies and there was a guy who was wearing a suit on that really hot day.

N: Oh yeah.

S: And he didn't take it off so.

N: It was hot, and you had to run, so I don't know how he did it.

S: There were hills. I, I we started running together.

N: Yeah we started together and then, our friend wasn't with us, it was just us two, and then there was a lot of people.

S: And she ran way from me.

N: And then um she just fell behind!

S: No she ran away from me.

N: Well she could've kept up! I was dodging people.

S: I was going steady, and she was like, "I'm going to go" so I said, "okay fine."

N: Yeah, exactly. You chose to stay behind. I, I,

S: You chose to go in front.

N: Yeah exactly, I did, I did choose to go in front!

S: Exactly.

Similar to James and Nat, the twin dyad's recall was highly vivid, involving direct quotes and laughter throughout. There were two main sections of interests in this extract. In the first few turns, the twins engaged in a run of co-constructed sentences to tell the funny story about how they discovered a strange man on their friend's balcony. At the end of the extract, the twins engaged in a run of corrections and disagreements coupled with mirrored repetitions as they argued over whose fault it was that they were separated during the race. Unlike in the previous extracts, in this extract the twins used the same amount of each kind of collaborative process. The equal distribution of collaborative processes between the twins along with long runs of the same collaborative process indicated that they did not have differentiated roles in recalling this event. Instead, they matched each other's style of recounting the event. This matching may have occurred because, unlike when they recalled with James where there was a difference in age, the twins were on truly equal footing. Even when they were engaging in corrections and disagreements, they used mirrored repetitions to strengthen their point of view ("And then she ran away from me"/ "And then um she just fell behind!", "You chose to stay behind."/ "You chose to go in front."). This aspect of their recall together reflected their shared identity or at least their perception of each other as highly similar equals.

This extract also demonstrated the twin dyads' low emotional intimacy, via their low use of “you” and the absence of emotion. They did not address each other or state what the other person did throughout most of the extract until their disagreement at the end. Here, instead of arguing directly with each other, they began by directing their disagreements to me, the experimenter, referring to each other as "she". It was only at the very end of the run of corrections and disagreements that they addressed each other directly. Their avoidance of directly addressing their disagreements to each other demonstrated that they do not engage emotionally with each other. This avoidance of emotional engagement was also displayed by their lack of overt emotion in a quite emotionally loaded topic of disagreement. They did not argue about what happened during the event; they both agreed that Nat ran ahead while Sarah stayed behind. Instead, they argued about the intention or meaning behind this separation during the race, which was much more emotionally loaded. However, when Sarah instigated the argument ("and she ran away from me"), she did not state how this action made her feel. Instead, she expressed her displeasure over Nat's actions by implying that she intentionally abandoned her. They then continued to argue in the same manner, avoiding stating their emotions outwardly, or directly addressing each other until the end of the extract. However, even this personal disagreement did not have a negative impact on their recall of the event. They continued to recall more details during this set of disagreements, providing a clear picture of what happened during the race. Although it was not part of this extract, they also recovered easily from this argument and continued to recall the rest of the event quite happily. Thus, corrections and disagreements did not impair this twin dyad’s shared remembering.

Triad. The addition of a third person meant that the triad's recall was quite different from the dyads' recall. One reason for this was that they appeared sometimes to be less aware of my presence as the experimenter compared to when they recalled in dyads and directed their recall to each other instead of to me. The differences between each dyad's intimacy and shared identity had less impact on recall when all three siblings recalled together.

Nevertheless, their different relationships were evident to a certain extent from the extract below, during their recall of their trip to Hong Kong Disneyland.

J: We went on all these um,

N: Rollercoasters.

J: Rollercoasters the whole day, like the one,

S: I was,

J: The one we went inside? What was?

N: Space Mountain.

J: Space Bar?

N: Space Mountain.

J: Space Mountain!

N: I'll never forget the photo of Dad!

S: (laughs)

J: Yeah and Dad's like "aargh!"

N: That was the funniest photo! But then there was, this was another one.

S: There was a really, really,

J: This was the second one, the one in the Western,

N: Yeah the Western one.

S: Yeah.

N: And we went backwards.

J: And we, (laughs)

S: 'Cause I wouldn't go on any other ride.

N: And then we found one!

S: I would have been happy to just walk around and be at Disneyland.

J: And then we cursed you,

N: (laughs)

J: And then we went “Sarah are you scared” and you were like “Shut up James!”

N: (laughs) It was only ‘cause it was close to the line, and you could see everyone, hear everyone screaming and like,

J: Yeah.

N: And then when we were on the ride and she goes “This is scary!”

S: (laughs)

N: And like she was screaming something and I was,

J: Yeah screaming and it was like, this is not the scary bit. (laughs)

S: I was screaming, “I hate you Nat!”

N: Yeah I did hear.

J: (laughs) Yeah!

N: “I hate you!”

S: It was all your fault!

J: (laughs)

S: ‘Cause we went backwards,

N: Yep. (laughs)

S: It was really fast, and it was really scary and,

J & N: (laugh)

S: I did not enjoy it.

This extract was highly vivid, with lots of direct quotes and laughter from all three siblings. It revealed their back-and-forth style of recalling together, with short turns, and lots of mirrored repetitions and co-constructed sentences. The high number of co-constructed sentences may have contributed to the triad's short turns. Apart from one instance of mirrored repetition ("I was screaming"), Sarah did not contribute to this extract's large number of collaborative processes. Instead, the vast majority of the collaborative processes were equally distributed between James and Nat. Unlike when they recalled as a dyad, James and Nat used similar collaborative processes to each other, indicating that their different roles did not carry over when they recalled with their sister. Sarah may not have provided many collaborative processes because James and Nat were allied against her in their enjoyment of rollercoasters and mirth over her fear of them. Thus, this extract demonstrated the closeness and shared interests between James and Nat, which Sarah did not share. Nevertheless, James and Sarah both provided direct quotes and laughed a great deal more than in their one-on-one recall. The twins also no longer avoided emotion when they recalled with James, unlike when they recalled one-on-one. Thus, recalling with an additional family member meant that the less emotionally intimate dyads were able to speak more about emotion than they would without the third family member. Sarah even quoted herself as saying she hated Nat.

Like the twin dyad's extract above, this extract dealt with a potentially emotionally loaded subject; the fact that James and Nat shared something that Sarah did not. However, this extract did not contain any runs of corrections and disagreements. Instead there was only one minor instance, when Nat corrected James on the name of the ride. The conversation did eventually end up in a run of corrections and disagreements, mostly between the twins, several turns after the end of this extract. Nevertheless, the triad was able to discuss this emotionally loaded subject for quite some time before they argued over it. Thus, having a third family member present may have had a somewhat placating effect.

Post-experimental interview. At the end of Session 2, I asked the triad about how they remembered together in their everyday lives. When I asked them about what sort of events they tended to remember together, at first, they were unsure what I meant, and whether they actually do so. However, after some discussion they agreed they tended to recall for fun.

J: Hmm.

N: Like what?

AS: Do you do it often, or?

N: What kinds of?

AS: Remember past events together? Talk about the past?

J: Outside of this?

AS: Yeah outside of this.

S: Yeah. (All laugh)

J: Do we?

N: Depends how significant they are. Like graduation for you,

J: As in how we do it?

N: If something sparked my memory like,

AS: Yeah, how and what you remember, how often, that kind of thing.

S: Oh I don't know, we…

J: Funny stuff we remember.

S: (laughs) Yeah we,

J: Funny stuff.

S: Funny stuff we talk about over dinner and stuff.

J: And we talk over dinner about some things, like "oh remember that time?"

N: Yeah (laughs)

S: And then we just do it.

N: "Remember that time," that's a good one.

J: Yeah (laughs)

N: (laughs)

J: Usually though, the funny or crazy,

N: Yeah.

J: For example like,

N: We're laughing at Dad or Mum.

J: Yeah, Mum and Dad, yeah, getting involved… Mm just like not the day-to-day stuff, all funny, all the old funny memories mainly. Funny, N: Yeah, mainly holiday ones.

J: Holiday ones.

S: Yeah.

N: That we talk about.

When I asked them whether one of them had a better memory for certain things than others, they agreed that James had the most detailed memory.

N: Him. His memory.

J: Details.

N: I want his memory.

S: He remembers everything.

J: I remember more details.

N: He remembers dates and holiday, like holiday, they, just everything. (laughs)

J: I can remember what you say, I can remember like yeah. More specific details.

N: Just ask James. Don't ask Mum.

S: We fill our brains with other things. (laughs)

Interestingly, James and Sarah had the least precise time detail of the groups, and James and Nat had no more precise time detail than the twin dyad. Thus, although they all agreed that James had the best memory for dates, it did not necessarily translate into more precise time detail being given. Nevertheless, it was James who provided most of the time detail.

When I asked them about whether their memories ever conflicted, Nat indicated that she tended to believe her family member's memories for the events over her own.

J: Yeahhh.

N: Maybe if they seem familiar with something else.

S: The date.

J: Depends what memory.

N: I'm usually wrong. (laughs)

J: If it's something we're all blurry on, we're like "oh you sure?" but if it's something like,

N: I end up usually believing the others.

J: If it's something that I really remember then, we feel like we can,

N: Yeah, unless, unless,

J: If we can quote each other. It's like, "yes you said that", then yeah.

Nat's assertion that she is "usually wrong.… I end up usually believing the others." reflected her behaviour when she recalled with James in the tennis match extract above, when she unquestioningly took on his memory for the event several times. When she recalled with her sister, however, she did not show this behaviour, indicating that she was more apt to believe her older brother than her sister. James noted their tendency to "quote each other" as an indication of having a better memory. Indeed, the vast majority of the events they recalled involved directly quoting each other multiple times. Thus, quoting each other appeared to be a salient feature in how they remembered events together.

Discussion

In this case study, I sought to explore more closely how siblings and twins remember together by comparing sibling and twin dyads and a triad from a single family. To do this, I also examined their relationships with each other in detail. I expected that the twins' relationship and shared remembering of shared events would be different from what they each shared with their brother. I did find the expected pattern in some cases. The twins' ratings on the IOS scale were much higher than their individual ratings with their brother, indicating that the twins had a stronger shared identity with each other than with James. When the twins recalled together, their rates of collaborative processes were quite different from when they each recalled with James. They had far more mirrored repetitions and co-constructed sentences as well as fewer successful cues with each other than with James. They also rated the events they recalled as being higher in detail/vividness than the events they each recalled with James. Thus, the twins' shared remembering appeared to be different from the siblings' shared remembering.

However, when I looked closer and compared the two sibling dyads to each other and the twin dyad, I found the story was not quite so simple. James and Sarah had a much less intimate relationship than James and Nat, who had a more emotionally and intellectually intimate relationship than the twins. This difference in intimacy between the two sibling dyads had widespread effects on their shared remembering of shared events. James and Sarah said less, took fewer turns, and gave less precise time detail than the other sibling dyads. This finding suggested that the low intimacy between these two siblings meant they recalled shared events together less fluently than the other dyads. It also suggested that their shared events were less interesting or important to them, as reflected in their low ratings for detail/vividness, emotion, and personal significance.

James and Nat were the most intimate dyad of the three, and this greater intimacy, particularly emotional and intellectual intimacy, had a considerable impact on their shared remembering of shared events. They had no unsuccessful cues, a high level of corrections and disagreements, gave more place detail, recalled the events more vividly and emotionally, used "I" less and "we" more, and had more words associated with positive and negative emotion in their recall than the other two dyads. Interestingly, the impact of higher intimacy on the two Factor 2 collaborative processes was in opposite directions; decreasing unsuccessful cues and increasing corrections and disagreements. Their high level of corrections and disagreements did not reduce how vividly they recalled the events; in fact they recalled the events more vividly than the other dyads. This finding consolidated my findings in Experiments 1 to 4 that corrections and disagreements do not appear to hinder siblings' shared remembering in the same way as it did for the older married couples in Harris et al.'s (2011) study. A high use of "we" usually is associated with shared identity and intimacy (Pennebaker, 2011), so James' and Nat's high use of "I" and low use of "we" were surprising. However, their IOS ratings were in the middle of the scale, suggesting that although they had high intimacy, they did not have a strong shared identity. Instead, it may be that their high intimacy fostered respect for each other's individuality, which may be why they used "I" so much more than "we". Their high emotional intimacy also was reflected in the fact that they recalled the events with the highest emotionality and the most words associated with positive and negative emotion. Thus, their high levels of intimacy allowed them to have arguably the most successful shared remembering of all the dyads in this case study.

As I suggested above, there may also be a difference in the kind of events the different dyads shared as a result of their different levels and kinds of intimacy. James and Sarah recalled events that they shared with other family members, which they rated as low in emotion and personal significance. James and Nat recalled events in which they were the two main players, which they rated as more highly emotional and personally significant than the other dyads. Finally, the twins recalled one event they shared with friends and one in which they were the two main players, which they rated as being less emotional than the other dyads. These different events may have contributed to the differences in memory quality between the three dyads, such as the use of personal pronouns, the kinds of details they recalled, and the emotionality and levels of positive versus negative emotion contained in the memories. In this case study, I was unable to separate the effect of intimacy on the kinds of events they shared and the way they recalled those events. It may not be possible to do so even in a larger experiment because the events that real-life groups share and their level and kind of intimacy are so closely intertwined.

Gender did not appear to have a clear influence on these siblings' relationships and shared remembering. The twin dyad, being sisters, scored highest on the IOS scale than the James-sister dyads. These scores were in keeping with Herrick's (2008) findings that mixed gender siblings scored lower on the IOS Scale than same gender siblings. However, the most intimate of the three sibling or twin dyads on the PAIR Inventory was James and Nat, a mixed gender dyad. Unlike the females in Floyd and Park's (1995) study, verbal behaviours did not appear to be a major aspect of the twin dyads' intimacy, as their three main shared activities were eating, shopping and socialising with other friends. However, shared activities appeared to play a more decisive role in the relationships between the three siblings. Both the twins' and James's and Nat's shared activities were a clear factor in their intimacy, and James's and Sarah's lack of shared activities seemed to contribute to their lack of intimacy. Thus, my findings reflect Floyd and Park's (1995) study, which suggested that shared activities were equally important for intimacy in male and female relationships. The twin dyad's recall was entirely lacking in emotionality, which contradicts the consensus in the literature that females recall more emotionally than males (Bauer et al., 2003; Davis, 1999; Fivush, 2008, 2011; Pasupathi & Hoyt, 2009; Pohl et al., 2005; Thorne & McLean, 2002). This contrast with the literature made the twins' lack of emotionality in their recall more conspicuous and highlighted the influence that their lack of emotional intimacy had on their shared remembering. The twins' female gender could have contributed to their high use of "we", but it was difficult to separate the effect of their gender from the effects of their shared identity and twinship. Thus, although gender must have played some role in their relationships and shared remembering, it did not have any more explanatory power in terms of their recall than their different levels of intimacy and the idiosyncrasies of their relationships. Gender may not have been a salient factor in their relationships or in the context of the events they recalled in this case study. The unimportance of gender in their relationships may have mitigated any effects gender may have otherwise had (Fivush & Buckner, 2003).

Evidence of a Family Style

The siblings in this case study recalled their events with lots of words and short turns, lots of mirrored repetitions, co-constructed sentences, and corrections and disagreements, low person detail, and precise place and time detail. The already high number of mirrored repetitions and co-constructed sentences increased when they recalled as a triad instead of in dyads. Therefore, there was some evidence that they were for the large part very fluent in recalling past events together. These findings suggest the family as a whole may recall the past using a coordinated perspective, which would create a shared rendering of the past and foster a shared family identity (Bohanek et al., 2006; Hirst et al., 1997; Hirst et al., 2003; Kellas, 2005). However, I would need to include the parents as well to verify this suggestion.

