A Schema-Based Account of a Negativity Bias in Collective Future Thinking

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THESIS

Submitted as partial fulfillment of the requirements
for the degree of Doctor of Philosophy in Psychology
in the Graduate College of the
University of Illinois at Chicago, 2021

Chicago, Illinois

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This thesis is dedicated to my late grandfather, Dr. P.S. Santhanam (aka Baabu Thaathaa), the first person in my family to receive his doctorate. It has been my privilege to carry forward his legacy.

ACKNOWLEDGEMENTS

I would like to thank my thesis committee – Susan, Eric, Dan, Jim, and Karl – for their tremendous support throughout the process of developing and completing this dissertation. Their guidance and feedback were invaluable, and ultimately strengthened the impact of this work. Incredibly special thanks to Karl Szpunar, my mentor and pillar of support over the past 6 years. I am truly indebted to him and would not be where I am today without his encouragement and unwavering belief in me.

Thank you to my colleagues in the department – especially Alyssa Blair, Vannia Puig, and Erika Gustafson – for their unconditional love and support, both professionally and personally. I am grateful that they have become a part of my life. Further, thank you to the amazing department staff, especially Jennifer and Karla for always having a solution to any issue or question I come to them with!

Finally, to my mom (Amma), my dad (Appa), my brother (Sanjay), my partner (Youssouf), my family in India, and my dearest friends from all walks of life – thank you for loving me and cheering me on throughout this roller coaster of a journey. I love you all, and hope I have made you proud.

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LIST OF ABBREVIATIONS

M	Mean
N	Sample Size
SD	Standard Deviation
SE	Standard Error

SUMMARY

Extant literature on collective future thinking has found a valence based-dissociation between the domain of collective futures and the personal future, such that people tend to imagine the future of their country in a more negative light while imagining their personal futures in a more positive light. Yet a mechanistic account for this phenomenon has yet to be delineated. This dissertation tested a schema account of collective future thinking by assessing people's recognition memory for news headlines. It was hypothesized that when presented with studied and lure headlines of positive and negative valence, participants would falsely recognize more negative headlines than positive.

In Experiment 1, when participants viewed a set of fifteen positive and fifteen negative headlines and were given a recognition test after a one-day or one-week delay, there emerged neither any false memory effects nor any effects of valence or delay on recognition. The bias of the stimuli set (i.e., more negative headlines, neutral, or more positive headlines) was manipulated in Experiment 2. Participants displayed false recognition for negative headlines when presented with more positive headlines at study, and showed worse discriminability for positive headlines after a delay. Experiment 3 examined whether a valence-based dissociation between the personal and collective domains could be explained by respective contributions from a positively-biased life script versus a negatively-biased collective schema. Participants studied both life script

statements and headlines, and were tested on recognition performance after a one-week delay.

Results showed that participants better recognized positive life script statements and negative headlines. All-in-all, while false memory did not emerge as a robust effect, participants nevertheless tended to better retain schema-consistent (i.e., negative) information about both the collective and the life script, thus lending partial support to my hypothesis. Limitations and future directions are discussed.

I. INTRODUCTION

We walk about life anticipating myriad future events. In our personal lives, we may look forward to our next meal, make plans for a vacation over the holidays, or save money for long-term investments such as buying a house several years in the future. However, outside our own lives, prospection takes different forms as we think about the futures of other entities such as businesses, neighborhoods and cities, or even the country and world at large. The latter form of prospection, referred to as *collective future thinking*, captures how individuals imagine the future of groups to which they belong. Though a ubiquitous phenomenon, collective future thinking is largely understudied compared to personal future thinking within the domain of memory research (Szpunar & Szpunar, 2016). Many theories and mechanisms in memory have been established in playing a role in how we imagine our personal futures (Addis & Schacter; Schacter, 2012; Suddendorf & Corballis, 2007; Szpunar, 2010, Szpunar et al., 2014). Yet less is clear about such mechanisms of memory as they relate to collective future thinking. This dissertation aimed to elucidate the potential role of schemas in shaping what we remember, and in turn anticipate, in terms of the collective.

