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The Self-Reference Effect: How Elaborative Processing and Associability Function Through Self-schemas

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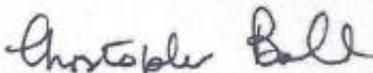
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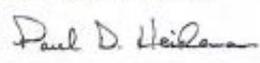
Self-schemas

A thesis submitted in partial fulfillment of the requirement
for the degree of Bachelor of Science in Psychology from
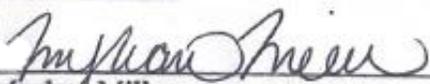The College of William & Mary

by

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Abstract

The self-reference effect (SRE) refers to the phenomenon where relating a piece of material to oneself allows it to be better remembered than material encoded in most other ways. This study tested a hypothesis of self-schemas as a sort of associative foundation for novel material at encoding, through the variation between strong and weak associates. To accomplish this goal, this study compared a self-referencing condition to an intimate and a distant other-referencing condition. The present study also investigated the SRE through a level-of-association variable. Participants were tasked to judge trait adjectives towards themselves and to a familiar person of the same age and gender (intimate "other") or to former President Barack Obama (distant "other"). Half the traits were denoted as having strong self-association in this participant population, and the other half as having weak association. This study found both an SRE and a retrieval advantage for strong, self-associated stimuli. These results support the self-schemas as an associative foundation assumption for the improved recall of self-related material.

Keywords: self-reference effect, self-schemas, elaborative processing, associability, strong associates, weak associates, intimate other-referencing, distant other-referencing

The Self-Reference Effect: How Elaborative Processing and Associability Function Through

Self-schemas

The self is an often-thought-of concept. The self-concept, as defined by Baumeister (1999) is the individual's belief about themselves, with regards to the person's qualities and their understanding of who and what the self is. In each person, the self-concept is very unique, and shapes how individuals live their lives. The self-concept may also be connected to various self-schemas (Bellezza, 1984). These self-schemas can be thought of as prototypes which process material more easily when that material is compatible with the self (Bellezza, 1984; Rogers, Kuiper, & Kirker, 1977). Each self-schema holds a variety of personal experiences within it. Connecting stimuli to personal experiences and thus to self-schemas may assist in the efficiency of information processing. Understanding how the self-concept acts through self-schemas to affect information processing may elucidate why individuals encode some material more deeply than other material. This understanding might then help researchers develop strategies for studying and remembering using the self-concept. The addition of the self-concept in such strategies may assist to ensure important information is deeply encoded.

One way to study the self-concept is through the self-reference effect, a term first coined by Rogers, Kuiper, and Kirker in 1977. This study found that relating information to the self allowed it to be better remembered than information processed in most other ways. Following the cornerstone 1977 study, the self-reference effect (from here on referred to as the SRE), has been utilized in numerous studies. The basic structure of these studies involves a self-referencing (SR) condition versus an other-referencing (OR) and/or a common/semantic condition. In the self-referencing condition, participants relate stimuli to themselves. In the other-referencing

condition, they relate stimuli to some defined "other" person, and in the semantic condition participants judge stimuli through a semantic specification, such as color. Despite its extensive use, the mechanism behind the SRE has not been properly determined. Therefore, the present study aimed to further investigate these mechanisms.

Although the mechanisms behind the SRE have not been thoroughly researched, some studies have proposed hypotheses attempting to explain how the effect works in the brain. Four major hypotheses are elaborative processing, organizational processing, dual processing, and associability to self-schemas.
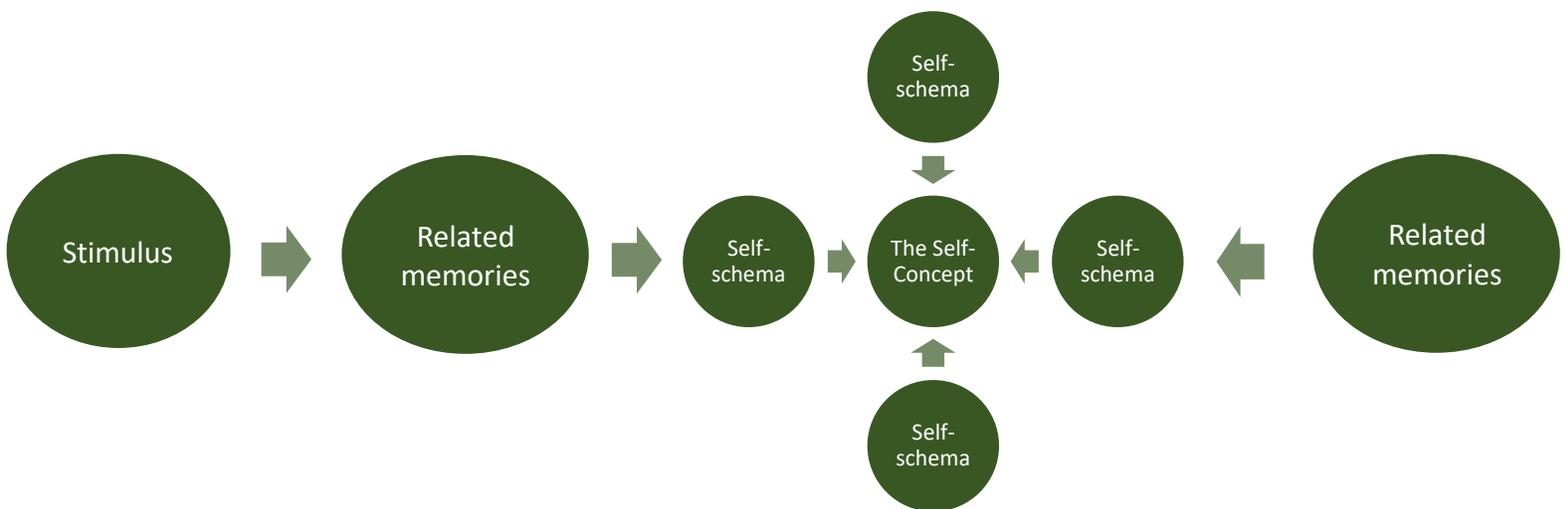
Elaborative Processing Hypothesis

Elaborative processing involves attending to the specific meaning of a word, as well as semantic associations between the word and related material in memory (Klein & Loftus, 1988; Symons & Johnson, 1997). When an individual addresses the meaning of a word, it leads to the encoding of information that is unique to that word (Klein & Loftus, 1988). Furthermore, elaborating upon an individual word causes the formation of multiple associations (elaborations) between the word and related material in memory (Klein & Loftus, 1988). A greater number of elaborations is superior because it creates multiple routes for retrieval (Klein & Loftus, 1988). Each additional connection between the material and the stimulus word creates another path for the participant to access the word in memory, and thus increases the probability of retrieval. The present study takes this hypothesis even further than just a connection between stimuli and material in memory. The elaborative processing hypothesis is similar in construction to that of a concept map, a diagram designed to show relationships between different concepts. The elaborative processing concept map as used by the present study can be seen in Figure 1. At the center of the map is the self-concept, surrounded by various established self-schemas. These

schemas are connected to a wide variety of related material in memory, which then form

connections with the stimuli. The present study adds to the elaborative processing hypothesis by

directly connecting it to self-schemas through material in memory.