In their relationship interviews, all three siblings reported that they had become more supportive of each other in recent years. This dynamic was evident in their recall together, with the high rates of mirrored repetitions and co-constructed sentences. It also was evident in James's support of Sarah's recall when they recalled her moving into university accommodation, which he provided despite their low intimacy. There were still traces of their previously argumentative relationship in terms of the high rates of corrections and disagreements. However, perhaps because of their newly harmonious relationships their recall was resistant to any negative impact that corrections and disagreements might be expected to have. Instead, these disagreements appeared to increase the vividness of their recall in some instances. Although these siblings did appear to have a family style, their shared remembering also was influenced by the unique relationships between each sibling when they recalled in dyads and as a tried. When they recalled as a triad, however, the unique relationships had less impact on their shared remembering indicating the family style prevailed in the larger group.

Summary and Limitations

The case study approach that I used here allowed me to examine in great detail how subtle differences in intimacy and shared identity influenced shared remembering. Comparing shared remembering in a pair of twins and their brother allowed me to determine that although twin relationships are believed to be a special kind of sibling relationship, the unique relationship each sibling has with each other appears to have just as much influence over shared remembering as the type of sibling relationship. However, my case study approach also meant that I could not extend my findings beyond this family. Nevertheless, I could extend the framework that I developed here to future studies examining how families vary in their relationships and shared remembering. My general finding that the relationships between siblings shapes their shared remembering is likely to extend to other siblings, even though the twins in this family could be unique in the fact that one twin was more intimate with her brother than with her twin sister. It is possible that twins in most other families are closer to each other than their other siblings. If so, their shared remembering would be more different from their shared remembering with other siblings than in this case study. In order to determine whether twins are often closer to each other than their other siblings and whether this would impact their shared remembering, I would need to conduct a larger experiment comparing shared remembering in twins and their siblings.

Nevertheless, this case study showed that shared remembering of autobiographical memories amongst siblings and twins was dependent on subtle differences in their relationships with each other. It showed that recalling in a larger family group allowed the less close siblings to bridge the emotional distance between them in terms of how they recalled shared events together.

In this case study, I showed that the widely believed special closeness between twins compared to non-twin siblings may not necessarily encompass all kinds of intimacy. Twin or sibling status is less important to shared remembering than more subtle differences in the relationships between siblings.

General Conclusion

Throughout this chapter I found little evidence that the way that twins recalled together differed quantitatively or qualitatively from the way that siblings recalled together. The only consistent difference I found between siblings and twins in both my re-analysis of sibling and twin data from Experiments 1 to 4 and my case study was that twins were higher in social and recreational intimacy than other siblings. However, this difference in intimacy did not translate into superior shared remembering, Instead, I found that each dyads' shared remembering was influenced more by the unique characteristics of their relationship and shared experience than the type of relationship they shared. In the next chapter, I discuss this theme alongside other themes that emerged from the findings across my thesis and place them in the context of current literature and theory.

CHAPTER SEVEN

Discussion

In the four experiments and one case study in this thesis, I aimed to examine the product and process of shared remembering for people in different kinds of non-romantic peer relationships when they recalled different kinds of information. I extended the collaborative recall paradigm to compare the product and process of collaborative recall in dyads of strangers, friends, siblings, and twins recalling categorized word lists, self-generated autobiographical lists, self-generated non-autobiographical lists, shared autobiographical events, and unshared autobiographical events.

In this chapter, I integrate my findings across the studies reported in Chapters 2 to 6, to discuss the effects of collaboration, relationship, and task, and place these findings within the context of the current literature on collaborative recall and shared remembering. I begin by briefly summarising each chapter's main findings (see Table 7.1 for an overview of the basic product findings). Next, I discuss the major themes, challenges, and theoretical implications of my research. One major theme of my research is the lack of consistent collaboration inhibition across all of my studies. Collaborative inhibition refers to the tendency for collaborative groups to recall fewer items than the pooled recall of the same number of participants who recalled individually (Rajaram & Pereira-Pasarin, 2010). Given that collaborative inhibition is such a robust effect, I consider what my pattern of findings means for the current state of the literature. I discuss the difficulty of matching meaningful stimuli across strangers, friends, and siblings. I consider what my findings reveal about the importance of shared history and knowledge in shared remembering. I argue that individual differences between dyads outweigh differences between relationship groups. I highlight the importance of process in research on collaborative remembering. Finally, I acknowledge limitations of my studies and suggest possibilities for future research in the field.

Brief Summary of Findings

In Experiment 1 (Chapter 2), I investigated strangers', friends', and siblings' typed collaborative recall of a word list, a list of people, and a list of events. I found no collaborative inhibition in the word list for all relationships. I also found no collaborative inhibition in friends' and siblings' recall of mutual friends and acquaintances (people list) and shared social events or shared holidays (event list). The only instance of collaborative inhibition I found was in strangers recalling news events (event list). Thus, I found no costs of collaboration, except in one instance. I found relationship effects in the event list, but these were most likely a result of the different kinds of events people in each relationship recalled.

In Experiment 2 (Chapter 3), I investigated the effect of collaboration on strangers', friends', and siblings' verbal recall of a word list, a list of each individual's social circles, and a list of news events. Again, I eliminated collaborative inhibition in the word list for all relationships. Unlike Experiment 1, I found collaborative inhibition for all relationships in the social circle list and news event list. This finding indicated that the lack of collaborative inhibition in the people and event lists in Experiment 1 was most likely due to the task rather than to the relationships. Thus, I found some costs of collaboration in some tasks across Experiments 1 and 2 but not others.

In Experiment 3 (Chapter 4), I investigated strangers', friends', and siblings' typed collaborative recall of autobiographical events. For strangers, these were unshared events belonging to one partner, which the other partner read prior to recall. For friends and siblings, these were events they experienced together. I found costs of collaboration for strangers, as collaboration reduced the length and vividness of the typed reports of autobiographical events. However, for friends and siblings, collaboration had little effect on the product of typed recall. This effect likely was due to collaborating strangers' tendency to attempt to reproduce the event as the memory owner had typed it individually.

In Experiment 4 (Chapter 5), I investigated strangers', friends', and siblings' verbal collaborative recall of autobiographical events. For strangers, these were events they experienced with a friend or sibling (not present), and their collaborative partner had no knowledge of the event prior to recall. For friends and siblings, these were events they experienced together. I found a benefit of collaboration for all relationships, as collaboration increased the vividness of recall. For siblings, I found benefits of recalling the events collaboratively, as their recall increased dramatically in terms of output. Thus, collaboration had benefits for autobiographical recall, but more so for siblings than for people in the other relationships.

In Chapter 6, I explored whether twins' collaborative recall and shared remembering were different to other siblings'. First, I re-analysed twins' and non-twin siblings' data from Experiments 1 to 4 and found overwhelming similarities in the costs and benefits of collaboration on twins' and non-twin siblings' recall. Second, I presented a case study of a pair of female identical twins and their older brother, in which I interviewed them about their relationships and asked them to recall together events they shared. I found that the costs and benefits of each dyad's shared remembering reflected differences in their relationships, which were unique and not related to their "twin" status. Thus, across the chapter, I found little evidence to suggest that twins' and non-twin siblings' recall was affected by their being "twins" versus "non-twins". Instead, similarities and differences in their recall were due to similarities and differences in the quality of their unique relationships and the function that shared remembering played in those relationships.

Table 7.1

Summary of Main Product Findings by Chapter and Task.

Task	Collaboration Effects	Relationship Effects
	Experiment 1 (Chapter 2)	
Word List	No costs or benefits	No differences across relationships
People List[a]	No costs or benefits	No differences across relationships
Event List	Costs in strangers (news events): Collaborative inhibition No costs in friends (shared social events) or siblings (shared holidays)	More costs for strangers than friends and siblings
	Experiment 2 (Chapter 3)	
Word List	No costs of collaboration	No differences across relationships
Social Circle List	Costs: Collaborative inhibition	Strangers recalled more names than friends and siblings
News Event List	Costs: Collaborative inhibition	No differences between relationships
	Experiment 3 (Chapter 4)	
Autobiographical Events	Costs in strangers: Decreased word count and vividness No costs or benefits in friends and siblings	More costs for strangers than friends and siblings
	Experiment 4 (Chapter 5)	
Autobiographical Events	Benefits in siblings: Increased word count Costs: Decreased emotionality Benefits: Increased vividness	More benefits for siblings than strangers and friends
	Case Study (Chapter 6)	
Autobiographical events	Costs and benefits depended on unique relationship	Relationship type less important than unique relationship

[a]The people list included friends and siblings only, for reasons outlined in Chapter 2.

Major Themes, Challenges, and Implications

Lack of Collaborative Inhibition

A surprising finding across my studies was the lack of consistent collaborative inhibition. Although I hypothesized reduced or eliminated collaborative inhibition in friends and siblings recalling lists relevant to their relationships, I hypothesized that strangers, friends, and siblings recalling less meaningful stimuli would show collaborative inhibition, as in the standard collaborative recall paradigm (Basden, Basden, & Henry, 2000; Congleton & Rajaram, 2014; Meudell et al., 1995; Rajaram, 2011). That is, I hypothesized that across all relationships, collaborative groups would recall fewer items than nominal groups. Nominal groups contained the same number of participants than collaborative groups, but who recalled individually. Thus, my word list findings in both experiments challenge the robustness of collaborative inhibition. As I explained in Chapter 1, collaborative inhibition is less robust in dyads than in triads but is still usually found in strangers (Rajaram & Pereira-Pasarin, 2010).

The fact that I found no collaborative inhibition in the word list may be due partly to task factors. The strength and robustness of collaborative inhibition are influenced by the composition of the word list. For instance, longer lists with fewer categories and more exemplars per category produce collaborative inhibition more reliably than shorter lists with more categories containing fewer exemplars (Rajaram & Pereira-Pasarin, 2010). My list in Experiment 1 was short, with a relatively large number of categories with few exemplars. These factors may have contributed to my findings in this experiment. With these factors in mind, I doubled the length of the word list and the number of exemplars per category in Experiment 2, while keeping the number of categories constant. Surprisingly, these changes did not produce collaborative inhibition (see Table 7.1).

The dominant explanation for collaborative inhibition is retrieval disruption (Barber, Harris, & Rajaram, 2014; Barber & Rajaram, 2011; Basden et al., 1997; Dahlstrom, Danielsson, Emilsson, & Andersson, 2011; Finlay et al., 2000). According to this account, each individual has their own idiosyncratic retrieval strategies to support their recall.

Collaboration disrupts each group member's retrieval strategies, and thus, the group recalls fewer items than if each member recalled individually. This account suggests that retrieval disruption is an inevitable process in collaborative remembering, which is out of the control of group members. However, my findings, and others (for example, Harris et al., 2011; Meade et al., 2009), suggest that collaborative recall is a skilled process, and individuals and groups can skilfully use group strategies and other processes to influence the product of their collaboration. Thus, collaborative inhibition is not the inevitable product of collaborating on particular tasks, but is a product of unskilled collaborative recall. In developing skill in collaboration, groups can produce successful recall.

For instance, the experimental context in which participants performed the word list in Experiment 2 may have promoted successful collaborative recall. Between individually encoding the word list and recalling it collaboratively, dyads collaboratively recalled the autobiographical events reported in Chapter 5. In other words, collaborative strangers recalled together three personal events each before they collaborated on the word list. The autobiographical memory task may have aided strangers' subsequent collaborative recall in the word list in two ways: by building rapport and by allowing them to practice the process of collaborative recall. In Experiment 1, the word list was the first task dyads collaborated on, so experimental context may not have played as great a role in the lack of collaborative inhibition I found in that experiment.

First, building rapport may have allowed strangers to have more collaborative success on the word list in Experiment 2. As I outlined in Chapter 1, strangers' conversations tend to rely on conventional practices and are filled with hesitation and politeness (Berger & Calabrese, 1975; Hornstein, 1985; Planalp & Benson, 1992). This manner of conversing is unlikely to be conducive to collaborative success. Through self-disclosure, such as by discussing personal events as in my studies, strangers can achieve a temporary sense of closeness and even shared identity (Aron et al., 1997; Vacharkulksemsuk & Fredrickson, 2012). This temporary sense of intimacy may have led their subsequent collaboration to be more fluent and less characterized by hesitation and politeness. Thus, they may have been able to show more collaborative success in terms of the product of recall in the word list. Future research manipulating the rapport between stranger dyads prior to word list recall may allow this potential factor in collaborative success to be tested directly.

Second, recalling the autobiographical events together may have allowed strangers to practice recalling collaboratively, increasing their subsequent effective use of collaborative processes in the word list task. In the autobiographical memory task reported in Chapter 5, strangers cued each other as often as friends and siblings, both successfully and unsuccessfully. Although strangers had fewer mirrored repetitions, co-constructed sentences, and corrections and disagreements than friends and siblings, the only two stranger dyads who had none of these were those who recalled in uninterrupted monologues. All other stranger dyads had at least two mirrored repetitions, and approximately two-thirds of the other dyads had at least one co-constructed sentence or one correction and disagreement. Thus, most stranger dyads did use a range of collaborative processes when verbally recalling autobiographical events. In practicing these collaborative processes before collaborating on the word list, strangers may have learnt how to recall successfully with their partner, and then applied these lessons to the word list task. I found similarly high rates of category use, group strategy use, successful cues, mirrored repetitions, and unsuccessful cues in strangers, friends, and siblings in the Experiment 2 word list. Thus, although there were differences in the ways friends and siblings used collaborative processes compared to strangers in the autobiographical memory task, this was not the case in the word list. On the other hand, the word list may not have allowed dyads as much scope to collaborate as the autobiographical memory task, which may have eliminated the differences in collaborative processes between friends and siblings on the one hand, and strangers on the other. Nevertheless, the high rates of collaborative processes used in the word list task indicated that most dyads did collaborate effectively. The clear categories in the word list may have allowed more dyads to use a group strategy, cue each other successfully, and mirror each other regardless of their relationship or lack of prior acquaintance. This may be the reason collaborative inhibition was eliminated in the word list. Currently, little is known about the effects of repeated collaboration on collaborative recall, and whether groups become more effective with practice. Future research needs to investigate the role of prior collaboration on collaborative success.

The Difficulty of Matching Meaningful Tasks Across Relationship Groups

In order to ensure collaborative recall experiments are more ecologically valid, the paradigm must be extended to real-world groups recalling real-world stimuli (Barnier et al., 2013; Barnier et al., 2008). In doing so, researchers can better ascertain whether the effects of collaboration found in traditional collaborative recall experiments, which involve unacquainted groups recalling stimuli learnt during the experiment, apply in broader contexts. In the research described in this thesis, I attempted to bridge the gap between traditional collaborative recall experiments and more real-world collaborative recall experiments by using both acquainted and unacquainted groups as well as real-world stimuli and stimuli learnt during the experiment. This bridge is an important step in research on joint remembering (Barnier et al., 2013). However, it comes with methodological difficulties. In order to best observe how real-world groups collaborate when they recall real-world stimuli, the stimuli must match the kinds of remembering they perform in the real world, and thus must be relevant to their relationship and based on knowledge they share prior to the experiment. For example, tasks based on experiences they shared together or people they both know can best demonstrate how their shared knowledge may benefit their collaborative recall. However, basing recall tasks on these stimuli does not allow unacquainted groups to collaborate in the same way as acquainted groups, as they do not share experiences or know the same people. Further, in order to determine which factors produce the costs and benefits of collaborative recall, I needed to equate the tasks on which they collaborated. If each relationship performed unmatched tasks, I would not be able to determine whether the findings were due to the task itself or their relationships. In other words, strangers, friends, and siblings needed to perform equivalent tasks that also revealed the potential benefits of relationship on collaborative recall.

Thus, in comparing strangers, friends, and siblings, I faced a methodological difficulty of equating tasks across relationships while still ensuring the tasks were meaningful and relevant enough to allow friends and siblings to benefit from their shared history. In Experiment 1, I focused on ensuring friends and siblings performed meaningful tasks relevant to their relationship, rather than ensuring all three relationships performed the same tasks. This focus meant that I could not determine whether friends' and siblings' lack of collaborative inhibition in the self-generated tasks was due to their shared history or to the task itself. In Experiment 2, I gave strangers, friends, and siblings the same tasks, but used tasks that may not have allowed friends and siblings to benefit from their shared knowledge and history, as they did in Experiment 1.