A. Valence-Based Dissociation Between Personal and Collective Future Thinking

A guiding principle of future thinking is that our prospective abilities are rooted in memory. The contents of our memory, be it specific episodic information (Atance & O'Neill, 2001; Hassabis & Maguire, 2007; Schacter & Addis, 2007; Suddendorf & Corballis, 2007) or general semantic knowledge (D'Argembeau & Mathy, 2011; D'Argembeau, Renaud, & van der Linden, 2011; Irish & Piguet, 2013; Klein,

2013; Szpunar, 2010), are routinely accessed to inform thoughts about the future across various domains (see Szpunar, Spreng & Schacter, 2014). Over a decade of research has established how the personal future is imagined, and how autobiographical memory structures contribute to personal future thinking. Yet very little is known about how the collective future is imagined, and the underlying structures in memory that contribute to this important ability. For the purposes of this study, the "collective" of interest was the country, specifically the United States of America. Focusing on the country, as opposed to another group such as race, religious group, or neighborhood, would best facilitate comparisons to prior work on collective memory and future thinking (Liu et al., 2005; McElwee & Brittain, 2007; Sani et al., 2007; Shrikanth et al., 2018).

Personal future thinking was used as a point of contrast to gain insight into how memory processes may be similarly or differently equipped when thinking about the collective future. What little work has been done comparing the two domains shows that personal future thinking can be more concrete and episodic, while collective future thinking is more semantic (Szpunar et al., 2014). However, one of the most striking differences between the two domains, which is most pertinent to the present inquiry, is the valence with which these two futures are imagined (Shrikanth, Szpunar, & Szpunar, 2018). For instance, measures of event probability converge on the finding that personal events of a positive nature are rated as more likely than negative personal events, while collective events of a negative nature are rated as more likely to occur than positively-valenced collective events (McElwee & Brittain, 2007; Wenglert & Rosen, 2000; Wenglert & Svenson, 1982).

Of particular relevance to the present research are recent data from Shrikanth et al. (2018) who used a novel future event fluency paradigm that required participants to generate positive and negative things that could take place in their personal future, as well as in the collective future (i.e., future of their country of residence). Across six experiments, the authors found a consistent negativity bias in relation to the future of the country coinciding with a positivity bias toward one's personal future, such that participants generated more negative than positive events in response to the collective future fluency task but more positive than negative events in response to the personal future fluency task. These differences persisted regardless of age, gender, and political orientation. Notably, the negativity bias in collective future thinking also extends to the collective past (Liu et al., 2005; Shrikanth & Szpunar, 2021) and occurs in countries other than the United States of America (Shrikanth et al., 2018; Wenglert & Rosen, 2000; van der Bles, Postmes, & Meijer, 2015). People further tend to be negatively biased even when thinking about the futures of countries for which they have little prior background knowledge (Shrikanth, Ganem, & Szpunar, in preparation).

These results, while robust, lack a strong theoretical or mechanistic account. Typically, a measure of fluency reflects the *accessibility* of events (Thorndyke & Hayes-Roth, 1979) suggesting that more positive than negative events are accessible in relation to the personal future and more negative than positive events are accessible in relation to the collective future. It is thus plausible that people's conceptions of the collective future are based on recollections of events transpiring in the collective, which people have acquired through sources such as the news. However, people are able to make

predictions about the distant collective future, as well as predictions about countries for which people have little background knowledge (i.e., Shrikanth et al., in preparation), indicative of deeper underlying processes at work. One possible reason for differences in accessibility of information is that we have formed different mental representations of how the future of these domains might turn out, based on our exposure to biased information. Such a mechanism has already been identified in relation to personal memory and future thinking (e.g., cultural life script; Berntsen & Rubin, 2004). Here, I explore whether a similar mechanism – a schema about the collective future – exists, and guides our predictions of a more negatively biased collective future.

B. A Collective Schema

Schemas are knowledge structures in memory that allow us to integrate new, incoming information with prior knowledge, thus allowing us to navigate the world (Alba & Hasher, 1983; Brewer & Nakamura, 1983; Hintzman, 1970; Rumelhart & Ortony, 1976; Smith & Graesser, 1981). Within the domain of cognitive psychology, schemata, sometimes referred to as scripts (Schank & Abelson, 1975) or frames (Minsky, 1975), are implicated in a wide variety of contexts ranging from low-level motor learning (Sherwood & Lee, 2003) to higher level text and discourse processing (Anderson, Spiro, & Anderson, 1978; Bransford & Johnson, 1972; Graesser & Nakamura, 1982). Despite its myriad applications, schemas are generally conceptualized as frameworks for representing knowledge in memory (Bartlett, 1932) or as internal cognitive structures that influence the encoding and representation of information (Minsky, 1975). Crucially, all schema share certain core attributes. These structures of knowledge: (a) are

extrapolated across multiple experiences, (b) represent domain-specific information at both gist-based and instance-based levels, and (c) influence information processing at encoding and retrieval (Brewer & Nakamura, 1983; for review, see Ghosh & Gilboa, 2014).