Figure 1

Concept Map Representation of Elaborative Processing Hypothesis

Self-schema → The Self-Concept

Stimulus → Related memories → Self-schema → The Self-Concept ← Self-schema ← Related memories

Self-schema → The Self-Concept

Note. The Elaborative Processing Hypothesis focuses on stimulus connection to related

memories. The present study added the self-schema and self-concept levels of this concept map.

Elaborative processing as it stands also provides a structure for inference-based

reconstruction of stimuli, through the large association net developed by self-referencing, in case

retrieval efforts fail (Klein & Loftus, 1988). Inference-based reconstruction is where participants

do not remember the exact word they saw during encoding, however the elaborations attached to

it and a word prompt during testing allow participants to infer what the stimulus was. These

inferred words the participants remembered would be reconstructions of the original stimulus word. This inference-based reconstruction would be beneficial on a recognition remember-know-new test because in this test, words are displayed as prompts and the participant must state whether they remember or know of the word, or whether the word is new to them. Participants would be able to use these presented words to prompt an inference-based reconstruction if they did not remember the original stimulus word. This strategy is less effective for a recall test however, because in recall tests there are no cues to prompt a reconstruction. Therefore, self-referencing could be most advantageous during recall tests because self-referencing has the greatest potential for generating a large "web" of associations, which allow the initial word to be more easily tracked down and recalled during testing. This would result in a larger recall difference between stimuli referenced in the "self" condition versus an "other" or semantic condition.

Anderson and Reder (1979) argued that some elaboration is easier than others due to habitual practice. Processing items as they relate to the self is a frequently-used method of processing. They also argued that the self is extremely well-learned due to this frequent use, which results in individuals having more expertise about themselves than about any other structure encoded in memory (Markus, 1977; Anderson & Reder, 1979). Consequently, referencing stimuli to oneself as is done in SRE studies may constitute a processing condition that receives an exorbitant amount of practice. This "practice effect" makes self-referencing easier to use and functionally more efficient than semantic or other-reference conditions. The underlying mechanisms of the SRE seem to include, at least partly, an elaborative process as described by this hypothesis.

The frequency of practice from the elaborative processing hypothesis was considered in the development of the present study. One way this concept was used in the present study was

through an associability manipulation, where strong and weak associates were used as stimuli to compare high and low frequencies of practice. A second use of this concept is the self- and other-referencing conditions. The present study included three condition levels, all varying in how frequently they were used as methods of processing. The condition with the highest frequency of use throughout a participant's life was the self-referencing condition. The second most-frequently used method of processing was an intimate other-referencing condition, where the "other" was someone of the same age and gender as the participant. The method with the least amount of practice throughout the participant's life was embodied by the distant other-referencing condition where the "other" was represented by former President Barack Obama. The present study investigated the self vs "other" comparison, where both other-referencing conditions were combined. but this study also investigated the distinctions between all three conditions, for a three-way interaction. Frequency of practice interacts with the self, intimate "other", and distant "other" conditions through the number of elaborations that occur for each condition. The goal of studying the self and "other" conditions through frequency of practice was to identify whether frequency affected how easily they related to self-schemas.

Within the elaborative processing theory, the intimate versus distant "other" has been a contentious topic. Klein and Loftus (1988), were one of the first to theorize that a more intimate "other" for the other-referencing condition, such as a close relative, may be thought of and elaborated upon almost as much as the self. Symons and Johnson (1997) took this even further, concluding that using this more intimate "other" would therefore result in a weak or not significant SRE when compared to the self. In addition to Klein and Loftus, and Symons and Johnson, a few studies utilized an intimate "other" in their research, and discussed the differences between this condition and a more distant "other" condition (Bellezza 1984; Serbun,

Shih, & Gutchess, 2011). These researchers concluded that comparing the intimate "other" to the self was futile. This intimate condition would only result in a weak or not significant SRE due to near-equivalent habitual practice between it and the self. Current researchers almost exclusively use the distant other-referencing condition in their studies. Serbun et al. from 2011 is among the few exceptions. It should be noted, however, that despite the weak SRE, the SR condition still tended to result in increased memory performance when using an intimate OR. This shows that there is still a memory advantage when comparing the SR to the intimate OR, and that more questions may answered using the intimate OR condition. The present study revisited the intimate "other" by comparing it in the same experiment to a distant "other". Analyses in previous studies evaluated the self in relation to one other-referencing condition, but did not evaluate the relation between two different levels of other-referencing conditions in the same experiment. The design in the present experiment was intended to test whether the intimate "other" was easier to connect to self-schemas than the distant "other".

Organizational Processing Hypothesis

Organizational processing involves grouping words together into categories (Klein & Kihlstrom, 1986; Klein & Loftus, 1988; Symons & Johnson, 1977). This is known more specifically as relational processing, where words are grouped based on some semantic criteria (Symons & Johnson, 1997). Relational processing produces an attention to similarities between words in a list, and the encoding of associations between words and a category label. This category label may be given to participants in the organizational task to assist with grouping seemingly unrelated words, or it may simply emerge when words are easily related to each other. Organizational processing is purported to function in two ways (Klein & Kihlstrom, 1986; Klein & Loftus, 1988). Firstly, it may encourage the encoding of associations between words in a list

that share the same category, which would result in the development of multiple retrieval paths. Secondly, the associations between each word and their category label could allow the label to act as a retrieval cue for the words within that category, facilitating recall.

This method of processing is often tested in two ways. The first way to test organizational processing is through the amount of "clustering" in recalled words. In this context, clustering is when words within one category label are remembered in succession, followed by words from a second category, continuing until recall is completed (Klein & Loftus, 1988). A large amount of clustering implies the use of relational information as a base for organizing words in memory. The second way to test the occurrence of organizational processing is by comparing a self-referencing condition to a semantic-encoding condition that is specifically designed to promote organization (Symons & Johnson, 1997). Symons and Johnson predicted that the SRE would disappear under these circumstances. This implies that the semantic-encoding condition would use an equivalent amount of organization as the self-referencing condition, resulting in the lack of a significant difference in retrieved information between conditions.

The present study did not utilize the organizational processing hypothesis extensively during development because the present study only included positive trait stimuli, which may nullify the effectiveness of categorization. Positive trait stimuli all fall within one easily identified category, that they are positive, and therefore it is a less effective memory strategy for the brain to try and categorize them into different groups. As a result, the present study was not designed to investigate this hypothesis. The lack of focus on the organizational hypothesis also meant that this study did not utilize a semantic-encoding condition, because they are often used in comparison to organizational tasks. The present study did not look for clustering in the recall data either, as this measure is only used in organizational processing research.

Dual Processing Hypothesis

After examining both the elaborative and organizational processing hypotheses, Klein and Loftus (1988) hypothesized that the effects of self-referencing on memory could not be explained by just one type of processing. These two researchers proposed that both processes worked in conjunction, although the words being judged influenced which process worked best. If the words in a list were highly related to each other, elaborative processing produced better results. If words were not related, or the relation was difficult to determine, organizational processing improved recall. Evidence supporting this claim include the idea that when words were highly related, it was easier to organize them all within one category, which was less useful for distinguishing the words from each other. It was more useful, under highly related conditions, to elaborate upon word-specific information. Conversely, if words were not easily related, it would make a greater impact on encoding to deeply consider organizational categories in which to fit each word.