However, shared knowledge does not necessarily come from shared experiences. Some experiences and knowledge are shared on a more cultural or societal level, through common experiences such as final high school exams (Barnier et al., 2008), or the media. News events are an example of shared knowledge gained through the media. For this reason, I asked strangers in Experiment 1 and strangers, friends, and siblings in Experiment 2 to recall news events. Although knowledge of most major news events is shared by society, this kind of knowledge is less relevant for already acquainted groups than knowledge based on shared experiences. Strangers are able to collaborate and even influence each other's memories for unshared events when these events are influenced by cultural norms and they share some knowledge about events due to cultural or social factors (Harris, Barnier, Sutton, & Keil, 2010), or potentially when those events are based on cultural life scripts (Berntsen & Bohn, 2009; Berntsen & Rubin, 2004).

In Experiment 3, friends and siblings recalled shared events, but strangers recalled two unshared events: one similar event, their most recent birthday celebration, and one potentially unique event, a significant event of their own choice (see also Barnier et al., 2008). As their events were unshared, I asked strangers to read each other's typed memories before collaborative recall to ensure they had some basis for collaboration. As they typed the events, I needed to ensure that the member of stranger dyads who experienced the event would not simply re-type the event without any input from their collaborating partner. If they had done so, the collaborative condition would have lacked a collaborative component. Allowing the stranger who had not experienced the event to read about it beforehand gave them the ability to aid their partner's recall. However, this method led to stranger dyads aiming to reproduce the original version of the typed event, rather than recalling the event itself during collaboration. Strangers' goal in this task was therefore quite different to friends' and siblings' goal. Unfortunately, my attempt to ensure strangers were able to collaborate on recall of autobiographical memories meant that they performed a different task to friends and siblings.

Even when events are unshared, they can still be recalled collaboratively, as the person who did not experience the event can use collaborative processes, such as cuing by asking questions based on their own experiences, scripts, or cultural expectations, to aid their partner's recall (Barnier et al., 2008). These cues may not be as specific or based on shared knowledge in the same way as those provided by someone who experienced the same event, but they may nevertheless aid recall. Thus, in Experiment 4, I did not provide details about the event to the stranger who did not experience the event. This method meant that strangers did not have any knowledge about each other's events, but they could still have input in collaboration. They were able to cue the memory owner with questions about the event or comment on what they said. Indeed, as stated above, most stranger dyads did use collaborative processes. Two stranger dyads recalled all of their events in a monologue without any input from the memory owner, but all other stranger dyads had at least one or two questions or comments by the stranger who had not experienced the event. However, cues based on open-ended questions may be less effective in aiding recall than cues grounded in shared knowledge. Whether the content of cues influences their effectiveness is an important question for future research.

Nevertheless, strangers still had a different task to friends and siblings. In stranger dyads, the memory owner had to explain the context, background, and who was involved. They were also the sole authority on the version of the event they recalled, as they were the only one who experienced it. In contrast, friend and sibling dyads described events they experienced together. Their shared knowledge meant they did not have to provide any context or background, and could simply name the people involved rather than explain who the people were. Thus, their shared remembering was embedded in their shared world outside of the experiment (Barnier & Sutton, 2008; Barnier et al., 2008; Harris, Barnier, et al., 2014). They also could endorse or correct their partner's input. These differences were reflected in the lower levels of person and place details, and the higher rates of mirrored repetitions, co-constructed sentences, and corrections and disagreements in friends' and siblings' recall compared to strangers'. These differences reflected real differences in their shared history, knowledge, and relationship.

There were other differences in strangers' collaborative recall of unshared autobiographical memories and friends' and siblings' collaborative recall of shared autobiographical memories, which occurred as a result of the difficulty in matching stimuli across acquainted and unacquainted groups. In Experiment 3, the types of events that strangers recalled were not necessarily the same kinds of events that friends and siblings recalled. Friends and siblings recalled events they shared, which meant their events were quite social in nature. In contrast, many of the events strangers recalled were quite individually focused and did not always involve peers. Thus, some of the differences in memory quality, such as pronoun use and emotion may have been because strangers recalled different kinds of events to friends and siblings. In Experiment 4, I asked strangers to recall events they experienced with a friend or sibling of their choice. They first chose a friend or sibling and then elicited events they shared with them, in the same way that friends and siblings elicited events they shared with each other. Thus, the events they recalled were equivalent. This equivalence meant that any differences between strangers' memory quality and friends' and siblings' memory quality must have been due to the person with whom they recalled the events. Thus, in Experiment 4, I could better differentiate the potential benefits of shared knowledge and experience, which are predicted by transactive memory theory (Wegner et al., 1991; Wegner et al., 1985), from the potential benefits of intimacy and acquaintance alone.

The Importance of Shared History and Knowledge in Shared Remembering

Across all of my experiments and case study, shared history and knowledge played a central role in the success of collaborative remembering, whether it was in recalling list-based stimuli or in recalling autobiographical events. The lack of collaborative inhibition I found suggested that shared history and knowledge aided collaborative friends and siblings in recalling a list of mutual friends and acquaintances and a list of shared events (social events and holidays) in Experiment 1. Shared history and knowledge are important because according to transactive memory theory (Wegner, 1987; Wegner et al., 1991; Wegner et al., 1985), it is through shared history that people in intimate relationships can come to share knowledge, by distributing among them the encoding, storage, and retrieval of information. In doing so, people in intimate relationships can remember more or more richly when they are together than when they are apart. My above findings support this claim. In my research on process, I found many instances in which friends and siblings (and more rarely, sometimes even strangers) were able to structure their recall in a way that allowed them to access information they may not otherwise have recalled. For instance, in the "squishy apartment" example I gave in the opening of Chapter 1, one sister was eventually able to cue her sister to recall the name of their great aunt, which was not easily accessible to either sister, and thus would most likely not have been recalled had they not collaborated.

The example of the two sisters demonstrates how shared history and shared knowledge impact not only the product, but also the process of collaborative recall. Shared history led friends and siblings to have a more back-and-forth collaboration style with more equal input between dyad members than strangers. Shared history meant that friends and siblings had more equally distributed expertise than strangers in the tasks that were based on their shared history. This expertise was reflected in the process of shared remembering. Friends' and siblings' shared history, shared knowledge and shared identity led to their greater use of mirrored repetitions, and corrections and disagreements in all tasks, and greater use of co-constructed sentences in autobiographical event recall. Strangers, on the other hand, had unequally distributed expertise in many cases, such as when they recalled autobiographical events in Experiment 4. Harris et al. (2011) found that even among older couples who had been married for decades, unequally distributed expertise led to longer monologues during autobiographical memory recall. Thus, genuinely collaborative shared remembering requires a more balanced expertise between the conversing partners, or at least differentiated but complementary expertise. The differences in strangers' collaborative processes compared to friends' and siblings' when recalling autobiographical memories may be due to this factor as much as intimacy or the number of years dyads had known each other prior to the experiment.

The pattern of mirrored repetitions and co-constructed sentences was very similar, as dyads who had many mirrored repetitions also had many co-constructed sentences. These two collaborative processes appeared to do similar work in the collaborative recall of shared and unshared autobiographical memories. Mirrored repetitions are more than mere acknowledgements. Mirrored repetitions indicate mutual understanding and establish common ground, and are often followed by elaborations and additional information (Clark & Bernicot, 2008; Harris et al., 2011; Meade et al., 2009; Svennevig, 2004). Meade et al. (2009) found that novice pilots and non-pilots who showed collaborative inhibition, tended to use simple acknowledgements such as "yeah" or "OK". In contrast, expert pilots who showed collaborative facilitation, tended to use mirrored repetitions. Co-constructed sentences require shared knowledge and a certain level of intimacy (Bogetic, 2011; Leung, 2009). Without this level of intimacy, co-constructed sentences could be interpreted as impolite interruptions.

However, between intimate speakers, co-constructed sentences and mirrored repetitions reinforce rapport and solidarity (Bogetic, 2011; Norrick, 1997). Thus, shared identity also plays a role in co-constructed sentences, as co-constructed sentences are instances of two speakers speaking for "us" rather than one speaker speaking for "me" (Norrick, 1997). These factors demonstrate how shared history, intimacy, and shared knowledge impact shared remembering.

Despite all of the above differences between friends' and siblings' processes and strangers' processes, across all of my studies I found similarities in the rates of cuing across relationships. Based on transactive memory theory (Wegner, 1987; Wegner et al., 1991; Wegner et al., 1985), I expected friends and siblings to cue each other more often or more successfully than strangers. Friends and siblings could use their shared history to cue each other for specific information they had difficulty accessing or knew their partner would know. However, I found strangers cued each other as often and as successfully as friends and siblings. Thus, certain types of cuing do not necessarily require shared knowledge or history, as strangers can cue each other by asking questions in a probing, exploratory manner, or use their own similar experiences or shared cultural knowledge to cue each other in more specific ways. Cuing and similar collaborative processes can therefore potentially be learnt or influenced by practice and experience. Perhaps for this reason, amount of shared history did not appear to influence the amount or the success of cuing in my research. However, the success of cuing may depend on the type of cue itself. As I did not distinguish between open-ended and more specific, content-rich cues in my research, the success of cuing based on the type of cue needs to be examined more directly in future research.

In order to determine the importance of shared history and shared knowledge in shared remembering, it is necessary to tease apart the impact that shared history and shared knowledge play. In sharing history, people can come to share knowledge, but this is not the only shared knowledge that can be acquired. Hence strangers, who had no shared history, shared knowledge in the word list and some broadly, culturally shared knowledge in the news event list (similar to Harris et al., 2010). According to Wegner (1987; Wegner et al., 1991; Wegner et al., 1985), to benefit from transactive memory people need more than shared knowledge; shared history is required to build up the knowledge of how shared and unshared information is distributed among members of the remembering system. However, I found that strangers were able to capitalize on their shared knowledge in the word list without shared history. Thus, for tasks such as word lists, which are not based on shared history, shared knowledge may be enough to aid collaborative recall. It is possible that more difficult tasks than a word list may differentiate between cuing based on shared history and cuing based on shared knowledge alone.

For more ecologically valid tasks based on knowledge prior to the experiment, the importance of shared history may depend on the extent to which the task is steeped in that shared history. When it came to recalling mutual friends and acquaintances as well as shared social events or holidays, which were based on both shared knowledge and shared history because they were experienced together in a deliberate, meaningful way, both of these factors together allowed friends and siblings to collaborate more successfully. When it came to recalling each dyad member's social circles, friends' and siblings' knowledge was less integrated and more distributed, and they were less able to benefit from their shared history in this task than the mutual friends and acquaintances task. However, the fact that siblings benefited from having greater overlap in their social circles supports the role of shared history in this task, even if it was not enough to overcome collaborative inhibition. When it came to recalling news events, which were self-generated based on knowledge already known prior to the experiment, partially shared knowledge and shared history were not enough for strangers, friends, or siblings to benefit in ways predicted by transactive memory theory. Thus, shared history and shared knowledge aid tasks only when the tasks are steeped in that shared history and knowledge.

Shared history and knowledge also may not be sufficient to benefit intimate dyads and groups. In order for shared knowledge to be accessed, dyads need to communicate in a way that promotes access to shared knowledge (Ren & Argote, 2011; Wegner, 1987; Wegner et al., 1991; Wegner et al., 1985). Through shared history, intimate groups not only come to share knowledge, but also learn how to communicate to better access that shared knowledge. Shared history, intimacy, shared task-relevant knowledge, and communicative practices are, thus, all distinct but interrelated factors. For instance, it is well established that the manner in which parents and children communicate about their shared and unshared past shapes not only children's recall of the events being discussed at the time, but also their recall of other events later in childhood and adolescence (Fivush, 1994; Fivush et al., 2006; Fivush & Nelson, 2006; Jack et al., 2009; Reese & Fivush, 1993, 2008; Reese et al., 1996; Reese et al., 2010). When parents, particularly mothers, discuss the past with their young children using a more elaborative reminiscing style, their children recount richer autobiographical memories at the time, later in childhood, and into adolescence (Fivush, 2011). Children whose parents adopt a less elaborative reminiscing style begin with memories similar to children whose parents adopt a more elaborative reminiscing style, but the latter learn techniques to access their knowledge about these shared events more effectively, and these techniques continue to scaffold their autobiographical remembering when they later remember alone (Fivush, 2011a; Fivush et al., 2006; Jack et al., 2009; Reese et al., 1993). Thus, the process by which dyads discuss the past and the techniques dyads use to aid each other's recall have a substantial impact on the success of their recall. Intimate dyads, whether they are parents and children, siblings, or romantic couples, have a history of remembering their shared and unshared past together. In this way, shared history is not only beneficial in terms of accruing shared knowledge, but also in terms of developing techniques to aid intimate dyads' collaborative remembering. It is for this reason that I examined the process, not just the product, of collaborative remembering across all of my studies, which I discuss in more detail below.

Shared history, intimacy, and shared identity. Shared history is not the only characteristic that separates friends and siblings from strangers and that may impact their shared remembering. Intimacy and shared identity are also important aspects of close relationships that are likely to influence collaborative success. Intimacy and shared identity are both factors related to relationship closeness. However, whereas intimacy concerns feelings of emotional closeness, liking, and behaviours related to time spent together in shared activities, shared friends, and mutual self-disclosure (Bauminger et al., 2008; Berg & Archer, 1983; Schaefer & Olson, 1981), shared identity is the perception of a close other existing within the bounds of the self (Aron, 2003; Aron & Aron, 1986; Aron et al., 2004; Brewer, 2007; Brewer & Gardner, 1996). Thus, two people can be intimate in various ways, but may not necessarily perceive themselves as a “we”, as in a shared identity. Conversely, two people may perceive each other to be closely bound into a shared identity, but be quite distant in terms of intimacy, such as in the case of the twins I describe in the next paragraph. In Experiment 2, I found that high emotional and intellectual intimacy (Schaefer & Olson, 1981) were associated with better collaborative success in the social circle list. In my case study, I found that both shared identity and intimacy ratings were associated with collaborative performance, such that sibling dyads who rated their shared identity as stronger and their intimacy as higher were also more successful in their shared remembering of autobiographical events they experienced together. Thus, in positive relationships at least, intimacy and shared identity can both support collaborative remembering.

However, intimacy and shared identity may impact autobiographical memory of shared events differently. Although it is not fully reported in this thesis, over the course of my research I conducted pilot interviews with a pair of identical female twins who were aged 59 years and had both experienced great success in their careers. When I interviewed them individually about their lives, they showed evidence of a strong shared identity but with very low intimacy. Based on memories of their childhood and description of their relationship in adulthood, their low intimacy appeared to be partly due to a shared identity that was forced on them by their parents, which they did not generate themselves. For instance, one twin recalled their early lives with the protagonist of the events being “we” instead of “I”. Her pronoun use thus suggested they had a strong shared identity. However, she described their relationship as competitive, and even said in reference to experiencing the death of their parents together, "I never once would've allowed myself to cry or be emotional in front of my sister. Never let down your guard. That is still my motto." Thus, they appeared to have very low intimacy, reported little contact with each other and almost never spoke together about the past. Despite their low intimacy and contact, more than once they both spontaneously recalled the same childhood events. Each twin recalled the events in slightly different ways but used the same specific events from their childhood to make the same points. These twins lived their lives with a much greater need for differentiation (Whiteman et al., 2007) than other twins because their shared identity was forced on them by others. Thus, unlike intimacy, shared identity is not necessarily positive, as it can be a feature even of dysfunctional interpersonal relationships. The important point is that the shared identity serves to cultivate a positive sense of self more broadly (Tajfel & Turner, 1979). In this way, intimacy and shared identity are distinct constructs. However, in less extreme cases, the two constructs may be harder to separate in terms of their effects, as they are both indexing forms of "closeness". Therefore more research is required before the effects of intimacy and shared identity on autobiographical memory of shared events can be clearly delineated.