Within the purview of the aforementioned definition of a schema, the negativity bias of collective future thinking appears to readily fit a schema-based account. That is, a gist-based associative network structure comprised of negative information related to the collective, as acquired through repeated exposure and retrieval of negative information, may be used when making predictions about the collective future. The follow section highlights the manner in which the aforementioned core attributes of schemas readily characterize the manner in which people think about the collective future, and also consider why predictions about the collective future are so negative and starkly in contrast to predictions about the personal future.

1. Collective schemas reflect experience

Schemas reflect experience, and our experience with the collective is largely negative. Though we may receive information about the collective from different sources, such as educational contexts, popular culture, and hearsay from others, focus was placed on the effects of exposure to news information pertaining to the collective. As Soroka and McAdams (2015) state, “Humans have a reasonably well-established tendency to react more strongly to negative than to positive information; it follows that news content, created by humans, with the goal of getting attention from other humans,

will tend to be biased toward the negative." (p.4). This succinctly describes longstanding trends in the field of news media and communications research. Decades of research have shown that the content of news information is negatively biased on the supply side, while consumers on the demand side tend to seek out negative over positive news information (Soroka, 2006; Trussler & Soroka, 2014). Outlets further specifically design newscasts to promote retention of the information they supply, by using tactics like vivid imagery and strong language when describing events (Kilgo, Harlow, Garcia-Perdomo, & Salaverría, 2018; Grabe, Lang & Zhou, 2003; Lang, 2000; Leshner & Coyle, 2000; Newhagen & Reeves, 1992; Robinson & Davis, 1990). Though extant literature has looked at the effects of television news on memorability for information, evidence also suggests that these tactics are utilized in online news media as well (Ceron, 2014; Trussler & Soroka, 2014). Additionally, with the aim of retaining viewership, outlets also turn to sensationalism, the strategy of utilizing editing and production techniques to hook a viewer's attention (Ducat et al., 2009, Grabe, Zhou & Barnett, 2001; Hofsetter & Dozier, 1986), thus rendering news information even more memorable.

Because schemas are formed from experience (Anderson, 1984; Bartlett, 1932; Ghosh & Gilboa, 2014; Rumelhart & Ortony, 1976; Schank & Abelson, 1975) and much of experience with the collective is negatively biased, it naturally follows that commonalities of our negative experiences eventually become represented in memory in a negatively biased schematic structure pertaining to the collective. Hence, schema theory offers a plausible account for why negative information is more frequently reported in the context of a collective future fluency task (Shrikanth et al., 2018). As a collective

schema is formed through repeated exposure to negative information, this information becomes more easily accessible.

2. Domain specificity: Self-versus-collective schema

Another facet of schemas is that they are domain-specific. There have been studies on schemas that pertain to our representation of concepts such as rooms (Lampinen et al., 2001), social impressions (Rojahn & Pettigrew, 1984), faces (Goldstein & Chance, 1980), a typical work day (Eldridge et al., 1993), and more. If schemas are domain specific, and a negatively-biased collective schema contributes to our conceptualization of the collective future, then a valence-based dissociation could be explained by the contribution of a positively-biased personally-relevant schema to the conceptualization of the personal future. Indeed, such a construct exists – namely, the cultural life script (Berntsen & Rubin, 2002). The cultural life script lends itself to be a natural progression in the line of research comparing personal to collective future thinking, given both its similarities and differences to the proposed collective schema. As per Conway and Jobson (2012)'s apt definition, "Life scripts are conceived of as expectations about probable activities that individuals will likely undertake or become involved with during the course of their life" (p.55; see also Berntsen & Ruben, 2004; Rubin & Berntsen, 2003). Like a collective schema, cultural life scripts are culturally bound and not necessarily idiosyncratic. Rather, they are a socially acquired outline of expectations for an individual's future, as well as a framework around which autobiographic memory is organized and retrieved (i.e., reminiscence bump; Berntsen & Rubin, 2004; Thomsen & Berntsen, 2008; Umanath & Berntsen, 2013). The cultural life script is further useful in

helping people make predictions about the long-term future (Berntsen & Jacobsen, 2008; Bohn, 2011; Grysman et al., 2015), serving perhaps a similar function as a collective schema in informing predictions about the collective future.