Symons and Johnson (1997) evaluated this claim in their meta-analysis and found that even though a task promoted relational (organizational) processing, this does not necessarily mean it would facilitate memory. To elaborate, providing a cue to facilitate recall of a category in organizational processing may facilitate memory for that category, but not necessarily the words within the category. Symons and Johnson also found that the size of the category is an important task criterion. Organization through relational processing is more likely to aid recall of smaller categories over large ones, due to effects of memory load on recall. Additionally, Klein and Loftus compared the trait adjectives in their SR condition with semantic conditions, instead of using an OR condition. This comparison might have produced an encoding bias against the semantic condition because most individuals do not frequently practice processing trait

adjectives semantically. Finally, Klein and Loftus, along with many other studies, used both positive and negative trait words as stimuli (Conway & Dewhurst, 1995; Conway & Dewhurst, 2001; Dewhurst, Anderson, Grace, & Boland, 2017; Hunt & Einstein, 1981; Jackson et al., 2019; Kalenzaga & Clarys, 2013; Kim, Johnson, Rothschild, & Johnson, 2018; Kim, Jeon, & Rothschild, 2018; Klein & Loftus, 1988; Leshikar, Dulas, & Duarte, 2014; Turk, Cunningham, & Macrae, 2008). These studies employed desirability ratings to judge these positive and negative stimuli. In theory, the desirability ratings promoted elaboration because the judgments made by participants formed connections between a stimulus with one rating and an existing construct in the brain with the same rating. However, it may also unintentionally promote relational processing. There is a possibility that participants may perceive a category label in those stimuli, and break them up subconsciously into positive (desirable) and negative (not desirable) traits. This unintentional relational processing is a major factor for the decision in the present study to use only positive traits.

Despite their concerns, Symons and Johnson ultimately supported Klein and Loftus's conclusion. They concluded that self-referencing used both elaborative and organizational processes, with one process stressed over another depending on whether stimuli in a list are related or unrelated. However, Symons and Johnson cautioned future researchers to consider the variables explored in their meta-analysis when writing methodology to more accurately test the effect. One reason for the present study's focus on the elaborative processing over organizational processing hypothesis is because the stimuli for the present study were all positive trait words. The uniform positivity would increase relatedness of the trait stimuli, moving the encoding process further into the realm of elaborative processing instead of organizational processing.

Associability to Self-Schemas Hypothesis

The final working hypothesis regarding the mechanisms behind the self-reference effect is associability to self-schemas (Bellezza, 1984). This hypothesis involves connecting internal cues in the form of personal experiences to one's self-concept. It simply states that traits which are self-descriptive are remembered better than traits that are not because they better fit into an individual's various self-schemas (Bellezza, 1984; Rogers et al., 1977). Each self-schema contains a range of qualitatively different information that can be associated with a set of personal experiences. Each schema also has a sort of "web" which encompasses its set of experiences. Measuring associability to these personal experiences is often accomplished through an autobiographical memory condition or self-descriptiveness condition. Using those two conditions requires participants to consciously think about how the words relate to their personal experiences, creating an association between the word and one schema. The strong, well-established schema network acts as a cue for the word during free recall and results in increased retrieval performance (Bellezza, 1984). Bellezza also noted that trait words which were more self-descriptive, and thereby fit better into the self-schema, were more likely to be remembered than those which were less self-descriptive (Bellezza, 1984; Kuiper & Rogers, 1979; Rogers et al., 1977). Bellezza did not discuss any potential for his multiple self-schemas to overlap, nor whether some self-schemas were more effective in promoting retrieval than others. To date, these questions still have not been addressed. This line of research was not picked up by many subsequent studies, but was revisited by the present study in the form of a level-of-association variable. This variable included trait words that were either more or less self-descriptive. In the present study, they were known as strong or weak associates. The associability hypothesis was also revisited in the present study through the investigation of the intimate versus

distant "other". According to this hypothesis, the self-descriptiveness of traits would decrease when participants were instructed to associate them to an "other" versus the self.

Symons and Johnson (1997) mentioned associability of words, but only as a part of the established elaborative or organizational processing hypotheses. They did not discuss or cite the 1984 Bellezza study, one of the only studies to promote word associability to the forefront to explain underlying mechanisms of the SRE. According to the meta-analysis, the major mechanism behind the SRE was "greater elaboration and organization of encoded information". Since 1997, there has been no further meta-analysis, and few studies have explored the elaborative and organizational hypotheses more deeply or elaborated upon the associability hypothesis proposed by Bellezza (1984).

More recent studies used association in their methodology to ask "how well does this trait word describe you?" (Dewhurst et al., 2017; Kalenzaga & Clarys, 2013; Kelley et al., 2002; Leshikar et al., 2014; Turk et al., 2008). This was not necessarily intended to test any associability a stimulus might have to self-schemas, but instead to assist in the creation of a web of elaborations around the stimulus to aid in retrieval through elaborative processing. More recent studies also continued the tradition of using both positive and negative trait words, although it was criticized in the 1997 meta-analysis by Symons and Johnson. As mentioned above when discussing the elaborative processing hypothesis, most studies used positive and negative words to demonstrate varying levels of association within elaborative "webs". In those studies, any strong level of association was defined as the self-reference condition, and the weak level of association was defined as the other-reference and semantic conditions. These definitions were applied because the self-referencing condition resulted in a greater recall than the other two conditions. The researchers did not consider that the stimuli themselves might

result in a stronger or weaker level of association within the self-referencing condition. They did not investigate association as an underlying function of the SRE. The associability hypothesis proposes a plausible hypothesis for the underlying mechanisms of the SRE, but it has not been sufficiently investigated. Therefore, the present study explored it to a great extent.

The elaborative processing, organizational processing, and associability hypotheses together propose viable mechanisms for the SRE, although no one theory can claim to explain it fully. The elaborative processing hypothesis focused on a stimulus building connections with existing information in the brain, and how this process is enhanced with self-referencing. The organizational processing hypothesis evaluated the tendency of the brain to chunk stimuli into categories, creating retrieval cues which functioned more efficiently with self-referencing. The associability to self-schemas hypothesis emphasized the link between trait stimuli and self-schemas through personal experiences, where personal experiences act as cues for various self-schemas. The greater the self-descriptiveness of the trait adjective stimulus, the better it would connect with personal experiences and self-schemas, which would then enhance retrievability.