Talking about the past with siblings may reinforce identification and differentiation between siblings. Across my studies, I found that siblings could tolerate a great deal of conflict in their memories, as shown by their successful recall despite many corrections and disagreements. Although disagreements previously have been shown to lead to poorer recall in older couples (Harris et al., 2011), the siblings in my studies and to a lesser extent, the friends, were resistant to the potential negative impact of disagreements on collaborative success. Disagreements about the past can highlight siblings' unshared perspectives and opinions about the past. In couples, these differences may weaken their efforts to maintain intimacy and shared identity. However, in siblings, these different perspectives may reinforce their identities as individuals. Thus, the relationship between shared identity and shared autobiographical memories, as well as the product and process of remembering together, are influenced by differences in the balance of optimal distinctiveness (Brewer & Pickett, 2002) in different kinds of relationships.

Individual Differences Outweigh Group Differences

Across all my studies, I found more similarities among the already acquainted dyads of different relationships than I expected. I also found more individual differences across dyads than the larger relationship groups, such that one sibling dyad may recall more similarly to a friend dyad than another sibling dyad. The manner of friends', siblings', and twins' recall was less influenced by the kind of relationship they had than by the unique characteristics of their relationship, personalities, and shared history. Chapter 6 suggested that any differences between twins' and siblings' collaborative recall and shared remembering were minimal at best. In my case study I found that even among the same three participants, two sibling dyads were more different from each other than from the twin dyad in terms of their intimacy, shared identity, and shared remembering. These findings mirror those of Harris et al. (2011) regarding older couples' shared remembering. In their study, some couples demonstrated collaborative inhibition whereas others demonstrated collaborative facilitation. The success of couples' shared remembering was almost entirely predicted by the collaborative processes they used. In Barnier et al. (2014), the success of younger couples' collaborative and individual recall of shared events was influenced by their intimacy. Thus, the benefits of shared remembering appear to reflect subtle factors including each dyads' unique shared history, intimacy and shared identity, as well as factors relating to each individuals' personality and individual histories. These subtle differences mean two things. First, two dyads may remember together very differently, even though they may have the same kind of relationship, for instance, they may both be friends. Second, two dyads may remember together in a similar way, even though they have different kinds of relationship, for instance, one dyad may be friends and the other, siblings.

The relationship characteristics outlined in Chapter 1 that differentiate friend relationships from sibling relationships, and sibling relationships from twin relationships, do not appear to translate into meaningful systematic differences in their collaborative recall or shared remembering. For instance, even though siblings had longer shared history than friends, they showed similar benefits of collaboration. Across my experiments, friends had known each other for an average of nearly six years, ranging from one year to more than 19 years. My youngest sibling participants were 18 years old, so 18 years was the minimum amount of time siblings had known each other. The only time when siblings showed more benefits of collaboration than friends was in the length of their recall of shared events in Experiment 4. Siblings showed costs of recalling individually and benefits of recalling collaboratively, but friends did not. On the other hand, friends showed similar benefits of collaboration to siblings in terms of vividness and similar costs of collaboration in terms of emotionality. Overall, friends' and siblings' collaborative recall of lists and autobiographical events was remarkably similar. Thus, the difference in the years of shared history between friends and siblings did not substantially impact their shared remembering. One reason for this finding may be that recent shared history may be more important for successful collaborative recall and shared remembering than early shared history. Another reason could be that young adults' shift away from the family means that the time spent with close friends is more important than time spent with siblings (Conger & Little, 2010). When they remember together, close friends' higher intimacy compared to siblings may make up for their shorter shared history. Finally, the strength of friend and sibling dyads' intimacy or shared identity may play a greater role in their shared remembering than the unique characteristics of each type of relationship. In my studies, I only looked at the impact of intimacy (as measured by the PAIR Inventory) on dyads' shared remembering within, not across, relationship types. Investigating whether intimacy impacts shared remembering across relationship types may reveal that the strength of intimacy is a factor in shared remembering that plays a role over and above relationship type.

The major differences I found were between the already acquainted dyads and strangers. Strangers showed more costs of collaboration than friends, siblings, and twins. On the other hand, friends, siblings, and twins showed as many benefits of collaboration as each other. This pattern suggests that the amount or type of history and intimacy shared between two people does not influence the product and process of their shared remembering as much as merely having shared history and knowledge to draw on. More work needs to be done to determine the amount and kinds of shared history, shared knowledge, intimacy, shared identity, and combinations thereof required for people in close relationships to benefit in the ways predicted by transactive memory theory (Wegner, 1987; Wegner et al., 1991; Wegner et al., 1985).

The Importance of Process in Collaborative Remembering

In order to understand collaborative remembering, it is necessary to investigate from various angles. In all of my studies, I not only analysed the product of recall, as is typical of experiments on collaborative recall and shared remembering (Barber et al., 2010; Harris et al., 2013; Rajaram & Pereira-Pasarin, 2010; Ross et al., 2004), but I also probed transcripts of dyads recalling collaboratively for the processes of collaboration, whether they varied with relationship, and whether they impacted the product of recall. Investigating the processes of collaboration is necessary to understand the product of collaboration (Meade, 2013). When comparing strangers, friends, and siblings, process was especially important because I hypothesized that collaborative processes would be different for dyads in different relationships. If so, it would mean that any differences in strangers', friends', and siblings' product may be due to differences in process, rather than directly due to their relationships.

Across my experiments, I sought to determine whether the collaborative process factors revealed by Harris et al. (2011) applied in a similar way to strangers, friends, and siblings. In their study, Harris et al. found that certain collaborative processes were associated with costs (Factor 1), and some were associated with benefits (Factor 2) of collaborative recall in older couples. In the coding scheme that I outlined in Chapters 2 and 3, I hypothesized four processes to be akin to Factor 2 (category use, group strategy use, successful cues and mirrored repetitions), and three processes akin to Factor 1 (individual strategy use, unsuccessful cues, and corrections and disagreements). In Chapters 3 and 4, my hypothesized Factor 1 processes were unsuccessful cues, and corrections and disagreements, and my hypothesized Factor 2 processes were successful cues, mirrored repetitions, and co-constructed sentences. However, I did not find the same associations in young adult strangers, friends, and siblings as Harris et al. found in older married couples. In Experiments 1 and 2, the use of hypothesized Factor 1 processes did not appear to have a negative impact on recall, as dyads who used them did not recall less than those who did. In Experiment 4, I found that all collaborative processes contributed to word count. Taken together, my findings regarding collaborative processes suggest less of a distinction between Factor 1 and Factor 2 processes in strangers, friends, and siblings than in couples. In particular, I did not find any evidence of collaborative processes having a negative influence on the product of collaborative recall. Instead, most collaborative processes appeared to have a positive or neutral influence on the product of collaboration for these groups.

Like other studies measuring strategy use in collaborative recall (Harris et al., 2013; Harris et al., 2011), I found evidence that a group strategy led to collaborative success. In Experiments 1 and 2, most collaborative dyads used categories to structure recall. Group strategies were more common than individual strategies in most tasks. Strategy use reflected the pattern of findings regarding collaborative inhibition. In tasks that resulted in collaborative inhibition, including strangers' news event list in Experiment 1 and the social circle task in Experiment 2, I found lower rates of group strategy use and higher rates of individual strategy use. Thus, in tasks in which dyads were less able to coordinate their recall strategies and relied on their own individual strategies, dyads had less collaborative success in terms of product. Several studies have demonstrated the benefits of using a group strategy on collaborative recall. Harris et al. (2011) found that older married couples who used a group-level strategy to recall a word list showed collaborative facilitation, whereas those who did not use a group-level strategy showed collaborative inhibition. Similarly, Harris et al. (2013) found that the number of triad members who reported using a group-level strategy to recall a word list correlated positively with the number of words they recalled. My results in Experiments 1 and 2 reinforce these findings to demonstrate the benefits of group strategy use on collaborative recall success and the importance of measuring strategy use in collaborative recall experiments.

Corrections and disagreements are a particularly interesting example of a Factor 1 process that did not hinder recall, as they highlight how friends' and siblings' relationships differ from each other's and married couples'. Specifically, as noted above, differences in each relationship's optimal distinctiveness can explain why siblings had more corrections and disagreements than friends and why corrections and disagreements did not lead to the same costs in these groups as in married couples (Harris et al., 2011). Optimal distinctiveness is the balance between the need to be the same as (identify with) and the need to be distinct from (differentiate from) others, and may differ for each person and each relationship (Brewer, 2007; Brewer & Gardner, 1996). Siblings' need for differentiation is well documented, and may play a more central role in their relationships than their need for identification (Whiteman et al., 2007; Wong et al., 2010). On the other hand, people seek friends who are similar to themselves (Ueno & Adams, 2006), meaning that identification may be more important to friends than to siblings. Married couples have committed to being partners for life and so identification and their shared identity may be far more important to them than to friends and siblings. Siblings' need for differentiation may mean that they are more able to tolerate different accounts or perspectives on the past. Although some siblings were quite passionate in their corrections and disagreements about past events, in many cases, they left the argument unresolved. For instance, Sarah and Nat, the twins in my case study, disagreed over how much faster Nat finished a charity run compared to Sarah. They were happy to let go of the disagreement and continue with their recall of the event, even with the remaining ambiguity.

N: I finished quicker and I got it over and done with quicker. (laughs)

S: Like five minutes! (laughs)

N: That's like two K (pause) One K maybe.

S: Still!

N: Anyway. I was still waiting for you at the finish line.

S: We ran, it was a six K run, so we ran around like [Town].

N: After, after that I didn't see her to the end so, I went ahead and then I when I got to the finish line I waited, I got some water and then I saw her not long after.

S: Yes.

In fact, disagreements about the past may help siblings to establish their own individual identity outside of their family, especially in the young adults in my studies (Cicirelli, 1995; Conger & Little, 2010; Goetting, 1986). On the opposite end of the spectrum, disagreements in long-married couples' recall of their shared past may undermine the partnership and shared identity they have spent decades building (Barnier et al., 2014; Harris, Barnier, et al., 2014; Harris et al., 2011). The possibility that identification is more important to friends than to siblings may explain why friends sometimes had fewer corrections and disagreements than siblings. The fact that people tend to have multiple friends may mean that friends have less need to establish a partnership and protect their shared identity than married couples, which may explain why disagreements about their shared past may be less costly for friends than for married couples.

It may also be the case that married couples are especially susceptible to the costs of corrections and disagreements compared to other groups. Indeed, although strangers had very few corrections and disagreements, they were no more susceptible to the costs of corrections and disagreements than friends and siblings. Meade et al. (2009) found that expert pilots, who showed collaborative facilitation, also corrected each other more often than novice pilots or non-pilots, who showed collaborative inhibition. Expert pilots had more knowledge about the aviation scenarios they were recalling, and so were able to correct each other more than novice pilots or non-pilots. In a similar way, friends' and siblings' higher rate of corrections and disagreements in recall of shared autobiographical events reflected their equal knowledge and ability to correct each other. Thus, the impact that corrections and disagreements have on collaborative success may reflect the nature of the groups being compared in each study. Meade et al. and my studies compared experts with non-experts, but Harris et al. (2011) predicted collaborative success within a group with comparatively similar levels of expertise. It may also reflect differences in the goals, function, and intimacy requirements of different kinds of collaborative groups (Alea & Bluck, 2007; Brewer, 2007; Conway, 2005; Hyman et al., 2013). Harris et al.'s married couples were also much older than the strangers, friends, and siblings in my studies and the pilots in Meade et al.'s (2009) study. Thus, it could be their older age, rather than their relationship per se, that made disruptions to recall especially costly for these married couples.

Friends' and siblings' higher rates of corrections and disagreements, mirrored repetitions, and co-constructed sentences compared to strangers' mirrors findings by Gupta and Hollingshead (2010) in their study looking at how the structure of transactive memory systems influences the process of collaboration in a memory and a non-memory task. They asked participants to report the group processes they used during the task in a post-collaborative survey. Groups with more integrated knowledge (shared by all group members) than differentiated knowledge (known only by one group member) reported that they corrected each other's errors, helped each other, and "worked together" more than those who had more differentiated knowledge. Friends and siblings had more integrated knowledge than strangers in all of my experiments, but especially when they recalled autobiographical memories. Although I did not code for different kinds of corrections and disagreements, not all corrections and disagreements in my transcripts were error corrections; often they were disagreements over details in which neither partner conceded the other was correct, and sometimes they were disagreements over how to perform the task. Nevertheless, the higher rates of corrections in my studies were likely to be caused by similar reasons to those in Gupta and Hollingshead's study. Error corrections require both partners to have knowledge about what was corrected, which may be why Gupta and Hollingshead found higher rates in groups with more integrated knowledge. Similarly, friends and siblings in my studies had more shared knowledge than strangers, which may be one reason why they showed more corrections and disagreements compared to strangers.

Mirrored repetitions and co-constructed sentences could be considered helping behaviour and "working together" (Gupta & Hollingshead, 2010) because they both are instances in which one partner not only validates the other partner's contribution, but also adds extra information to extend their partner's contribution. These processes can only be used effectively in cases where collaborative partners have integrated knowledge. Strangers and people with highly differentiated knowledge are less able to validate each other's contributions, work together, and help each other. Thus, my findings on collaborative processes fit with the idea that people in close relationships have integrated or shared knowledge, and that through their shared history people in close relationships can develop the ability to share the encoding, storage, and retrieval of knowledge (Wegner, 1987; Wegner et al., 1991; Wegner et al., 1985). Thus, in transactive memory research, process is as important as product.

Theoretical Implications

Transactive Memory

As the above discussion shows, my research confirmed the central role of communication in transactive memory (Barnier et al., 2014; Gupta & Hollingshead, 2010; Harris, Barnier, et al., 2014; Hollingshead, 1998a, 1998b). Via certain collaborative processes, such as cuing, mirrored repetitions, and co-constructed sentences, dyads were able to help each other recall both shared and unshared knowledge. Interestingly, although cross-cuing is often given as an example of a communicative process through which groups can remember more together than they remember separately (Barnier et al., 2014; Harris, 2010; Meudell et al., 1995), I found that cuing did not rely on shared knowledge and history to the same extent as other collaborative processes. Across all of my studies, I found that strangers cued each other as successfully and as often as friends and siblings. People with shared history or shared expertise may be able to produce richer and more specific cues that are more informed by shared knowledge and more focused towards a particular piece of information than strangers, whose cues may be more open-ended (Barnier et al., 2014; Meade et al., 2009). However, strangers' open-ended cues were as successful in eliciting information as friends' and siblings' richer, more specific cues. Future research may need to differentiate between the different kinds of cues in intimate and stranger dyads and groups to determine whether intimate dyads' cues are indeed richer and more focused than stranger dyads' cues, and whether the effectiveness of each type of cue depends on intimacy, shared knowledge, and shared history. For instance, more open-ended cues may lead to collaborative success in strangers but may not be sufficient to provide the same benefits in intimate dyads. Thus, my research validates the fundamental role that communication plays in transactive memory theory, but future research is required to understand the particular mechanisms by which communication allows people in intimate relationships to share the encoding, storage, and retrieval of information.

Although most research on transactive memory has focused on organizational applications of the theory, my research supports Wegner's concept of transactive memory in intimate relationships (Wegner et al., 1991; Wegner et al., 1985). When recalling lists of shared knowledge and memories of shared events, collaborative friend and sibling dyads showed fewer costs of collaboration than stranger dyads. Thus, friends' and siblings' shared history, shared knowledge, intimacy, and history of recalling the past together benefited their collaborative remembering. Similar to Gupta and Hollingshead (2010), my research demonstrated the importance of integrated knowledge over differentiated knowledge in collaborative success. Friends and siblings benefited most from their shared knowledge, intimacy, and prior experience in recalling the past together when the tasks involved more integrated knowledge and less differentiated knowledge. For instance, when friends and siblings recalled mutual friends and acquaintances (Experiment 1), their collaborative recall was more successful than when they recalled each of their individual social circles (Experiment 2). The latter task involved both integrated and differentiated knowledge, but the former task was based almost entirely on integrated knowledge. The benefits of shared history and knowledge were most apparent when it came to recalling richer information such as shared autobiographical events compared to recalling lists or information less embedded in their shared experience. Recalling shared events may better capture the kind of shared remembering that people in intimate groups recall together in their everyday lives. Among the three unmarried sisters who I described in Chapter 1, it was their remembering of shared autobiographical events that revealed their transactive memory practices (Davies, 2010). Shared autobiographical memories may strongly reveal benefits of shared history, shared knowledge, and intimacy because they tap into the functions of shared remembering by intimate dyads more generally.