While the life script and collective schema are comparable in many ways, there are also key differences between the two, of which one difference is integral to the present study. Namely, there is evidence indicating that the life script is positively biased in healthy adult populations (Bernsten & Rubin, 2004; Collins et al., 2007; Grysman et al., 2015; Rubin & Berntsen, 2003; Scherman, 2013), a sensible pattern given that most major life events are positively-valenced (e.g., marriage, retirement). This contrasts with a negatively-valenced collective schema. As noted above, people tend to be exposed to negative information about their country from sources such as the media (Soroka & McAdams, 2015), and likely derive expectations about the future of the world, based on such information, that are distinct from expectations about their own lives. Indeed, Janssen (2014) found that people's recollection of public events (i.e., news events or collective events) is not tied to life script events transpiring in a person's past, implying that the two domains indeed are distinct and non-overlapping. Notably, a valence-based dissociation in collective and personal future thinking can be attributed to valence-based differences in the underlying schematic representations underlying the two domains, respectively a collective schema and cultural life script. As such, having two distinct schemata pertaining respectively to the domains of the personal future and the collective future plausibly contributes to the valence-based dissociation previously found (Shrikanth et al., 2018). Of course, the representations underlying these two domains of prospection

may differ in more ways than just valence. For instance, one way in which the two constructs may differ is the fact that the life script, by virtue of being a “script”, includes a temporal order of events. It is unclear whether a collective schema would similarly incorporate temporality. Though the cultural life script and the collective schema may not be perfect corollaries, they are nevertheless comparable in terms of their function in organizing memory and future thinking. Thus, a schema account appears to readily explain the valence-based dissociation between the two forms of future thinking.

3. Schema’s influence on information processing

An important aspect of schema is its influence in how we process information and understand the world around us. Research across domains of psychology converge on the idea that schema influence how information is encoded, retrieved, and utilized in service of making predictions about the future (Alba & Hasher, 1983; Anderson, 1983; Anderson et al., 1978; Bartlett, 1932; Brewer & Nakamura, 1984; Bower, 2000; Ghosh & Gilboa, 2014; Minsky, 1974; Reiser, Black & Abelson, 1985; Rumelhart & Ortony, 1976; Schank & Abelson, 1977). For instance, it has consistently been found that people tend to recall and recognize schema-consistent information (Bower, Black, & Turner, 1979; Brewer & Treyens, 1981; Friedman, 1979; Goodman, 1980; Graesser, Gordon, & Sawyer, 1979; Smith & Graesser, 1981; Thorndyke & Hayes-Roth, 1979; but for evidence of schema-inconsistent effects see Graesser & Nakamura, 1982; Pezdek, Whetstone, Reynolds, Askari & Dougherty, 1989). In line with my conjectures regarding the existence of a collective schema, there is evidence showing that activating a collective as compared to a personal perspective can

influence the contents of people's thoughts about the future. When Shrikanth et al. (2018) asked people to think about positive and negative consequences of technology for their personal future versus the future of the country, people generated more positive personal consequences and more negative collective consequences. The only difference between the two prompts was a manipulation of the perspective taken when generating events. These findings, along with the replicable valence-based dissociation between personal and collective future thinking (Shrikanth et al., 2018, Wenglert & Rosen, 2000), could be interpreted as resulting from the activation of a positive-personal schema versus a negative-collective schema, consequently affecting the information people retrieve in each of these tasks.

C. Testing for the Collective Schema

Though extant literature is generally in line with the schema account of collective future thinking, evidence directly testing this point has not been garnered yet. Next, I turn to literature on false memory – in other words, the extent to which people claim to remember information that was never presented to them – to provide more direct evidence of schematic processes at work. I further outline how I used a false memory paradigm to test for the presence of a negative schema pertaining to the collective future.

1. False memories and schema

False memories have been studied under a variety of contexts in memory research, including misinformation for event memory (Loftus, 2003; Loftus & Pickrell, 1995), misinformation from text (Ayers & Reder, 1998), and semantic memory tasks such as the Deese-Roediger-McDermott paradigm that studied misremembering due to word

associations (Roediger & McDermott, 1995; Roediger, McDermott, & Robinson, 1998; Schacter, Norman, & Koutstaal, 1998). Across these various contexts, false memory refers to the phenomenon wherein information is identified as having been studied, viewed, or otherwise experienced, when it had never been encountered before. These errors are attributable to a top-down influence of prior knowledge on recognition or recall (Collins & Loftus, 1975; Lampinen, Faries, Neuschatz, & Toglia, 2000; Loftus & Pickrell, 1995).