These hypotheses have many similarities and differences. The associability to self-schemas hypothesis is similar to the elaborative processing hypothesis because they both involve making connections between stimuli and habitually-practiced material in the brain. However, the associability hypothesis specifically identifies this material as personal experiences, which are more directly related to stimuli that are trait adjectives. The associability hypothesis also emphasizes the trait adjective stimuli advantage in recall, while the elaborative hypothesis is more general. The associability hypothesis stresses these stimuli because traits are more frequently linked with personal experiences than stimuli such as nouns or images, whereas the elaborative processing hypothesis does not discriminate between the ability of different stimuli to

form stronger or weaker connections with existing material in memory. Additionally, the

associability hypothesis contains facets of the organizational hypothesis in that personal

experiences act as internal cues for the stimuli. And yet, unlike the organizational hypothesis, the

brain is not creating novel categories for the stimuli as they appear. Instead, the internal cues are

already attached to existing self-schemas. The organizational hypothesis, by contrast, adds an

extra level of processing through the creation of categories in the brain, and then uses the novel

categories instead of existing information to retrieve the stimuli. The elaborative and

organizational processing hypotheses contain the most differences between the four major

hypotheses. They operate differently in that lists of words with high relatedness seem be encoded

more effectively through elaborative processing, and lists with minimal relatedness seem to work

better with organizational processing. This contrast is why some studies hypothesized that both

the elaborative and organizational processing hypotheses work in conjunction, creating the dual

processing hypothesis. The present study's use of only positive stimuli, as stated in the

organizational processing section, prompted this study's adherence to elaborative processing

over the organizational processing hypothesis. Using only positive stimuli is a context of high

relatedness, falling in the realm of elaborative processing. The present study also considered the

inference-based reconstruction aspect of the elaborative processing hypothesis. This

reconstruction aspect was one reason the present study decided to use a recall test. The

elaborative processing and associability hypotheses were also used to inform the two other-

referencing conditions, the intimate and distant "other". The self-descriptiveness of traits in the

associability hypothesis, and the levels of habitually-practiced processing methods from the

elaborative processing hypothesis, came together in the present study to investigate the

relationship between the SR, intimate OR, and distant OR conditions. In this way, these two

hypotheses were used in conjunction to structure the present study for an investigation of self-schemas as an underlying mechanism of the SRE.

SRE Methodology

As stated briefly above, in many SRE studies the self-concept was compared in a "self-referencing" (SR) condition to another entity representing an "other-referencing" (OR) condition. This comparison often manifested as the participant themselves (SR) versus another individual (OR). Participants might judge a stimulus word or image on how well it relates to themselves in the SR condition, or to the other individual in the OR condition. A "common" or semantic condition was often added as a control in many studies. It was used as a baseline for comparing the SR and OR conditions and measured stimuli judgments through semantic processing. Semantic processing, while differing between studies, often meant determining whether a word was positive or negative (Conway & Dewhurst, 1995; Conway & Dewhurst, 2001; D'Arbembeau, Comblain, & Linden, 2005; Dewhurst et al., 2017; Leshikar et al, 2014).

Even when using the names of the participant and another individual for the SR and OR conditions, the methodology may still differ. The methodology will especially differ if the researchers adhere more to either the elaborative or the organizational processing hypothesis. During learning, participants might be instructed to relate each word they see to themselves or to the "other" (Conway & Dewhurst, 1995; Conway & Dewhurst, 2001; Dewhurst et al., 2017). In those studies, instructions were presented followed by screens containing only the target word, and participants must remember to whom they are relating the words. Other studies presented either the participant's or the "other's" name on a screen in conjunction with a target word. This target word may be above or below the name, and the participant might be asked to judge the location of the target word in relation to the name for self- or other-relational encoding (Kim et

al., 2018). This relational encoding study is a prime example of the application of organizational processing. Similarly, a study by Turk et al. (2008) included aspects of both the organizational and elaborative processing hypotheses. Turk et al. asked participants if the target trait word above or below the name described the person represented by the name. The 2008 study repeated this structure in a second experiment, using faces as referential cues instead of names. They presented either the participant's or an "other's" face in the center of the screen with a target word above or below the face. Both studies above included semantic processing conditions as common conditions. The common condition for the Kim et al. 2018 study was whether the target word was red or green. By contrast, for the Turk et al. 2008 study it involved whether the trait adjective was above or below the face/name cue. Both studies found a significant SRE, demonstrating the effectiveness of both the organizational and elaborative hypotheses. The above studies demonstrate the variety even within what may be considered a "standard" SRE study structure.

　　　　Other SRE studies did not contain the standard other-reference condition. Leshikar et al. (2014) only compared an SR condition with a common condition, and asked if a word was self-descriptive or if the participant considered it a common word. Another example of the lack of a traditional OR condition is Dewhurst et al. (2017). In this study, participants rated traits in three different conditions, the first being how helpful the trait would be for survival. The second was a traditional self-reference condition, how well the participant thought the trait word described themselves, and the third was the semantic condition, judging how positive or negative the trait word was. The present study did not include a common condition because of the focus on comparing the self- and other-referencing conditions.

The studies that did not use a standard OR condition are in the minority, and those that

did use an OR condition used a variety of individuals for this "other". Examples include a close

relative, celebrity, or prominent political figure, such as "your mother", "Angelina Jolie", or

"Bill Clinton", respectively (Conway & Dewhurst, 1995; Conway & Dewhurst, 2001;

D'Arbembeau et al., 2005; Kalenzaga & Clarys, 2013; Kelley et al., 2002; Kim et al., 2018; Kim

et al., 2018, Serbun, Shih, & Gutchess, 2011; Turk et al., 2008). One such study used both "your

mother" and "Bill Clinton" to test the intimate versus distant level of the "other" debate as

mentioned in the elaborative processing section (Serbun et al., 2011). To accomplish this, the

study presented photos of common objects with either the word "self", "mother", or "Bill

Clinton" presented underneath the photo. Participants were required to judge whether the object

was something either themselves, their mother, or Bill Clinton would buy sometime in the next

year. The Serbun et al. study is similar to another study with a more general SRE structure. In the

other study, participants were presented with nouns representing objects, and they judged if they

would like the object, if an "other" would like it, or if the object was living or non-living (Yin,

Ma, Xu, & Yang, 2019). The present study utilized both manifestations of the "other" to

investigate whether participants practiced processing an intimate "other" with the same

frequency as they practiced processing a distant "other". This intimate versus distant "other" was

then also compared to the frequency of processing for the self, resulting in a three-way

interaction analysis which tested the self-schemas hypothesis.

Not only have the appearances of the SR and OR conditions vary, the stimuli have varied

as well. Most studies used trait adjectives, but some used images (Brown et al., 1986; Serbun et

al., 2011; Turk et al., 2008) and a very few used nouns (Bellezza, 1984; Yin et al., 2019). The

meta-analysis conducted by Symons and Johnsons in 1997 determined that the mean SRE was

greater in studies using traits rather than nouns. The meta-analysis also found that studies using self-descriptiveness tasks with trait adjective stimuli produced a significantly larger mean SRE than those using imagery stimuli. Additionally, Symons and Johnson concluded that as memory load increases, the magnitude of the SRE also increases, but only for trait adjective stimuli. Therefore, when there is a large number of trait adjective stimuli, self-referencing is shown to be a more efficient processing strategy than semantic encoding. Researchers after 1997 either applied the meta-analysis by Symons and Johnson as instrumental literature in the structuring of their studies, or partially disregard its recommendations to perhaps investigate their validity. The present study did not contain a semantic condition, but it did take memory load into consideration by including only 32 stimuli.

After the encoding conditions, many studies included a retention interval (RI), varying from one minute to 24 hours. The inclusion and length of the RI is not standardized in SRE studies. Of the studies included in the Symons and Johnson (1997) meta-analysis, only about half used an RI. Although significant SRE's resulted from studies with and without an RI, the mean SRE was larger for studies that did contain one. A few studies supported the conclusions of the meta-analysis, theorizing that the longer the RI, the greater the effect due to consolidation in the brain (Conway & Dewhurst, 1995; Conway & Dewhurst, 2001). Such studies therefore advised including RIs of one hour or longer. Despite these collective conclusions, some researchers believed the RI carried more weight than others, and few later studies explored the possible consolidation aspect of the SRE. Instead, they included vastly shorter intervals in their studies or no interval at all, and still obtained significant results (Dewhurst et al., 2017; Kalenzaga & Clarys, 2013; Kim et al., 2018; Kim et al., 2018; Jackson et al., 2019; Leshikar et al., 2014; Rogers et al., 1977; Turk et al., 2008). The present study was not focused on studying the effects

of consolidation, and based on other studies which received the SRE using a short RI, the present study only included an RI of a few minutes.