Functions of Autobiographical Memory

In Chapter 1, I argued for the importance of social functions of autobiographical memory (Bluck & Alea, 2011; Bluck et al., 2005; Harris, Rasmussen, et al., 2014). I argued that recalling autobiographical events in social settings is a primary function of autobiographical memory as it aids in establishing and maintaining relationships by facilitating conversation and building intimacy (Alea & Bluck, 2007; Alea & Vick, 2010; Bluck & Alea, 2009). My research supports this claim, especially when it came to verbal recall of autobiographical events. Dyads recalled the events more vividly than individuals, indicating that autobiographical events are more easily recounted in a social setting. Thus, I found benefits of collaboration when recalling events with a friend or sibling who also experienced the event, reinforcing the idea that recalling shared events maintains intimacy in already existing relationships. So far, this function primarily has been found in romantic couples (e.g. Alea & Bluck, 2007), and parents and children (Fivush, Bohanek, & Duke, 2008; Fivush & Waters, 2013). My research validated this function in friends and siblings. I also found benefits of collaboration when recalling events with a stranger who had not experienced the event, reinforcing the idea that recalling unshared events establishes intimacy in new relationships (Bluck, 2003; Bluck & Alea, 2011). Together, these findings support the idea that people tend to recall autobiographical events in social settings more often than they recall individually for self-continuity, as Bluck and Alea (2009) found in their study of self-rated use of social, self-continuity, and directive functions.

My case study showed how recalling shared events can maintain intimacy in sibling relationships. The unique relationships among James, Sarah, and Nat were apparent in the way they recalled shared events together. In this in-depth case study, I was able to see how closely intertwined siblings' intimacy and shared identity are with the kinds of events they experience together, and with the way they recall together. The high intimacy between James and Nat was reinforced in their recall of events they experienced with one or two other friends. The lower intimacy between James and Sarah was reinforced in their stilted shared remembering of events they experienced with their family as a whole. When all three siblings recalled together as a triad, their unique relationships still had an impact, but less so, as their relationship as a threesome was now maintained. In this way, shared remembering maintains relationships on two levels: one-on-one relationships between each dyad of siblings and an overarching family relationship.

As I argued in Chapter 1, autobiographical memory not only includes memory for events, but also includes personal semantic memory. Personal semantic memory includes autobiographical knowledge, knowledge about the self, and other self-relevant information (Grilli & Verfaellie, 2014; Renoult et al., 2012). Thus, friends' and siblings' people and event lists in Experiment 1 (mutual friends and acquaintances and shared social events or shared holidays) and the social circle list in Experiment 2 are both autobiographical memory tasks. Most research on the functions of autobiographical memory has focused on episodic event memory, although this is not always explicitly acknowledged (Bluck, 2003; Bluck & Alea, 2009, 2011; Harris, Rasmussen, et al., 2014). However, recalling semantic autobiographical information may serve similar functions to those described above. For instance, talking about mutual friends may help to maintain intimacy between two friends. Friends and siblings may not need to discuss the episodic details of shared events or holidays to reap the intimacy benefits of autobiographical memory. Establishing new relationships with strangers often involves the exchange of autobiographical facts in an attempt to find common ground before discussing more complex topics, such as the episodic details of autobiographical events (Berger & Calabrese, 1975; Planalp & Benson, 1992). However, there remain ambiguities in the literature concerning the potential social functions of recalling episodic autobiographical memories versus personal semantic autobiographical information.

Shared Identity and Shared Autobiographical Memory

One function of autobiographical memory that I found particularly relevant is maintaining a shared identity in friends and siblings by recalling shared autobiographical memories. Shared identity is more than mere intimacy. It is the perception of a close other within the boundaries of the self, creating a "we" identity, which encompasses both individuals and emphasizes their togetherness over their individuality (Andersen & Chen, 2002; Aron, Aron, Tudor, et al., 1992; Brewer & Chen, 2007; Brewer & Gardner, 1996). In Chapter 1, I proposed that if autobiographical memory is closely intertwined with perceptions of identity on an individual level (Conway, 2005), then the autobiographical memories we share with close others might also be closely intertwined with perceptions of a shared identity. This extension of Conway's (2005) framework to a shared identity can be considered the point at which the self and social functions of autobiographical memory intersect. People in close relationships are motivated by the goal to maintain a shared identity with family members, close friends, and romantic partners (Aron, Aron, Tudor, et al., 1992). In contexts where this goal is made salient, such as when recalling a shared past with close others, shared identity may become more apparent. It was for this reason that I analysed the use of "I" and "we" pronouns in individual versus collaborative autobiographical remembering. I expected that if friends, siblings, and twins had a strong shared identity, they would use "we" pronouns more often when they collaborated on recalling autobiographical events than when they recalled them individually, and that this would not extend to strangers. Although a higher use of “we” versus “I” pronouns seems to imply group identification over individual identification and vice versa (Pennebaker, 2011), the use of “I” and “we” pronouns may not be the most accurate way to measure shared identity, as their use may depend on the task or the autobiographical events being described. I did not find consistent, systematic differences in pronoun use between strangers and acquainted dyads, or between collaborative and individual friends, siblings, and twins. Instead, I found that pronoun use varied greatly among dyads, which may depend on individual differences in the strength of their shared identity, their intimacy, their personalities, and the events themselves.

In Chapter 6, I discovered that pronoun use depended considerably on these factors, as the sibling dyads' use of “we” versus “I” pronouns differed according to their unique relationships as well as the features of the events they recalled, such as the involvement of other family members or friends, and the siblings' roles in the events. In my experiments, each friend, sibling, and twin dyad may have differed enormously on each of these factors, which may then have obscured the effect of social context on the salience of shared identity and, thus, pronoun use. I may have found more consistent differences in pronoun use if I had compared the same friend, sibling, and twin dyads recalling the same events either separately or collaboratively, with collaborative condition as a within-subjects variable. Nevertheless, in my reanalysis of Experiments 3 and 4 in Chapter 6, I found that twins used “we” more and “I” less than other siblings, suggesting they had a stronger shared identity than siblings. In discussing individual differences below, I discuss how the salience of shared versus individual identity could be more thoroughly investigated in future studies.

Limitations and Future Research

Lack of Collaborative Inhibition

Although collaborative inhibition is found more often than not in strangers’ recall of word lists, as noted above, I eliminated collaborative inhibition entirely in both of my word list tasks. Dyads’ collaborative success appeared to be partly due to their use of collaborative processes. I predicted that friends and siblings might be better able to use collaborative processes to aid their recall because of their history of shared remembering and knowledge of each other. However, the question remains why even stranger dyads used the collaborative processes that aided their collaborative success. I found that the Transactive Memory Scale (Lewis, 2003) did not adequately explain collaborative success or failure in my dyads. I also found that intimacy as measured by the PAIR Inventory (Schaefer & Olson, 1981) only partially predicted friends' and siblings' performance on their recall of mutual friends and acquaintances. Thus, I was unable to explain what made my dyads (across all kinds of relationships) use group level strategies instead of individual strategies, for instance. Most studies on the process of collaboration also do not answer the question of what makes some dyads collaborate in a manner that aids or hinders their recall, although there is some indication that expertise leads some dyads towards more successful strategies (Harris et al., 2011; Meade et al., 2009). In my studies, collaborative inhibition or lack thereof was not predicted by expertise about the other dyad member, as strangers were as successful as friends and siblings. Thus, future research needs to explore the factors that lead to dyads' use of processes that aid or hinder their collaborative recall. Nevertheless, my studies do go some way further than traditional collaborative recall studies (Rajaram, 2011; Rajaram & Pereira-Pasarin, 2010) to explain how the collaborative success or failure in terms of product can be engendered by the manner in which groups collaborate. Other possible ways to do so include detailed assessments of expertise, personality assessments, and measures of group dynamics, motivation, or liking between participants.

The methods I used in Experiment 2 may have impacted on the costs and benefits of collaboration across tasks. In the word list, in which I eliminated collaborative inhibition, I gave participants no time limit. In the social circle and news event tasks, in which I did find collaborative inhibition in all relationships, I gave participants two minutes to recall as many items as possible. This method meant that collaborative dyads had two minutes and nominal dyads had four minutes in total to recall as many items as possible. I timed all self-generated lists to ensure some dyads or participants did not generate more items because they took more time. However, I found that some collaborative dyads were unable to say all the items they could recall in the time they were given, especially in the social circle task. This difficulty may have inflated the amount of collaborative inhibition I found because I did not find the same in nominal dyads. In order to address the unequal time in Recall 2 for nominal and collaborative dyads, in future research I would remove the time limit to ensure collaborative dyads have as much time as nominal dyads to recall items. If removing the time limit removed collaborative inhibition, it would be evidence against the robustness of collaborative inhibition. These small differences in task requirements may have, therefore, impacted on my findings (Hyman et al., 2013), indicating how reliant on methodological choices experimental findings such as collaborative inhibition are when dyads are asked to perform tasks in the laboratory. Thus, in order to explore how people recall collaboratively outside of the laboratory, we need to be aware of how these small changes may influence findings, and take care to design tasks that mirror everyday memory practices as closely as possible.

My pattern of collaborative inhibition across tasks may suggest the possibility that self-generated lists may be more prone to retrieval disruption than experimenter-provided lists, particularly in strangers. According to the retrieval disruption explanation of collaborative inhibition, when two or more individuals recall collaboratively, they disrupt each others' individual retrieval strategies (Barber et al., 2010; Basden et al., 1997; Congleton & Rajaram, 2014; Rajaram, 2011). The self-generated lists in my studies differed from the word list in other ways, such as how embedded the items were in their everyday lives, how much shared knowledge they involved, the size and composition of categories, and how self-relevant they were. The fact that they were self-generated may have influenced the extent to which they relied on individual retrieval strategies.

Retrieval disruption is greater when the group members have very different strategies for retrieval and recall items in very different orders to each other (Congleton & Rajaram, 2014). Some of my tasks, such as friends' and siblings' mutual friends and acquaintances, relied almost entirely on shared knowledge, and items were likely to be retrieved in similar ways by each dyad member, possibly making group strategies easy to implement. These tasks may be less prone to retrieval disruption than other tasks. However, tasks such as news events involve knowledge that may be strongly influenced by individuals' daily habits, personality, and interests. These tasks may rely very strongly on individual retrieval strategies, and this reliance may be stronger when group members originally elicit the items individually. When they are not based almost entirely on shared knowledge, self-generated lists may be quite idiosyncratic and be generated using individual retrieval strategies at elicitation. Experimenter-provided lists may be less based on individual retrieval strategies than self-generated lists because their retrieval may be influenced by the order in which the items were presented to participants or how the experimenter composed the list. Group-generated lists may be much less based on individual retrieval strategies than both self-generated and experimenter-provided lists, as there is no initial individual elicitation or encoding. In order to address this question, future studies would need to compare experimenter-provided, self-generated and group-generated lists of the same kind.

To date, no studies have investigated collaborative recall of group-generated lists. The closest any studies have come to group-generated lists was Harris et al. (2013). They compared collaborative recall of groups who encoded a word list together with that of groups who encoded the same list individually. They found that groups who shared the encoding of the list did not show collaborative inhibition, whereas those who encoded individually did show collaborative inhibition. The list used in their study was experimenter-provided, but these results suggest that group-generated stimuli may also eliminate collaborative inhibition, or even reverse it. In their study, Harris et al. found no effect of relationship between friends and strangers, but relationship may have more of an impact on group-generated lists than experimenter-provided lists because the content and structure of group-generated lists may be influenced by shared history and knowledge. This kind of experiment would provide scope for extending my research on the process of collaborative recall because I could investigate whether the collaborative processes of list generation impacts subsequent collaborative recall.

The Difficulty of Matching Meaningful Tasks Across Relationship Groups

In the main section on this theme above, I described several difficulties that arose across my experiments due to the friends' and siblings' highly shared knowledge and strangers' sparsely shared knowledge. Another pertinent example of this difficulty came from Experiment 2 (Chapter 3). In the social circle list, strangers by definition had no overlap in their social circles, whereas friends and siblings had varying degrees of overlap. I changed the task from mutual friends and acquaintances to each participant's social circle so that I could use this task in strangers as well as friends and siblings. However, I still found problems with strangers collaboratively recalling their social circles. The lack of overlap in strangers' social circles created difficulties for defining nominal group recall. Nominal group recall is the pooled recall of two or more participants who had recalled the same list individually (Rajaram, 2011). Strangers' nominal recall in the social circle list was a combination of both dyad members' full lists. However, as there was no overlap, it was essentially a sum of the two individuals' recall rather than a pooled aggregate. Nominal strangers' lists, therefore, differed in composition to nominal friends' and siblings' lists. This difficulty meant I was less able to meaningfully compare strangers' collaborative recall of the social circle list with friends' and siblings'. Thus, future research on the costs and benefits of shared knowledge on strangers' and acquainted dyads' recall would either have to use a different task, instead of social circles, or deal with this difficulty in new ways.

One possibility is to approach the question of whether friends' and siblings' shared history and knowledge benefits their shared remembering in a different way. Rather than compare their collaborative recall with strangers, I could compare their recall of self-generated stimuli that relies heavily on their shared history with self-generated stimuli that does not involve their shared history. For instance, I could compare friends' and siblings' recall of mutual friends and acquaintances with their recall of one friend's or one sibling's friends and acquaintances that they do not share. If friends' and siblings' shared history benefits their collaborative recall, they would be more successful at recalling friends and acquaintances they share than friends and acquaintances they do not share. Another possibility would be to include strangers and ask them to recall mutual friends and acquaintances, for instance, that one stranger shares with a friend or sibling. I would then compare their collaborative performance to that of those who performed the same task but with the friend or sibling with whom they share the mutual friends and acquaintances. Both of these methods would allow me to compare the same task when the knowledge is shared and when the knowledge is unshared without changing the task or adding extra items.

The Importance of Shared History and Knowledge in Shared Remembering

In my experiments, I aimed to understand the influence of relationship – specifically shared history and intimacy – on collaborative success. As noted above, the main differences I found were between strangers and acquainted dyads. I found few differences in the collaborative recall and shared remembering of friends and siblings. In order to see better the effects of shared history and intimacy, future research may need finer-grained assessments of relationship quality. In my case study, I found that using a combination of quantitative and qualitative assessments of the nature of their relationships clarified how relationship influenced the shared remembering of twins and their brother. However, in an experimental study I would not be able to adequately assess each dyads' relationship in the same way. Thus, in future research I need to find measurements of shared history, intimacy, and shared identity that can point to more subtle effects of relationship on collaborative remembering.

Another way to differentiate the effect of shared history and knowledge from intimacy on shared remembering would be to compare friends and siblings recalling autobiographical events they had and had not experienced together, similar to my suggestions for following up the mutual friends and acquaintances task. For instance, I could ask siblings to recall together events they shared, as well as events only one of them shared with a friend. I could then compare siblings' recall of events shared with other friends with friends' recall of events shared with siblings. This method would allow me to determine whether experiencing the event together is what aided friends' and siblings' recall in my experiments or whether it was their more general shared history, intimacy, or shared identity.