A few SRE studies also investigated the effects of incidental versus intentional encoding following a retention interval. As collated by Symons and Johnson (1997), most studies included an incidental, or "surprise" test following encoding. A minority did use an intentional encoding structure and informed participants that there would be a test. This was to see whether participant effort might affect SRE significance. The 1997 meta-analysis determined that the mean SRE for studies with expected tests was not significant. Conversely, there was a larger, and significant, mean SRE for studies where participants were not expecting a memory test. Since the meta-analysis, few to no studies used an intentional encoding structure. The present study follows the example of past studies, utilizing an incidental structure for recall.

A greater number of SRE studies experimented with the type of testing, either free recall, cued recall, or recognition. It can be difficult to compare the effectiveness of a recall versus a recognition exam because they test the memory differently. Free recall testing is very simple: usually participants are presented with a blank sheet of paper and asked to write down all words they remember from the encoding task. Cued recall adds a layer of complexity, providing participants with a word or phrase to represent each stimulus word to prompt recall. Recognition tests are more involved than both free and cued recall. The standard recognition test requires participants to make judgments on words they saw during the encoding task as well as novel words, in a remember-know-new format (Tulving, 1985; Leshikar et al., 2014). Participants are prompted to decide if they "remember" or "know" whether each word on the test appeared during encoding. "New" meant that the participant had not seen the word during encoding. Due to the increased amount of judgments made by participants during recognition tests, these tests

result in more data points for analysis. The difference in data points and analyses between recall and recognition tests was considered individually by each researcher when deciding which test was preferred for their studies. Which test a researcher used could be decided by how they were studying the SRE.

It was uncertain whether one form of testing better evaluated the SRE. To investigate this question, Symons and Johnson (1997) compared the results of studies with recognition versus recall tests and concluded that the mean SREs calculated from studies using recognition tests were not significant, while those for studies using cued or free recall were significant. This may have changed with the greater number of successful studies using recognition tests after the meta-analysis, but it still indicates an advantage for recall testing in receiving a larger SRE.

D'Argembeau et al. (2005) examined this recall versus recognition testing issue through two experiments. The first experiment tested the participants' free recall of positive and negative trait adjectives, and the second tested their recognition. The researchers found that positive adjectives were better recalled than negative adjectives, but only when they were encoded in the self-referencing condition. In contrast, the encoding condition and valence (how positive or negative the trait words were) did not interact with a recognition test. Simply put, for a recognition test, the probability of remembering positive or negative words was equivalent between the SR and OR conditions. A later study from 2014 (Leshikar et al.) supported these findings. The uneven retrieval of positive and negative words for a recall test was also alluded to by the meta-analysis (Symons & Johnson, 1997) when it mentioned the possible confounding effect of word valence on elaborative processing. These data imply that if a researcher wanted to use a recall test, it would be best to include only positive words and avoid the positive skew in data. As mentioned in the organizational processing hypothesis section, the present study

included only positive trait adjectives, so the positive skew for a recall test would not be seen. However, based on the conclusions of previous studies which state that recall results in a larger SRE, the present study utilized a recall test.

After evaluating the existing literature, the present study structured a methodology which would allow the most efficient testing of the underlying mechanisms of the SRE. The present study utilized trait adjectives because previous studies indicated they would result in a larger SRE than other stimuli options. Previous studies also indicated that using a recall test would result in a larger SRE, so the present study used a recall test. Utilizing only 32 stimuli was a consideration of memory load, and only including positive traits served two purposes. Firstly, utilizing only positive traits removed any skew when using a recall test. Secondly, positive traits which were either strongly or weakly self-descriptive fit within the level-of-association variable of this study, as mentioned briefly in the associability hypothesis section. The present study also chose to investigate the intersection between the self-referencing condition and the intimate and distant other-referencing conditions because this intersection was under-addressed in both the elaborative processing and associability hypotheses. The present study tested for the effects for self vs "other" and intimate vs distant "other", and a three-way interaction between these conditions to evaluate their relationship. A common condition was not included because it was not relevant to the "self" versus "other" comparison goals of this study.

Present Study

The present study reexamined the intimate "other" and compared its effects to those of a distant "other". In the distant OR condition, participants were instructed to think of former President Barack Obama, mimicking the structure of other studies which also used prominent political figures. The intimate OR condition, conversely, asked participants to think of an

individual with the same age and gender as themselves. The purpose of defining the intimate OR condition as an individual with the same age and gender as the participant, instead of a relative, was to widen the definition of an intimate "other". A close friend, like a relative, could be someone involved in the formation of the participant's self-concept. Additionally, this close friend may be someone the participant identified with even more than a relative, due to the similarity in congruent life experiences and cognitive development. A gender-congruent OR condition has been utilized in previous studies, however an OR condition that is also age-congruent has never been studied (Kim et al., 2018, Turk et al., 2008). By studying this intimate "other" in a novel way and in comparison to a distant OR, it may allow the present study to find a significant three-way relationship between the self, intimate "other", and distant "other".

The other major aspect of the present study involved the SRE operating through personal experiences that connected words to one's self-schemas. In the present study, this was encompassed by the level-of-association variable, although it also functions in the self vs "other" variables. As developed in past studies following the elaborative processing hypothesis, the strong level of association was the self-reference condition because self-referencing was known to create the most elaborations and result in enhanced retrieval. The weak levels of association were the other-reference and common conditions because they did not result in many elaborations. Therefore, stimuli randomly assigned to the SR condition assumed the categorization of strong associates, and weak associates were relegated to the OR and common conditions. The stimuli used by many past SRE studies were from the Anderson (1968) list of 555 positive and negative words rated by 100 college students for likeability (Conway & Dewhurst, 1995; Conway & Dewhurst, 2001; Dewhurst et al., 2017; Jackson et al., 2019; Kalenzaga & Clarys, 2013; Kim et al., 2018; Kim et al., 2018; Leshikar et al., 2014; Turk et al.,

2008). Likeability, or desirability, was defined by a scale of how positive or negative each word was.

The present study did not assume that a word was strongly associable just because it was referenced to oneself. Instead, the present study moved out of the realm of the elaborative processing hypothesis and integrated the associability hypothesis by exploring the possibility that a word denoted as a "strong associate" may be more easily recalled in either the self or other condition. To this end, a previously unused source, the Adolescent Self-Image database (Hards et al., 2019), was utilized to obtain trait adjective stimuli. This database classified words based on their self-descriptiveness, or associability rating, either strong or weak. These classifications were determined by how often each word was used by participants in the Hards et al. study to describe themselves. Words used most often by participants were denoted as strong associates, and words used least often as weak associates. Integrating the elaborative processing and associability hypotheses through this expression of association may assist to uncover how certain stimuli affect encoding and retrieval.

The present study was developed to investigate the underlying mechanisms of the SRE as they related to self-schemas. To accomplish this, the present study compared the self-referencing condition with intimate other-referencing and distant other-referencing conditions. The comparison was intended to test first whether the self was the most frequently-practiced processing method over both other-referencing conditions. Second, this comparison attempted to show that the intimate and distant other-referencing conditions differed in how frequently each was utilized to process information. This would manifest by seeing a significant difference between the self vs "other", and intimate vs distant "other" conditions. Within the larger theory behind the present study, this test of frequently-practiced processing methods intended to

evaluate whether the self, intimate "other", and distant "other" differed in their ability to connect stimuli to self-schemas. The present study also investigated the relationship between the SR and two OR conditions through a three-way interaction. Under this interaction, each condition would differ from each other due to the difference in trait self-descriptiveness and frequency of practice for each condition. This would clearly show a differentiation in how easily each condition connected to self-schemas. Additionally, the present study added a level-of-association variable to further integrate the associability hypothesis. The level-of-association variable included strong and weak associates which were all positive trait adjectives. This addition intended to determine whether the strong associates, denoted as such because they were used most frequently by participants to describe themselves in Hards et al. (2019), had a similar processing advantage as the self-referencing condition. To conclude, the present study tested how associability of strong and weak associates played a role in the strength of the self-reference effect, and whether the self versus "other", intimate versus distant "other", and strong versus weak conditions each differed significantly in their abilities to connect to self-schemas.

Method

Participants

Participants in this experiment were 73 undergraduates at William & Mary. One participant identified as non-binary, 11 as male, and 61 as female. Participants had a mean age of 19.05 years (SD = 1.129). All participants were from the two introductory psychology courses and received course credit for partaking in this study.

Apparatus

A SuperLab 5 program displayed on desktop computers was used to run the study. The testing room had three rows of four desktops each. The present study used the second and fourth

desktops in the first and third rows of the testing room to physically separate participants. Participants utilized a Cedrus RB-840 response pad to log responses as prompted by the program. Each key on the response pad was labeled from 1-6 which was used for ratings of personality attributes during encoding. Following completion of the program, participants were tested on their free recall of stimuli using a pen and a blank sheet of paper.

Design

The present study was a three-way mixed ANOVA design, including two within-subjects and one between-subjects factors. The two within-subjects factors were level-of-association and "self versus other". The between-subject factor was intimate other versus distant other. The level-of-association variable was measured as either a strong or weak associate. The self vs other variable was measured through two conditions. The first was the "self-reference" (SR) condition, measured as the participants themselves, and the second was the "other-reference" (OR) condition. Within the OR condition, participants were either assigned to the intimate OR or distant OR conditions. The intimate OR condition was measured as an individual with the same age and gender as the participant, who the participant knew well. Former President Barack Obama was used to represent the distant OR condition. The dependent variable was the score on the free recall test.

Stimuli

Stimuli were 32 trait words from the Adolescent Self-Image database (Hards et al., 2019). The database included a list of all trait adjectives organized from most often used to least often used. Strong associates were chosen as singular, easily generalizable words from the top of the list. Weak associates were chosen with the same qualifications but instead were located closer to the bottom of the list. Participants received two blocks of 16 trait words with half of the words in

the block as strong associates (athletic, caring, friendly, funny, happy, kind, cheerful, confident, hardworking, helpful, loving, musical, smart, trustworthy, creative, positive) and the other half as weak associates (academic, ambitious, brave, focused, grateful, logical, loveable, lucky, mature, open-minded, playful, quirky, reliable, responsible, successful, truthful). Because these were novel stimuli, it was important to determine whether any association effect might be explained by the Word Frequency Effect. To ensure validity of the stimuli, a t-test was conducted with an added log transformation due to a positive skew. This test established whether the strong versus weak associates differed in frequency use within the Adolescent Self-Image Database. The t-test confirmed that the chosen strong and weak associates significantly differed in frequency use ($M = 47.47$; $SD = 61.01$; $p = 0.00$). This indicated that strong and weak associates were significantly different from each other, and could therefore be compared to indicate measures of associability to self-schemas. A second test was conducted, to determine if these words differed in frequency use in the English language. Word frequency norms were taken from Brysbaert and New (2009) to conduct the analysis, and no significant difference was found. This indicated that The Word Frequency Effect cannot explain the difference in recall between strong and weak associates as used in the present study.

Procedure

One to four participants were run during each data session. When participants entered the testing room, all monitors were turned off. Immediately upon entry, participants sat in front of a computer and completed the informed consent form. Participants then received instructions from the experimenter to press the power button on the monitor in front of them. Once the monitor turned on, participants read the instructions that appeared on the screen and began the study. The experimenter remained in the room to supervise and to mitigate any technical difficulties.

There were two versions of instructions, one for the SR, and one for the OR condition. In both, participants could read the instructions for as long as they needed before moving onto the first block. In the SR condition, participants were asked to rate each stimulus word on a scale from 1-6, where 1 indicated "not at all true of myself" and 6 indicated "always true of myself". In the OR conditions, participants were instructed to think of someone they knew very well who was of the same age and gender, or President Obama, and to rate how true the word was for this other person. This scale was based on that of Dewhurst et al. (2017). Participants pressed any key on the response pad to begin the block. The order of each word in each block was randomized, and the order of blocks was counterbalanced across data sessions. Each word was presented in the center of the screen for five seconds, and the words were interspersed with an interstimulus interval of 250 milliseconds.

Once participants completed the SR and OR conditions, instructions appeared on the screen for a two-minute retention task. Participants were directed to use the bottom two keys on the response pad to log responses for 20 simple mathematical problems, again presented for five seconds. Like the 1-6 rating scale, this measure was also derived from Dewhurst et al. (2017). Once participants completed all problems, another set of instructions was shown detailing the procedure for a free recall test. When ready, participants pressed any key on the response pad to start a five-minute timer. During this time, participants wrote down as many trait words as they could remember. After these five minutes concluded, one last set of instructions arose. They instructed participants to put their pen down and raise a hand in the air, indicating completion of the study. Once all participants completed the study, the experimenter debriefed and released them.

Results

Six participants were not included in analysis. Four were excluded due to recall scores varying significantly from the other participants, and two due to a system malfunction which resulted in a lack of data. A three-way ANOVA analysis was conducted on the remaining data, with self vs other and strong vs weak acting as within-subject factors. The between-subject factor was intimate other vs distant other. A Pearson Chi-Square test conducted on gender distribution concluded that gender did not vary between the two "other" groups (p = 0.309), making the intimate and distant OR conditions comparable. Median response times were used for analysis due to response times in SRE studies tending towards a positive skew. There was a significant main effect for response times in both the self vs other, $F(1, 70) = 3.961$, $p = 0.050$, and strong vs weak association variables, $F(1, 70) = 6.511$, $p = 0.013$. No main effect was found in response time when comparing intimate vs distant other, $F(1, 70) = 0.421$, $p = 0.518$. The rates for the SR condition (M = 1862.976; SD = 416.636) were faster than those for the OR condition (M = 2052.382; SD = 1005.865), and the rates for strong traits (M = 1815.66; SD = 444.177) were faster than those for weak traits (M = 2099.698; SD = 1025.352). None of the three two-way interactions were significant: (1) self vs other and intimate vs distant other analysis, $F(1, 70) = 1.846$, $p = 0.179$, (2) strong vs weak association and intimate vs distant other analysis, $F(1, 70) = 0.264$, $p = 0.609$, (3) self vs other and strong vs weak association, $F(1, 70) = 1.990$, $p = 0.163$. The three-way interaction for all within and between-subject factors was not significant, $F(1, 70) = 0.438$, $p = 0.510$.