Individual Differences Outweigh Group Differences

Despite the differences between friend and sibling relationships that I outlined in Chapter 1, I found friends' and siblings' collaborative recall to be overwhelmingly similar. Instead, as noted above, the costs and benefits of collaboration on friends' and siblings' recall depended more on the unique relationships of each individual dyad than on the type of relationship they shared. This finding is not in itself a limitation, but it may have masked hypothesized effects such as the effect of collaborative condition on the salience of individual versus shared identity in friends, siblings, and twins. In all of my studies, collaborative condition (collaborative versus nominal dyads or dyads versus individuals) always was a between-subjects variable. In other studies, such as Harris et al. (2011), collaborative condition was a within-subjects variable. That is, couples completed the same tasks two weeks apart. In the first session, couples recalled individually and their recall was pooled into nominal scores, then in the second session, couples recalled collaboratively. Their method meant that the costs and benefits of collaboration could be seen on a couple level. The limitation of their method was that when couples recalled collaboratively, they had already completed the tasks two weeks prior. Indeed, most collaborative recall experiments use collaborative condition as a between-subjects variable introduced during the second recall session (Rajaram, 2011; Rajaram & Pereira-Pasarin, 2010), which separates the effects of collaboration from the effects of repeated recall. For this reason, in my experiments I used a between-subjects measure of collaboration. If I had used a within-subjects measure of collaboration in my experiments, using a method similar to Harris et al. (2011), but counterbalancing the order of conditions, I may have found stronger costs and benefits of collaboration across my experiments.

In conjunction with a within-subjects measure of collaboration, future research should also examine more closely the links between collaborative recall and shared identity by including the Inclusion of Other in the Self (IOS) Scale (Aron, Aron, & Smollen, 1992) alongside the PAIR Inventory (Schaefer & Olson, 1981) for a more reliable index of shared identity than merely tracking pronoun use. Alongside the IOS Scale, more refined measures of pronoun use could also allow a more complete measure of shared identity. "We" pronouns can be used in various ways that can refer to: (1) the speaker and their conversing partner, (2) the speaker, their conversing partner, and one or more others, or (3) the speaker and one or more others, but not their conversing partner. LIWC software (Pennebaker et al., 2007), which I used in my experiments, does not differentiate between these different uses of "we" pronouns. Each different use of "we" reflects a different kind of shared identity. The first reflects a shared identity of the kind I describe above, similar to the relational self (Brewer & Gardner, 1996). The second could reflect a shared identity with a larger group that still reflects relational ties, such as family identity, or a shared identity with broader social groups, similar to the collective self (Brewer & Gardner, 1996). The third could reflect the same kinds of shared identities as the second, but excluding one member of the dyad. Each of these different uses of "we", therefore, may mean very different things in terms of the role of shared identity in collaborative remembering. Measuring their relative use with "I" pronouns alongside the IOS Scale may index shared identity more comprehensively.

The Importance of Process in Collaborative Remembering

My research demonstrated that the process of collaboration is crucial to understanding the costs and benefits of collaborative remembering. In doing so, I reinforced the findings of other collaborative recall researchers who also have examined process (Barnier et al., 2014; Fivush et al., 2006; Fivush et al., 2009; Harris et al., 2012; Harris et al., 2011; Meade, 2013; Meade et al., 2009; Reese & Fivush, 1993). However, most collaborative recall experiments primarily focus on the product of recall, and in doing so leave questions unanswered. Most studies on process, including my own, have focused on experts (Meade et al., 2009) or already acquainted groups (Barnier et al., 2014; Fivush et al., 2006; Fivush et al., 2009; Harris et al., 2011; Reese & Fivush, 1993) and few have focused on groups larger than dyads (for some exceptions, see Bohanek et al., 2009; Bohanek et al., 2006; Fivush et al., 2009; Harris et al., 2012, 2013). My research examined dyads of strangers alongside already acquainted dyads, but as I described above, my stranger dyads were unusual in the product of their collaborative recall, as they did not show the usual collaborative inhibition in the word list. Already it has been established that the product of collaborative recall is influenced by various factors such as group size, the number of repetitions of recall, methods of encoding and retrieval, the number of items to be recalled, and how these items are organized (Blumen & Rajaram, 2008; Blumen & Rajaram, 2009; Congleton & Rajaram, 2014; Harris et al., 2012, 2013; Pereira-Pasarin & Rajaram, 2011; Rajaram & Pereira-Pasarin, 2010). It is highly likely that each of these factors also influence the process of collaboration. As my research shows, the process of collaboration changes depending on whether dyads are intimate or unacquainted, and whether the stimuli is learnt in the laboratory or self-generated, list-based or episodic, and shared or unshared. If we understand how each of the above factors influences the process of collaborative recall, we can understand more completely how they in turn influence the product of collaborative recall.

Conclusion

The research presented in my thesis demonstrates that the people with whom we recall information and events play a central role in collaborative remembering. I aimed to determine whether recalling with a stranger, friend, sibling, or twin influenced the product and process of collaborative remembering, and whether intimacy and shared identity played a role in friends', siblings,' or twins' collaborative remembering. Recalling with a friend, sibling, or twin has less impact on collaborative remembering than the unique qualities of each relationship. Even so, across my studies, I found that recalling with someone with whom we have shared history, intimacy, shared identity, and shared knowledge can influence considerably both the product of recall and the process of collaboration.

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APPENDIX A

Collaborative Process Coding Scheme: Typed Lists

Experiment 1 Word List Coding

Words in the original list (by category):

Animals	Birds	Tools	Clothing	Dwellings	Precious Stones
Horse	Eagle	Screwdriver	Blouse	Tent	Emerald
Cow	Bluebird	Wrench	Shoes	Cave	Pearl
Tiger	Crow	Chisel	Skirt	Hut	Opal
Lion	Canary	Nails	Pants	Hotel	Sapphire

Criteria For Word List Coding

- Answer Yes (1) or No (0) to the following:
  - Did participants use **categories** at any stage in their **typed recall**? Y/N
  - Did participants use **a group strategy** in their **transcript**? Y/N
  - Did participants use **an individual strategy** in their **transcript**? Y/N
  - Do they **successfully cue** each other at least once? Y/N
  - Do they **unsuccessfully cue** each other at least once? Y/N
  - Is there at least one example of **mirrored repetition**? Y/N
  - Did they **explicitly disagree** on anything or **correct each other** at least once? Y/N
- THEN count instances of:
  - **Successful Cues**
  - **Unsuccessful Cues**
  - **Mirrored Repetitions**
  - **Corrections and Disagreements**

Categories (Typed Recall)

- If they use categories for **at least some** of the task
- I.e. If there is **more than one** instance of:
  - 3 or more words from the same category occurring together in recall
  - If one of the words is incorrect but within the same category, this counts towards the category
- Do not count if:
  - There is **only one instance** where a category occurs in recall

Group Strategy

- They should look like they are using a coordinated strategy, that includes both participants in a group
  - E.g. reliance on the categories (this is the most common strategy)
  - If they mention that there were categories, this counts as a group strategy
  - If they use another strategy not based on category (e.g. order in list) this also counts
- Count but make a not if:
  - Only one participant uses categories and the other doesn't
  - They appear to be recalling the words in categories, but don't say anything about it
  - They only start to use the categories near the end, after they have already recalled most of the words
- If they use a group-level strategy but only start talking about the strategy after they start using it, this still counts – they just have to consistently use the same strategy from the beginning

NOTE: *Encoding strategies are not the same as retrieval strategies*

- If they talk about what they did to memorize the words, this is not the same as discussing a group-level strategy in recall (e.g. "I grouped them" is an encoding strategy). HOWEVER if they then go on to use this strategy in recall, it does count

Individual Strategy

- One participant uses their own individual strategy in recall
    - E.g. if one participant just types all their words with minimal/no input from the other participant, and appears to use a particular strategy to recall it (this could be categories)
    - OR if one participant refuses the other participant's input because they insist on using their own idiosyncratic strategy, which the other participant cannot access
- Count but make a note if:
    - This only occurs for a short section of the transcript

Cuing - Successful

- Does at least one participant successfully cue the other?
    - E.g. A: "What were the first ones?" B: "Opal, shoes"
    - Categories can be counted as cues e.g. A: "What were the tools?" B: "Screwdriver"
- Do not count it if:
    - The cue does not elicit any new information (e.g. A: "What were the first ones"? B: "I don't remember the order" or A: "What were the tools?" B: "We already said screwdriver") – these are *unsuccessful* cues
- Count but make a note if:
    - It would normally be too specific to be a cue (e.g. "Was there screwdriver?") and the participant responds with "oh yeah, screwdriver was there"
    - It would normally be too broad to be a cue (e.g. "What else did you say?") and the participant responds with one or more words

Cuing - Unsuccessful

- Does at least one participant *unsuccessfully* cue the other?
    - E.g. A: "What were the first ones?" B: "I don't remember the order"
    - Categories can be counted as cues e.g. A: "What were the tools?" B: "We've already said them all"
    - If the cue only elicits an item already recalled, this counts as an unsuccessful cue e.g. A: "What were the tools:" B: "We're already said screwdriver"
- Do not count it if:
    - The cue elicits new information (e.g. A: "What were the first ones"? B: "Opal, shoes" or A: "What were the tools?" B: "Screwdriver") – these are *successful* cues
- Count but make a note if:
    - It would normally be too specific to be a cue (e.g. "Was there screwdriver?") and the participant responds with "I don't know"
    - It would normally be too broad to be a cue (e.g. "What else did you say?") and the participant does not respond with any new items

Mirrored Repetition

- Mirrored repetition occurs when one participant repeats the **item** that the other participant just said
    - This should be words (e.g. A: "Sapphire" B: "Sapphire, Opal, Pearl")
    - There could be one or two words in between, but no more (e.g. A: "Sapphire" B: "Yep Sapphire, Opal…")
    - They don't have to be correct (e.g. A: "Hammer" B: "Hammer")
- Do not count it if:
    - The two instances of the same word occur in different parts of the transcript
    - One participant repeats him/herself
    - What is repeated is not an item in recall (e.g. A: "Any more gems?", B: "Gems")
- Count but make a note if:

- It's a repetition in the form of a question/answer (e.g. A: "Pearl" B: "Pearl?", or A: "Pearl?" B: "Yeah pearl", or A: "Did you say Pearl?" B: "Yeah I put Pearl")
- If the repetition is included in a sentence A: "Pearl" B: "I forgot Pearl"

Corrections and Disagreements

- Does one participant correct or disagree with the other participant at least once? E.g.:
    - Disagreements over how to structure recall or definitions of particular categories (e.g. "that's a bird not an animal"), or on on how to do the task (e.g. A: "What was the first word?" B: "No let's do categories"), or anything else (e.g. "wait, slow down", "don't interrupt me!")
    - Corrections over whether a person can be included in recall (e.g. A: "Hammer", B: "There was no hammer", spelling (e.g. "you spelled it wrong", or "It's P H, not f")
- Do not count if:
    - It's simply a "no" response to a question (e.g. A: "Was hammer there?" B: "No, there was no hammer")
    - One participant appears to be unhappy with the other participant but doesn't explicitly disagree with or correct them (e.g. "Off you go do the whole thing!")

Note

- For all **Y/N (present/absent) questions**
    - Don't worry if there aren't many instances of some of the codes – some might not be very frequent
    - Don't worry if some of the transcripts don't show any examples of any of the codes

Experiment 1 People List Coding

Criteria For People List Transcript Coding

- Answer Yes (1) or No (0) to the following:
    - Did participants use **categories** at any stage in their **typed recall**? Y/N
    - Did participants use **a group strategy** in their **transcript**? Y/N
    - Did participants use **an individual strategy** in their **transcript**? Y/N
    - Do they **successfully cue** each other at least once? Y/N
    - Do they **unsuccessfully cue** each other at least once? Y/N
    - Is there at least one example of **mirrored repetition**? Y/N
    - Did they **explicitly disagree** on anything or **correct each other** at least once? Y/N
- THEN count instances of:
    - **Successful Cues**
    - **Unsuccessful Cues**
    - **Mirrored Repetitions**
    - **Corrections and Disagreements**

Categories (Typed Recall)

- If they use categories for **at least some** of the task. I.e. if there is **more than one** instance of:
    - 2 or more names occurring together in Recall that occurred together in at least one participants' Elicitation (example 1 next slide)
    - OR 2 or more people of the same first or last name occurring together in recall (examples 2 and 3 next slide)
    - OR 2 or more people with the same description occurring together in recall (example 4 next slide)

- Do not count if:
    - There is **only one instance** where a category occurs in recall

Examples of Categories (Typed Recall)

Example 1

A elicitation	B elicitation	A & B recall
Lara	Sally	Sally
Penny	Lara	Katy
Emily	Katy	Emily
Sally		Lara
Katy		Penny

Example 2

A & B recall
Sally W
Sally G
Sally R

Example 3

A & B recall
Sally Smith
Katy Smith
Emily Smith
Lara Smith
Penny Smith

Example 4

A & B recall
Sally from work
Lara from work
Katy from work

Group Strategy

- They should look like they are using a coordinated strategy, that includes both participants in a group
    - E.g. using categories (this is the most common strategy) E.g. "Let's start with family" If they mention that categories, this counts as a group strategy
    - If they use another strategy not based on category (e.g. name similarity "All the Natalies") this also counts
- Count but make a note if:
    - Only one participant uses categories and the other doesn't
    - They only start to use categories near the end, after they have already recalled most of the words
- If they use a group-level strategy but only start talking about the strategy after they start using it, this still counts – they just have to consistently use the same strategy from the beginning
- **NOTE**: *These strategies must be used during collaboration*
    - If they talk about what they did in the previous individual recall, this is not the same as discussing a group-level strategy in recall

Individual Strategy

- One participant uses their own individual strategy in recall
    - E.g. if one participant just types all their words with minimal/no input from the other participant, BUT ALSO appears to use a particular strategy to recall it (this could be categories)
    - OR if one participant refuses the other participant's input because they insist on using their own idiosyncratic strategy, which the other participant cannot access
- Count but make a note if:
    - This only occurs for a short section of the transcript

Cuing - Successful

- Does at least one participant successfully cue the other?
    - E.g. A: "What's his friends name?" B: "Tom"

    - What is cued does not have to count as another item in recall, e.g. A: "What's Tom's last name?" B: "Smith".
- Do not count it if:
    - The cue does not elicit any new information (e.g. A: "What's his friend's name"? B: "I don't know" or A: "What's Tom's last name?" B: "Just put Tom from work") – these are *unsuccessful* cues
- Count but make a note if:
    - It would normally be too specific to be a cue (e.g. "Did you say Tom?") and the participant responds with "oh yeah, Tom" OR "no I didn't say him" (NOTE: if they just say "no" or "yes" this counts as a successful cue because the other participant has remembered Tom)
    - It would normally be too broad to be a cue (e.g. "What else did you say?") and if the participant responds with one or more names

Cuing - Unsuccessful
- Does at least one participant *unsuccessfully* cue the other?
    - E.g. A: "What's his friends name?" B: "I don't know"
    - What is cued does not have to count as another item in recall, e.g. A: "What's Tom's last name?" B: "Just put Tom from work".
    - If the cue only elicits an item already recalled, this counts as an unsuccessful cue e.g. A: "Is there anyone from work" B: "Tom but we've already said him"
- Do not count it if:
    - The cue does elicits new information (e.g. A: "What's his friend's name"? B: "Tom" or A: "What's Tom's last name?" B: "Smith") – these are *successful* cues
- Count but make a note if:
    - It would normally be too specific to be a cue (e.g. "Did you say Tom?") and the other participant responds with "who?" or does not respond (NOTE: if they just say "no" this counts as a *successful* cue because the other participant has remembered Tom)
    - It would normally be too broad to be a cue (e.g. "What else did you say?") and the participant fails to respond with one or more names

Mirrored Repetition
- Mirrored repetition occurs when one participant repeats the **item** that the other participant just said
    - This could be names (e.g. A: "Matt" B: "Matt, Simon, Jane")
    - There could be one or two words in between, but no more (e.g. A: "Matt" B: "Yep Matt, Simon…")
- This could be a partial repetition of the item (e.g. A: "Matt Smith" B: "Smith"
- Do not count it if:
    - The two instances of the same name occur in different parts of the transcript
    - One participant repeats him/herself
    - What is repeated is not an item in recall (e.g. A: "Any more from school?", B: "School")
- Count but make a note if:
    - It's a repetition in the form of a question/answer (e.g. A: "Tom" B: "Tom?", or A: "Tom?" B: "Yeah Tom", or A: "Did you say Tom?" B: "Yeah I put Tom"/ "No I didn't put Tom")
    - If the repetition is included in a sentence e.g. A: "Tom" B: "I forgot Tom"

Corrections And Disagreements
- Does one participant correct or disagree with the other participant at least once? E.g.:
    - Disagreements over how to structure recall or definitions of particular categories (e.g. "he's not a work friend"), or on on how to do the task (e.g. A: "Aunty Sally?" B: "It's not supposed to be family"), or anything else (e.g. "wait, slow down", "not her!")