Regarding the results for recall, there was a significant main effect with both the self vs other, $F(1, 71) = 13.751$, $p = 0.000$, and the strong vs weak variable, $F(1, 71) = 52.997$, $p = 0.000$. Stimuli from the SR condition (M = 49.914; SD = 13.878) were remembered more than

stimuli from the "other" conditions (M = 42.123; SD = 14.769), and the same effect occurred for

strong (M = 52.911; SD = 14.248) versus weak (M = 39.127; SD = 12.674). No main effect was

found for recall when comparing the intimate vs distant other conditions, $F(1, 71) = 0.003$, p =

0.959. Once again, none of the three two-way interactions resulted in significant results: (1) self

vs other and intimate vs distant other analysis, $F(1, 71) = 1.2636$, p = 0.265, (2) strong vs weak

association and intimate vs distant other analysis, $F(1, 71) = 2.441$, p = 0.123, (3) self vs other

and strong vs weak association, $F(1, 71) = 1.990$, p = 0.572. There was no significant three-way

interaction between the within-subject and between-subject factors, however it may be

interpreted as a trend, $F(1, 71) = 2.554$, p = 0.114. Figure 2 below denotes the three-way

interaction graph for self vs other, strong vs weak, and intimate vs distant other.

Figure 2

Three-way Interaction Analysis
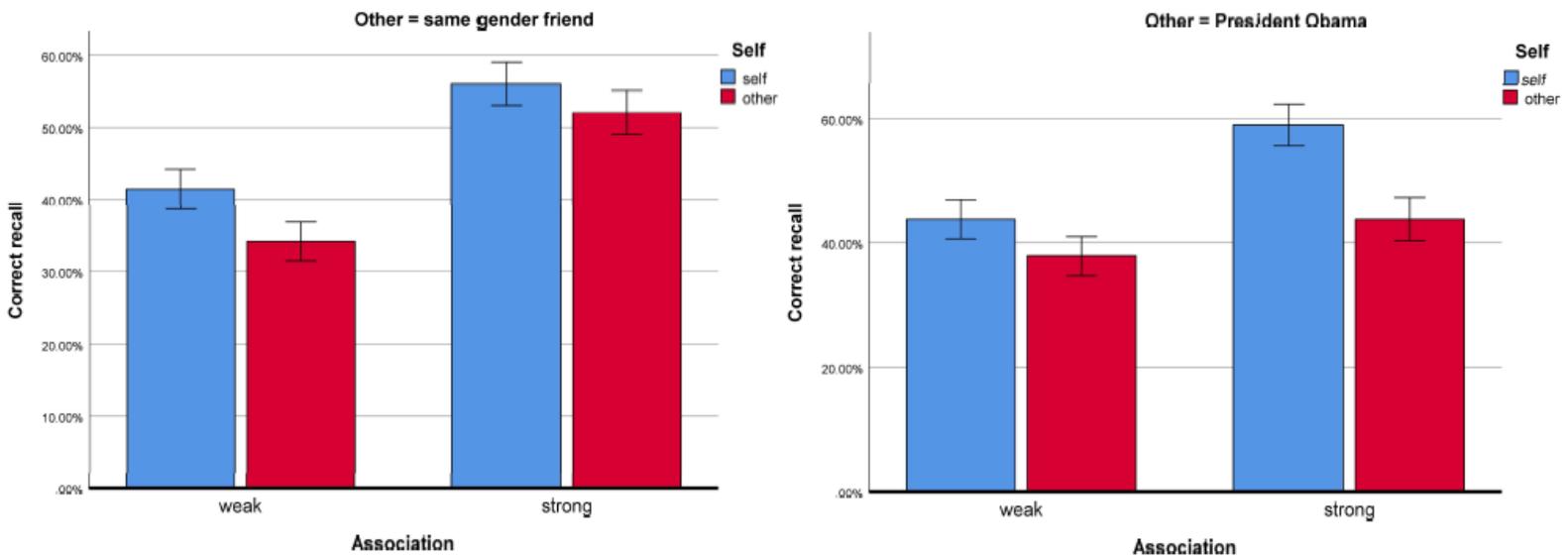
Note. Correct recall (%) by strong or weak association with standard error bars.

Discussion

The recall findings support the present study's hypothesis that the self-reference effect would occur strongly for the self vs "other" and strong vs weak associate comparisons. Firstly, these findings indicate that participants were more likely to recall words from the self-referencing condition. This main effect for self versus other was a successful self-reference effect. It corroborates the findings of previous studies which claim that self-referencing has a memory advantage over other-referencing. Secondly, strong associates were recalled more frequently than weak associates. This level-of-association variable main effect supports the associability hypothesis (Bellezza, 1984) because it demonstrated that trait stimuli which are more self-descriptive lead to enhanced retrieval. The present study did not find a difference between the two "other" conditions as expected, however the level-of-association main effect did validate the categorization of strong and weak personality traits as used in this study.

The response time findings for the present study substantiate the hypothesis that response time would be faster for the self-referencing and strong associate conditions, meaning they were more easily processed than the other-referencing and weak associate conditions. These findings indicate that response time is a valuable measure to add when studying the self-reference effect, especially when a level-of-association variable is included. Firstly, the present study achieved a main effect for self vs other. This demonstrates that not only did a self-referencing advantage appear in recall, but it also emerged for response time. Participants made judgments more easily, and therefore more quickly, when considering themselves instead of an "other". Secondly, the main effect for strong vs weak associates indicated that strong associates were more easily judged than weak associates. This effect also corroborates the associability hypothesis, because it speaks to the high self-descriptiveness of strong associates.

There were no significant results within the two-way interactions for either recall or response time, although the three-way interaction analysis for recall approached significance ($p = 0.114$). The three-way interaction hypothesis was that the self, intimate "other", and distant "other" would vary significantly from each other. Although it is only a trend in the present study, the three-way interaction highlighted the main effects, that participants were more efficient at judging personality traits when self-referencing and when judging strong trait associates. As portrayed in Figure 2, strong associates seemed to be recalled more often than weak associates in both the self-referencing and other-referencing conditions. This could point to their memory advantage within each condition. Figure 2 also seems to indicate that the SRE is stronger for the distant "other" condition, although this cannot be confirmed without a significant three-way effect. It may be worth collecting more data to see if this three-way interaction reaches significance.

Despite the lack of a three-way interaction, the present study's existing main effects still assisted to elucidate the underlying mechanisms of the self-reference effect in relation to self-schemas. To begin, the self-reference effect itself, as achieved in this study, demonstrates both a recall and response time advantage. It is possible that for both recall and response time, this superiority is found due to the more frequent use of the self throughout the participant's life. The frequent use factor is an aspect of the elaborative processing hypothesis. According to the elaborative processing hypothesis, the frequent use of the self would result in a greater amount of elaborations between the self-referenced stimuli and existing material in memory (Klein & Loftus, 1988; Symons & Johnson, 1997). The greater amount of elaborations would then cause enhanced retrieval for self-referenced material. The self as a frequently-practiced schema which results in enhanced retrieval does seem to be supported by the results of the present study. Self-

referencing, through frequent practice, seems to connect stimuli more easily to self-schemas. This implies that the self-reference effect functions, at least in part, due to elaborative processing. However, this self-referencing discussion does not consider the specific stimuli used in the present study. The memory advantage for the self-referencing condition may not only be from the more frequent use of the self as a method of information processing. Instead, it could also be attached to the highly self-descriptive strong associate stimuli. The stimuli were designed based on the associability hypothesis to act as another level of analysis, working in conjunction with self-referencing. The inclusion of associability through the level-of-association variable may address mechanisms within the self-reference effect which were not considered by the elaborative processing hypothesis.