    - Corrections over whether a person can be included in recall (e.g. A: "Sally", B: "I don't know her", spelling (e.g. "you spelled it **Wrong", Or "It's P H, Not F")**
- Do not count if:
    - It's simply a "no" response to a question (e.g. A: "Did you say Matt?" B: "No, I didn't")
    - One participant appears to be unhappy with the other participant but doesn't explicitly disagree with or correct them (e.g. "Put the whole friggin' school")

Note
- For all **Y/N (present/absent) questions**
    - Don't worry if there aren't many instances of some of the codes – some might not be very frequent
    - Don't worry if some of the transcripts don't show any examples of any of the codes

Experiment 1 Event List Coding

Criteria For Event List Coding
- Answer Yes (1) or No (0) to the following:
    - Did participants use **categories** at any stage in their **typed recall**? Y/N
    - Did participants use **a group strategy** in their **transcript**? Y/N
    - Did participants use **an individual strategy** in their **transcript**? Y/N
    - Do they **successfully cue** each other at least once? Y/N
    - Do they **unsuccessfully cue** each other at least once? Y/N
    - Is there at least one example of **mirrored repetition**? Y/N
    - Did they **explicitly disagree** on anything or **correct each other** at least once? Y/N
- THEN count instances of:
    - **Successful Cues**
    - **Unsuccessful Cues**
    - **Mirrored Repetitions**
    - **Corrections and Disagreements**

Categories (Typed Recall)
- If they use categories for **at least some** of the task
- If there is m**ore than one instance** in which **at least two related events occur together** in recall
    - E.g. for news events "NZ earthquake, QLD floods", "royal wedding, Queen visited Australia"
    - E.g. for shared social events "Trip to Newcastle, trip to Gosford", "Schoolies, HSC exams, HSC party"
    - E.g. for shared holidays "Canada, US", "UK 2010, UK 2008, UK 2002", "Port Macquarie with Sally, Port Macquarie with Smiths,"
- Do not count if:
    - There is **only one instance** where a category occurs in recall

Group Strategy
- They should look like they are using a coordinated strategy, that includes both participants in a group
    - E.g. using categories
    - If they mention categories, this counts as a group strategy
    - If they use another strategy not based on category (e.g. chronological order) this also counts
- Count but make a note if:
    - Only one participant uses categories and the other doesn't

    - They appear to be recalling the events in categories, but don't say anything about it
    - They only start to use the categories near the end, after they have already recalled most of the words
- If they use a group-level strategy but only start talking about the strategy after they start using it, this still counts – they just have to consistently use the same strategy from the beginning
- **NOTE**: *These strategies must be used during collaboration*
    - If they talk about what they did in the previous individual recall, this is not the same as discussing a group-level strategy in recall

Individual Strategy

- One participant uses their own individual strategy in recall
    - E.g. if one participant appears to use a particular strategy to recall events without coordinating the strategy with their partner (this could be categories)
    - OR if one participant refuses the other participant's input so they can use their own idiosyncratic strategy, which the other participant cannot access
- Count but make a note if:
    - This only occurs for a short section of the transcript

Cuing - Successful

- Does at least one participant successfully cue the other?
    - E.g. A: "Who else had birthday drinks?" B: "Tom"
    - What is cued does not have to count as another item in recall, e.g. A: "Where was that youth camp shooting?" B: "Norway?".
- Do not count it if:
- The cue does not elicit any information (e.g. A: "Who else had birthday drinks?" B: "No one" or A: "Where was that youth camp shooting?" B: "I don't know just put youth camp shooting") – these are *unsuccessful* cues
- Count but make a note if:
    - It would normally be too specific to be a cue (e.g. "Did you say Forster camping trip?") and the participant responds with "oh yeah, Forster" OR "no I didn't say that" (NOTE: if they just say "no" or "yes" this counts as a successful cue because the other participant has remembered the event)
    - It would normally be too broad to be a cue (e.g. "What else did you say?") and the participant responds with one or more events

Cuing - Unsuccessful

- Does at least one participant *unsuccessfully* cue the other?
    - E.g. A: "Who else had birthday drinks?" B: "No one"
    - What is cued does not have to count as another item in recall, e.g. A: "Where was that youth camp shooting?" B: "Just put youth camp shooting".
    - If the cue only elicits an item already recalled, this counts as an unsuccessful cue e.g. A: "Any birthday drinks?" B: "Tom's but we've already said his"
- Do not count it if:
    - The cue does elicits new information (e.g. A: "Who else had birthday drinks"? B: "Tom" or A: "Where was that youth camp shooting?" B: "Norway") – these are *successful* cues
- Count but make a note if:
    - It would normally be too specific to be a cue (e.g. "Did you say Forster camping trip?") and the other participant responds with "who?" or does not respond (NOTE: if they just say "no" this counts as a *successful* cue because the other participant has remembered Tom)
    - It would normally be too broad to be a cue (e.g. "What else did you say?") and the

participant fails to respond with one or more events

Mirrored Repetition

- Mirrored repetition occurs when one participant repeats the **item** that the other participant just said
  - This could be events (e.g. A: "NZ earthquake" B: "NZ earthquake")
  - There could be one or two words in between, but no more (e.g. A: "NZ earthquake" B: "Yep NZ earthquake")
  - This could be a partial repetition or summary of the item (e.g. A: "That road trip with Mum to Melbourne" B: "Melbourne with Mum")
- Do not count it if:
  - The two instances of the same event occur in different parts of the transcript
  - One participant repeats him/herself
  - What is repeated is not an item in recall (e.g. A: "Any other holidays?", B: "holidays")
- Count but make a note if:
  - It's a repetition in the form of a question/answer (e.g. A: "Japan" B: "Japan?", or A: "Japan?" B: "Yeah Japan", or A: "Did you say Japan?" B: "Yeah I put Japan"/ "No I didn't put Japan")
  - If the repetition is included in a sentence A: "Japan" B: "I forgot Japan"

Corrections And Disagreements

- Does one participant correct or disagree with the other participant at least once? E.g.:
  - Disagreements over how to structure recall or definitions of particular categories (e.g. "that's not news"), or on on how to do the task (e.g. A: "Newcastle?" B: "It's not daytrips"), or anything else (e.g. "wait, slow down")
  - Corrections over whether a person can be included in recall (e.g. A: "Sam's 18th", B: "I wasn't there", A: "Michael Jackson's death", B: "That wasn't in the last 12 months"; spelling (e.g. "you spelled it wrong", or "It's P H, not f"); or anything else
- Do not count if:
  - It's simply a "no" response to a question (e.g. A: "Did you say Japan?" B: "No, I didn't")
  - One participant appears to be unhappy with the other participant but doesn't explicitly disagree with or correct them

Note

- For all **Y/N (present/absent) questions**
  - Don't worry if there aren't many instances of some of the codes – some might not be very frequent
  - Don't worry if some of the transcripts don't show any examples of any of the codes

APPENDIX B

Collaborative Process Coding Scheme: Verbal Lists

Experiment 2 Word List Coding

Words in the original list (by category):

Four-footed animals	Birds	Items of clothing	Precious stones	Food flavourings	Dwellings
Bear	Bluebird	Blouse	Amethyst	Cinnamon	Cave
Cow	Canary	Coat	Emerald	Cloves	Cottage
Elephant	Crow	Dress	Jade	Garlic	Hotel
Horse	Eagle	Hat	Onyx	Oregano	Hut
Lion	Hawk	Pants	Opal	Paprika	Igloo
Mouse	Parrot	Shoes	Pearl	Pepper	Mansion
Pig	Robin	Skirt	Sapphire	Sugar	Shack
Tiger	Sparrow	Tie	Topaz	Vanilla	Tent

Criteria for Word List coding

- Answer Yes (1) or No (0) to the following:
  - Did participants use **categories** at any stage? Y/N
  - Did participants use **a group strategy**? Y/N
  - Did participants use **an individual strategy**? Y/N
  - Do they **successfully cue** each other at least once? Y/N
  - Do they **unsuccessfully cue** each other at least once? Y/N
  - Is there at least one example of **mirrored repetition**? Y/N
  - Did they **explicitly disagree** on anything or **correct each other** at least once? Y/N
- THEN count instances of:
  - **Successful Cues**
  - **Unsuccessful Cues**
  - **Mirrored Repetitions**
  - **Corrections and Disagreements**

Categories

- If they use categories for **at least some** of the task
- I.e. If there is **more than one** instance of:
  - 3 or more words from the same category occurring together in recall
  - If one of the words is incorrect but within the same category, this counts towards the category
- Do not count if:
  - There is **only one instance** where a category occurs in recall

Group strategy

- They should look like they are using a coordinated strategy, that includes both participants in a group
  - E.g. reliance on the categories (this is the most common strategy)
  - If they mention that there were categories, this counts as a group strategy
  - If they use another strategy not based on category (e.g. order in list) this also counts
- Count but make a not if:
  - Only one participant uses categories and the other doesn't
  - They appear to be recalling the words in categories, but don't say anything about it
  - They only start to use the categories near the end, after they have already recalled most of the words
- If they use a group-level strategy but only start talking about the strategy after they start using it, this still counts – they just have to consistently use the same strategy from the beginning

NOTE: *These strategies must be used during collaboration*

- If they talk about what they did in the previous individual recall, this is not the same as discussing a group-level strategy in recall

Individual strategy

- One participant uses their own individual strategy in recall
  - E.g. if one participant just types all their words with minimal/no input from the other participant, and appears to use a particular strategy to recall it (this could be categories)
  - OR if one participant refuses the other participant's input because they insist on using their own idiosyncratic strategy, which the other participant cannot access
- Count but make a note if:
  - This only occurs for a short section of the transcript

Cuing - successful

- Does at least one participant successfully cue the other?
  - E.g. A: "What were the first ones?" B: "Opal, shoes"
  - Categories can be counted as cues e.g. A: "What were the foods?" B: "Pepper"
- Do not count it if:
  - The cue does not elicit any new information (e.g. A: "What were the first ones"? B: "I don't remember the order" or A: "What were the foods?" B: "We already said Pepper") – these are *unsuccessful* cues
- Count but make a note if:
  - It would normally be too specific to be a cue (e.g. "Was there Pepper?") and the participant responds with "oh yeah, Pepper was there"
  - It would normally be too broad to be a cue (e.g. "What else did you say?") and the participant responds with one or more words

Cuing - unsuccessful

- Does at least one participant *unsuccessfully* cue the other?
  - E.g. A: "What were the first ones?" B: "I don't remember the order"
  - Categories can be counted as cues e.g. A: "What were the foods?" B: "We've already said them all"
  - If the cue only elicits an item already recalled, this counts as an unsuccessful cue e.g. A: "What were the foods:" B: "We're already said Pepper"
- Do not count it if:
  - The cue elicits new information (e.g. A: "What were the first ones"? B: "Opal, shoes" or A: "What were the foods?" B: "Pepper") – these are *successful* cues
- Count but make a note if:
  - It would normally be too specific to be a cue (e.g. "Was there Pepper?") and the participant responds with "I don't know"
  - It would normally be too broad to be a cue (e.g. "What else did you say?") and the participant does not respond with any new items

Mirrored repetition

- Mirrored repetition occurs when one participant repeats the **item** that the other participant just said
  - This should be words (e.g. A: "Sapphire" B: "Sapphire, Opal, Pearl")
  - There could be one or two words in between, but no more (e.g. A: "Sapphire" B: "Yep Sapphire, Opal…")
  - They don't have to be correct (e.g. A: "Onion" B: "Onion")
- Do not count it if:
  - The two instances of the same word occur in different parts of the transcript

    - One participant repeats him/herself
    - What is repeated is not an item in recall (e.g. A: “Any more gems?”, B: “Gems”)
- Count but make a note if:
    - It’s a repetition in the form of a question/answer (e.g. A: “Pearl” B: “Pearl?”, or A: “Pearl?” B: “Yeah pearl”, or A: “Did you say Pearl?” B: “Yeah I put Pearl”)
    - If the repetition is included in a sentence A: “Pearl” B: “I forgot Pearl”

Corrections and Disagreements
- Does one participant correct or disagree with the other participant at least once? E.g.:
    - Disagreements over how to structure recall or definitions of particular categories (e.g. “that’s a bird not an animal”), or on on how to do the task (e.g. A: “What was the first word?” B: “No let’s do categories”), or anything else (e.g. “wait, slow down”, “don’t interrupt me!”)
    - Corrections over whether a person can be included in recall (e.g. A: “Onion”, B: “There was no Onion”, spelling (e.g. “you spelled it wrong”, or “It’s P H, not f”)
- Do not count if:
    - It’s simply a “no” response to a question (e.g. A: “Was Onion there?” B: “No, there was no Onion”)
    - One participant appears to be unhappy with the other participant but doesn’t explicitly disagree with or correct them (e.g. “Off you go do the whole thing!”)

Note
- For all **Y/N (present/absent) questions**
    - Don’t worry if there aren’t many instances of some of the codes – some might not be very frequent
    - Don’t worry if some of the transcripts don’t show any examples of any of the codes

Experiment 2 Social Circle List Coding

Criteria For People List Transcript Coding
- Answer Yes (1) or No (0) to the following:
    - Did participants use **categories** at any stage? Y/N
    - Did participants use **a group strategy**? Y/N
    - Did participants use **an individual strategy**? Y/N
    - Do they **successfully cue** each other at least once? Y/N
    - Do they **unsuccessfully cue** each other at least once? Y/N
    - Is there at least one example of **mirrored repetition**? Y/N
    - Did they **explicitly disagree** on anything or **correct each other** at least once? Y/N
- THEN count instances of:
    - **Successful Cues**
    - **Unsuccessful Cues**
    - **Mirrored Repetitions**
    - **Corrections and Disagreements**

Categories (Typed Recall)
- If they use categories for **at least some** of the task.
- I.e. if there is **more than one** instance of:
    - 2 or more names being recalled together in Recall that occurred together in at least one participants’ elicitation
    - (e.g. A elicitation: “Caitlin W, Suzie S”; B elicitation: “Suzie S, Caitlin W, Molly O”; Recall: “Caitlin W, Suzie S, Molly O”)

    - OR 2 or more people of the same first or last name occurring together in recall (e.g. "Steph T, Steph P, Steph L", or "H. Ho, J. Ho, E. Ho, K. Ho")
    - OR 2 or more people with the same description occurring together in recall (e.g. "Troy from work, Cam from work, Kelly from work"
- Do not count if:
    - There is **only one instance** where a category occurs in recall

Group Strategy
- They should look like they are using a coordinated strategy, that includes both participants in a group
    - E.g. "we'll do yours then mine", "let's start with family"
- Count but make a note if:
    - Only one participant uses categories and the other doesn't
    - They only start to use categories near the end, after they have already recalled most of the words
- If they use a group-level strategy but only start talking about the strategy after they start using it, this still counts – they just have to consistently use the same strategy from the beginning

NOTE: *These strategies must be used during collaboration*
- If they talk about what they did in the previous individual recall, this is not the same as discussing a group-level strategy in recall

Individual Strategy
- One participant uses their own individual strategy in recall
    - E.g. if one participant just types all their words with minimal/no input from the other participant, BUT ALSO appears to use a particular strategy to recall it (this could be categories)
    - OR if one participant refuses the other participant's input because they insist on using their own idiosyncratic strategy, which the other participant cannot access
- Count but make a note if:
    - This only occurs for a short section of the transcript

Cuing - Successful
- Does at least one participant successfully cue the other?
    - E.g. A: "What's his friends name?" B: "Tom"
    - What is cued does not have to count as another item in recall, e.g. A: "What's Tom's last name?" B: "Smith".
- Do not count it if:
    - The cue does not elicit any new information (e.g. A: "What's his friend's name"? B: "I don't know" or A: "What's Tom's last name?" B: "Just put Tom from work") – these are *unsuccessful* cues
- Count but make a note if:
    - It would normally be too specific to be a cue (e.g. "Did you say Tom?") and the participant responds with "oh yeah, Tom" OR "no I didn't say him" (NOTE: if they just say "no" or "yes" this counts as a successful cue because the other participant has remembered Tom)
    - It would normally be too broad to be a cue (e.g. "What else did you say?") and if the participant responds with one or more names

Cuing - Unsuccessful
- Does at least one participant *unsuccessfully* cue the other?