The level-of-association variable in the present study targeted the trait adjective stimuli, a level of analysis not often used in self-reference effect studies. The findings of this study clearly exhibited a strong advantage for highly associable stimuli, supporting the associability hypothesis. The associability hypothesis operates through the trait adjective stimuli and how the stimuli connect with personal experiences in the brain. These personal experiences are connected to established self-schemas. Therefore, if trait adjectives are highly self-descriptive, as were the strong associates in the present study, they should connect more easily to personal experiences and therefore one of the self-schemas. The strength of this connection for highly self-descriptive traits results in their superior retrieval. Uniting associability and elaborative processing, the present study conveyed that the self-schemas seem to function as an associative foundation for the improved recall of self-descriptive material.

In addition to supporting the present study's self-schema hypothesis, the main effect for the level-of-association variable is notable because the present study used only positive traits as

stimuli, while most previous studies used both positive and negative trait words. Utilizing only positive traits is consequential because it removes any unintentional relational processing (Symons & Johnson, 1997). This unintentional relational processing is when participants subconsciously perceive category labels within the stimuli, e.g. desirable (positive) or not desirable (negative) traits. This categorization could then affect retrieval, particularly in studies using a recall test. Past researchers found that positive adjectives are better recalled than negative adjectives, leading to a positive skew in the data (D'Argembeau, 2005; Leshikar et al., 2014; Symons & Johnson, 1997). The present study concluded that using only positive traits with a recall test could ensure a more accurate reading of the self-reference effect. Bringing to light this positive skew once again may also encourage future studies to take it into consideration when structuring their methodology. In addition to the inclusion of only positive traits, the present study utilized the novel Adolescent Self-Image database (Hards et al., 2019) to obtain strong and weak stimuli.

As stated above, the present study was one of the few to define level of association in this manner, and the first to use the Adolescent Self-Image database as the methodology. Previous studies utilizing trait words used the Anderson (1968) list of 555 positive and negative words. The difference in database is notable because the Adolescent Self-Image database was rated for how frequently traits were used across participants, while the Anderson database was rated for likeability, or desirability. This means that the studies using the Anderson database were unable to judge trait adjectives as strong or weak, but only as desirable or undesirable. The desirability structure did not consider that trait words within one category, e.g. all positive traits, could have levels like strong and weak. This limited their analysis and prevented the consideration that the strength of the self-reference effect might also depend on the strength of the trait adjectives

themselves. The present study demonstrated that utilizing positive and negative traits was not the

only way to measure the self-reference effect. Strong associates contained a retrieval advantage

over weak associates, although the present study did not show that the self vs other and strong vs

weak interaction was significant. It may be beneficial to collect more data for this study to

determine whether the self-reference effect is significantly stronger when using strong associates.

Study Limitations

The present study was not able to find a significant difference between the intimate and

distant other-referencing conditions. This might be because there is in fact no difference.

Conversely, there might be a difference, but this study did not have enough power to find it. One

possible method for finding the difference between these two "other" conditions is through

manipulating the "other" in a repeated-measures design rather than as two groups as done in this

study.

Future Research Directions

The results of the present study raise some interesting possibilities about the mechanisms

behind the self-reference effect in the brain. According to this study, it appears that the self-

reference effect functions due to the elaborative processing and associability hypotheses in

conjunction. The operations described in these two hypotheses depict the enhanced connections

of the self-referencing condition and strong-associates to self-schemas. However, the results of

the present study were not able to show a significant three-way interaction, which would have

led to more definitive conclusions. Future studies might test other methods of manipulating the

distance between the self and the "other" while continuing to include both the intimate and

distant other-referencing conditions. One way to do this might be to test the effect of a longer

retention interval on the two versions of the "other". A reason to investigate the effect of a longer

retention interval is that it is possible, based on past studies which claim a self-referencing consolidation advantage (Conway & Dewhurst, 1995; Conway & Dewhurst, 2001), that the intimate and distant other-referencing conditions might be better distinguished under these circumstances. It may be seen that the effects of information processing strategies which are frequently practiced, such as self-referencing, may last longer than those that are less frequently practiced. This lasting effect would manifest in a greater retrieval advantage for the intimate other-referencing condition over the distant other-referencing condition. This difference in retrieval advantage might show more easily a distinction between the two "other" conditions. The elaborative processing hypothesis as discussed in the Symons and Johnson meta-analysis (1997) does not emphasize any effect that consolidation has on elaboration, so it may be valuable to test this factor. It might be found that within the fewer elaborative connections formed between stimuli and the other-referencing conditions, the connections for the intimate "other" may last better over time than those for the distant "other". This could occur due to the smaller distinction between the intimate "other" and the self, as found in previous studies (Klein & Loftus, 1988; Symons & Johnson, 1997; Serbun et al., 2011). If this strategy is investigated, it might reveal a consolidation effect that shows a significant distinction between the self, intimate "other", and distant "other" in the brain.

The present study found that the strong and weak associates used in this study differed significantly from each other within the Adolescent Self-Image Database, however they did not differ in frequency use for the English Language. This meant that the Word Frequency Effect could not explain the difference in recall between strong and weak associates, and that the associates accurately determined self-descriptiveness levels of stimuli. Future studies might investigate these associates and attempt to determine how and why they differ.

The present study did not address the organizational hypothesis, and therefore did not look for clustering in the data. It is uncertain whether it is possible to further organize trait adjectives which are all positive and have been designed to vary by associative strength. The design of the present study did not allow for the examination of this uncertainty, but it could have placed all traits together to see if any clustering appeared in recall. Future studies might consider this factor, and endeavor to develop a method for manipulating associative strength within all positive stimuli.

Overall, the present study achieved its goal of investigating self-schemas as an underlying mechanism of the self-reference effect. First, this study found supporting evidence for the use of the elaborative processing hypothesis in conjunction with the associability hypothesis in evaluating the SRE. Frequently-practiced information processing methods and highly self-descriptive trait adjectives resulted in a retrieval advantage for the self-referencing condition. This retrieval advantage in the self-referencing condition means that these processing methods and self-descriptive traits connected more easily to self-schemas. Measuring the self-reference effect with strong and weak associates proved to be a valuable addition to this study's methodology. Second, the three-way interaction trend found between the self, intimate "other" and distant "other", shows promise for determining the distinction between these three conditions in future studies. An increase in power of the present study, or future studies testing a possible consolidation effect on elaborative processing and associability, could reveal a significant retrieval hierarchy between these three conditions. To conclude, the present study demonstrated the viability of the elaborative processing and associability hypotheses together in studying the self-reference effect, and successfully presented self-schemas as an associative foundation for novel material at encoding.

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