    - E.g. A: "What's his friends name?" B: "I don't know"
    - What is cued does not have to count as another item in recall, e.g. A: "What's Tom's last name?" B: "Just put Tom from work".
    - If the cue only elicits an item already recalled, this counts as an unsuccessful cue e.g. A: "Is there anyone from work" B: "Tom but we've already said him"
- Do not count it if:
    - The cue does elicits new information (e.g. A: "What's his friend's name"? B: "Tom" or A: "What's Tom's last name?" B: "Smith") – these are *successful* cues
- Count but make a note if:
    - It would normally be too specific to be a cue (e.g. "Did you say Tom?") and the other participant responds with "who?" or does not respond (NOTE: if they just say "no" this counts as a *successful* cue because the other participant has remembered Tom)
    - It would normally be too broad to be a cue (e.g. "What else did you say?") and the participant fails to respond with one or more names

Mirrored Repetition

- Mirrored repetition occurs when one participant repeats the **item** that the other participant just said
    - This could be names (e.g. A: "Matt" B: "Matt, Simon, Jane")
    - There could be one or two words in between, but no more (e.g. A: "Matt" B: "Yep Matt, Simon…")
- This could be a partial repetition of the item (e.g. A: "Matt Smith" B: "Smith"
- Do not count it if:
    - The two instances of the same name occur in different parts of the transcript
    - One participant repeats him/herself
    - What is repeated is not an item in recall (e.g. A: "Any more from school?", B: "School")
- Count but make a note if:
    - It's a repetition in the form of a question/answer (e.g. A: "Tom" B: "Tom?", or A: "Tom?" B: "Yeah Tom", or A: "Did you say Tom?" B: "Yeah I put Tom"/ "No I didn't put Tom")
    - If the repetition is included in a sentence e.g. A: "Tom" B: "I forgot Tom"

Corrections And Disagreements

- Does one participant correct or disagree with the other participant at least once? E.g.:
    - Disagreements over how to structure recall or definitions of particular categories (e.g. "he's not a work friend"), or on on how to do the task (e.g. A: "Aunty Sally?" B: "It's not supposed to be family"), or anything else (e.g. "wait, slow down", "not her!")
    - Corrections over whether a person can be included in recall (e.g. A: "Sally", B: "I don't know her", spelling (e.g. "you spelled it wrong", or "It's P H, Not F**")**
- Do not count if:
    - It's simply a "no" response to a question (e.g. A: "Did you say Matt?" B: "No, I didn't")
    - One participant appears to be unhappy with the other participant but doesn't explicitly disagree with or correct them (e.g. "Put the whole friggin' school")

Note

- For all **Y/N (present/absent) questions**
    - Don't worry if there aren't many instances of some of the codes – some might not be very frequent
    - Don't worry if some of the transcripts don't show any examples of any of the codes
- It can be difficult to tell whether some participants are using certain strategies or listing them in a structured way if they don't explicitly state that they are doing

Experiment 2 News Event List Coding

Criteria For News Event List Coding

- Answer Yes (1) or No (0) to the following:
  - Did participants use **categories** at any stage? Y/N
  - Did participants use **a group strategy**? Y/N
  - Did participants use **an individual strategy**? Y/N
  - Do they **successfully cue** each other at least once? Y/N
  - Do they **unsuccessfully cue** each other at least once? Y/N
  - Is there at least one example of **mirrored repetition**? Y/N
  - Did they **explicitly disagree** on anything or **correct each other** at least once? Y/N
- THEN count instances of:
  - **Successful Cues**
  - **Unsuccessful Cues**
  - **Mirrored Repetitions**
  - **Corrections and Disagreements**

Categories

- If they use categories for at least some of the task
- If there is more than one instance in which at least two related events occur together in recall
  - E.g. for news events "NZ earthquake, QLD floods", "royal wedding, Queen visited Australia"
  - E.g. for shared social events "Trip to Newcastle, trip to Gosford", "Schoolies, HSC exams, HSC party"
  - E.g. for shared holidays "Canada, US", "UK 2010, UK 2008, UK 2002", "Port Macquarie with Sally, Port Macquarie with Smiths,"
- Do not count if:
  - There is **only one instance** where a category occurs in recall

Group Strategy

- They should look like they are using a coordinated strategy, that includes both participants in a group
  - E.g. using categories
  - If they mention categories, this counts as a group strategy
  - If they use another strategy not based on category (e.g. chronological order) this also counts
- Count but make a note if:
  - Only one participant uses categories and the other doesn't
  - They appear to be recalling the events in categories, but don't say anything about it
  - They only start to use the categories near the end, after they have already recalled most of the words
- If they use a group-level strategy but only start talking about the strategy after they start using it, this still counts – they just have to consistently use the same strategy from the beginning

NOTE: *These strategies must be used during collaboration*

- If they talk about what they did in the previous individual recall, this is not the same as discussing a group-level strategy in recall

Individual Strategy

- One participant uses their own individual strategy in recall
  - E.g. if one participant appears to use a particular strategy to recall events without coordinating the strategy with their partner (this could be categories)

  - OR if one participant refuses the other participant's input so they can use their own idiosyncratic strategy, which the other participant cannot access
- Count but make a note if:
  - This only occurs for a short section of the transcript

Cuing - Successful

- Does at least one participant successfully cue the other?
  - E.g. A: "E.g. "Who was that woman who was murdered?"
  - What is cued does not have to count as another item in recall, e.g. A: "Where was that youth camp shooting?" B: "Norway?".
- Do not count it if:
  - The cue does not elicit any information (e.g. A: "Who was that woman who was murdered?" B: "No idea") – these are *unsuccessful* cues
- Count but make a note if:
  - It would normally be too specific to be a cue (e.g. "what's the one in Parliament with the speaker? ")
  - It would normally be too broad to be a cue (e.g. "What else did you say?") and the participant responds with one or more events

Cuing - Unsuccessful

- Does at least one participant *unsuccessfully* cue the other?
  - E.g. A: "Who else had birthday drinks?" B: "No one"
  - What is cued does not have to count as another item in recall, e.g. A: "Where was that youth camp shooting?" B: "Just put youth camp shooting".
  - If the cue only elicits an item already recalled, this counts as an unsuccessful cue e.g. A: "Any birthday drinks?" B: "Tom's but we've already said his"
- Do not count it if:
  - The cue does elicits new information (e.g. A: "Who was that woman who was murdered?" B: "Jill Meagher") – these are *successful* cues
- Count but make a note if:
  - It would normally be too specific to be a cue (e.g. "what's the one in Parliament with the speaker? ") and the other participant responds with "who?" or does not respond (NOTE: if they just say "no" this counts as a *successful* cue because the other participant has remembered Tom)
  - It would normally be too broad to be a cue (e.g. "What else did you say?") and the participant fails to respond with one or more events

Mirrored Repetition

- Mirrored repetition occurs when one participant repeats the item that the other participant just said
  - This could be events (e.g. A: "The QLD floods" B: "QLD floods")
  - OR another phrase (e.g. A: "What about natural disasters?" B: "Natural disasters…"
  - There could be one or two words in between, but no more (e.g. A: "Hurricane Sandy" B: "Yep Hurricane Sandy…")
- Do not count it if:
  - The two instances of the same event occur in different parts of the transcript
  - One participant repeats him/herself
  - What is repeated is not an item in recall (e.g. A: "Any other holidays?", B: "holidays")
- Count but make a note if:
  - It's a repetition in the form of a question/answer (e.g. A: "Japan" B: "Japan?", or A: "Japan?" B: "Yeah Japan", or A: "Did you say Japan?" B: "Yeah I put Japan"/ "No I didn't put Japan")

  - If the repetition is included in a sentence A: “Japan” B: “I forgot Japan”

Corrections And Disagreements

- Does one participant correct or disagree with the other participant at least once? E.g.:
  - Disagreements over how to structure recall (e.g. A: “What happened recently?” B: “No, let’s go by country”)or definitions of particular categories (e.g. “that’s not news”), or on how to do the task (e.g. “that’s not politics”)
  - Or any other disagreement (e.g. “wait, slow down”)
- Do not count if:
  - It’s simply a “no” response to a question (e.g. A: “Did you say New York floods?” B: “No, I didn’t”)
  - One participant appears to be unhappy with the other participant but doesn’t explicitly disagree with or correct them

Note

- For all **Y/N (present/absent) questions**
  - Don’t worry if there aren’t many instances of some of the codes – some might not be very frequent
  - Don’t worry if some of the transcripts don’t show any examples of any of the codes
- It can be difficult to tell whether some participants are using certain strategies or listing them in a structured way if they don’t explicitly state that they are doing

APPENDIX C

Collaborative Process Coding Scheme: Autobiographical Memories

Experiment 2 Autobiographical Memory Coding

Criteria For Autobiographical Memory Coding

- Count the number of instances of the following:
  - Do they successfully cue each other? [**Successful cues**]
  - Do they unsuccessfully cue each other? [**Unsuccessful cues**]
  - Does one participant repeat what the other just said? [**Mirrored repetition**]
  - Did they explicitly disagree or correct each other on anything? [**Corrections & disagreements**]
  - Did one participant finish or continue on a sentence started by the other? [**Co-constructed sentences**]

Cuing - Successful

- Does one participant attempt to cue the other? I.e. does one participant successfully elicit information from the other. E.g.:
  - **A:** Who else was there? **B:** Anita
  - **A:** What did we do that night? Did we have a barbeque at home? **B:** Yeah. OR B: No. [*This results in new information that they DIDN'T have a barbecue at home*.]
  - **A:** What else? **B:** There were about 10 people there
  - **A:** You start **B:** Okay. Um at my work they needed someone….
- Do not count it if cue does not result in additional recall. E.g..
  - **A:** Who else was there? **B:** No idea – these are *unsuccessful* cues

Cuing - Unsuccessful

- Does one participant UNSUCCESSFULLY attempt to cue the other? I.e. does one participant unsuccessfully try to elicit information from the other. E.g.:
  - **A:** Who else was there? **B:** I don't know
  - **A:** What did we do that night? Did we have a barbeque at home? **B:** Maybe
  - **A:** What else? **B:** [*no response*]
  - **A:** You start **B:** I don't know where to start…
  - **A:** Who else was there? **B:** Then we had dinner. [*Additional information is supplied but it doesn't answer the question*]
- Do not count it if:
  - The cue does elicits new information – these are *successful* cues

Mirrored Repetition

- Does one participant repeat what the other participant just said? E.g.:
  - **A:** We had the exact same drinks **B:** We had the exact same drinks, I bought her something, she bought me something.
  - **A:** Miss um, blond hair. Percy **B:** Percy, Miss Percy
  - **A:** We both got kicked out of Maths class one day. For, were we talking? **B:** We were talking [*This is a response to a question but it still counts as mirrored repetition because the same phrase is repeated*]
- Do not count it if:
  - The two instances of the same phrase occur in different parts of the transcript, not in the next turn
  - One participant repeats him/herself
  - A participant repeats what the experimenter just said
  - One participant echoes the sentiment just said by the other participant but doesn't use the same words [e.g. **A:** That was funny **B:** It was hilarious]

Corrections And Disagreements

- Does one participant disagree with, correct or intentionally contradict the other participant? E.g.:
  - **A:** During the day we went to the beach. We spent the day at the beach. **B:** No we went to the beach in the evening. Didn't we? **A:** No we went to the beach during the day. On my birthday. [*NOTE: This is also a mirrored repetition*]
  - **A:** Um I remember his other brother, what's his name Marick? **B:** Marrick {pronounces it differently}. [*NOTE: A's question is a successful cue, and B's response is a correction*]
- Do not count if:
  - It's simply a "no" response to a question. E.g.**:**
  - **A:** Did we have a barbeque at home? **B:** No. (see SUCCESSFUL CUES)

Co-Constructed Sentences

- Does one participant finish or continue on a sentence started by the other AT LEAST ONCE in the transcript? E.g.:
  - **A:** It was either that or **B:** The red.
  - **A:** Every night was a party. Wake up, drink, eat food, drink, sleep, drink, go to the beach, drink. **B:** Listen to music, watch the lasers.
  - **A:** And we had headbands and we made the bouquets and they were **B:** Creamy **A:** Cream and white, mainly [*NOTE: These are two co-constructed sentences*]
- Do not count if:
  - One participant adds additional information about the same topic but doesn't finish the other participant's sentence. E.g.:
    - **A:** We had five cases of beer; we just filled the fridge up. **B:** There was no room for food
- NOTE: If they say <u>the same thing at the same time</u>, this is a co-constructed sentence NOT a mirrored repetition, even if they are the same words. E.g.
  - **A:** We travelled by **A&B:** Ferry

APPENDIX D

Final Ethics Approval

MACQUARIE UNIVERSITY

Amanda Selwood <amanda.selwood@mq.edu.au>

Amendment Approved- Ethics Ref 5201100021

Ethics Secretariat <ethics.secretariat@mq.edu.au> Fri, Jun 24, 2011 at 2:16 PM
To: A/Prof Amanda Barnier <amanda.barnier@mq.edu.au>
Cc: Ms Amanda Selwood <amanda.selwood@mq.edu.au>

Dear Amanda,

Thank-you for your email. The following amendments have been approved:

1. Additional of Amanda Selwood to the personnel listed.

2. The previous application planned to test healthy older married couples. The project will now test strangers, friends and siblings of at least 18 years of age. Strangers will be recruited from the PSY105 Participation pool and receive course credit. Whereas friends and siblings will be recruited through on campus using flyers and the MACCS paid participant pool and receive $15 per hour for their participation.

3. The participants will be asked to type their responses into a computer instead of all the tasks being completed verbally and being recorded. During the collaborative conditions the participants discussions will still be audio recorded to determine the strategies used to remember together.

4. In the approved project, subjects were being asked to recall a word list, names of members of their social club, shared holidays, and autobiographical events. In this study, the word list will remain the same, but instead of generating a list of the members of their social club and holidays, subjects will be asked to generate different lists depending on which type of couple they are. Strangers will be asked to generate and recall a list of Psychology lecturers and tutors, as well as major news events in the past year. Friends will be asked to generate and recall a list of mutual friends and acquaintances, as well as a list of shared social events in the past year. Siblings will be asked to generate and recall a list of mutual friends and acquaintances and a list of the family holidays they have taken to date. The autobiographical events will also be different: participants will be asked to recall their latest birthday and another event of their choice.

4. Change in questionnaires. The Personal Assessment of Intimacy in Relationships Scale, Transactive Memory Scale will remain the same, but adapted to be relevant for strangers, friends and siblings. An event questionnaire and demographic questionnaire have been added.

Please note that the error in the flowsheet for Group 3 (Siblings) condition 2(Collaborative Condition) still remained in the Recall 1 with the participants being asked about Psychology lecturers instead of mutual friends (only the schedule was amended). Please amend this and forward us the amended copy for our records.

Please do not hesitate to contact us should you have any questions or concerns.

Kind regards
Kate

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Office of the Deputy Vice Chancellor (Research)

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