For the purposes of the present studies, given that the misinformation and DRM paradigms have been shown to reflect different processes (Ost et al., 2014; Zhou et al., 2013), I draw from the DRM-paradigm literature to formulate my hypotheses and theoretical arguments. Schema theory suggests that learned information that is closely associated with schematic knowledge may be encoded and later retrieved inaccurately, such that it better fits the schema to which it relates (Bartlett, 1932; Bransford & Franks, 1971; Roediger & McDermott, 1995; Roediger, McDermott, & Robinson, 1998). This phenomenon has been found in the context of people misremembering objects they saw in an office (Brewer & Treyens, 1981), accounts of a mugging that was viewed (Garcia-Bajos & Migueles, 2003), memory for pictures of everyday scenes (Pezdek, Whetsone, Reynolds, Askari, & Doughery, 1989) and with semantically associated wordlists (Roediger & McDermott, 1995). Again, in all these instances, highly schema-consistent information that had never been experienced was mistakenly remembered as having been previously observed. In other words, false memories can be, and often have been, used as evidence for the influence of schema on information processing.

At a mechanistic level, observable false memory effects can be linked to the spreading activation of related concepts in memory during encoding and retrieval (Anderson 1983; Collins & Loftus, 1975; Meade et al., 2007). Underwood (1965) referred to this perspective as the implicit associative response theory. Take, for instance, the false memory phenomenon in the DRM paradigm. When participants study a list of categorically associated words, prior knowledge is activated in memory both with regard to the words studied and with other closely related concepts (i.e., word category). Likewise, when people falsely recognize words that are closely associated with words they studied, it reflects the activation and intrusion of these related concepts. These false memory effects are driven by the co-activation of schematic units within semantic memory. As such, activation of the schema, through the processing of schema-relevant stimuli allows for the activation of related idea units in the schema, both during encoding and retrieval (see Ghosh & Gilboa, 2014). Thus, a schema could drive false memory effects through the mechanism of spreading activation at encoding and retrieval. Though episodic memory processes (i.e., encoding and retrieval of specific spatiotemporally bound episodic information) could contribute to false memory effects even in a DRM paradigm (e.g., Meade et al., 2007), that schemas supported by semantic memory is the primary driver of false memory in this case -- this point is revisited in the General Discussion.

Within the context of the present experiments, I would expect that exposure to headlines at study would contribute to spreading activation of related prior knowledge and lead to a false memory effect for closely related concepts. If a collective schema was

formed through repeated exposure to negative news information, the net valence of the units comprising the schema would in turn be negatively biased. Thus, the co-activation related concepts within this collective schema would render negatively biased headlines more familiar at recognition than information inconsistent with that schema (i.e., positive), regardless of whether it was studied or not. Ostensibly, the false memory effect should not occur for positive information, given that it is not strongly associated with a previously formed schematic representation. Therefore, in the context of testing whether a collective schema may influence how people remember information, observable false memory effects may serve as an indicator of this influence.

Interestingly, prior literature already suggests that people are more susceptible to falsely remembering negative collective events, even confabulating negative collective events altogether, than positive collective events. Porter, Taylor and ten Brinke (2008) showed participants either accurate or digitally altered images of news events that either really occurred or never occurred (e.g., Obama shaking hands with a foreign leader), and asked them to describe what they remember about the event that took place. Crucially, people falsely remembered seeing a greater number of negative fabricated events than positive fabricated events. Also, when asked to elaborate on episodic details pertaining to those events, people were able to come with more detail for negative than positive false events. When viewed from a collective schema perspective, these effects could plausibly result from a collective schema's influence in contributing to how people recalled past collective events. More specifically, negative news likely fits better with prior knowledge, as driven by the coactivation of related, negatively-biased information.

Indeed, it is much simpler to elaborate on episodic details of events when the event can be supported by a schematic framework (van Mulukom et al., 2016). Thus, these findings may point to the existence of some schematic representation of the collective that biases how people remember collective information.

Though Porter et al. (2008)'s findings align with my hypothesis that people may be susceptible to endorsing fictitious negative news as real, a conceptual replication is needed to more explicitly and stringently test this through the lens of schema theory. However, the present study departed methodologically from their study in several important ways. Whereas Porter and colleagues (2008) manipulated both the use of imagery and the length of time the stimuli were presented, participants were provided with standalone headlines with no use of images, to minimize individuals' reliance on imagery in this task (i.e., memorability and imagery of images contributing to how well participants remember the headlines, as opposed to top-down influence of schema). Further, participants in Porter at al. (2008)'s study were not explicitly test on memory, but rather were measured on whether they could elaborate on events that either truly occurred or did not. The present memory paradigm is significantly different from Porter and colleagues' methods (2008), as participants studied novel headlines developed and normed for this study and were tested on recall and recognition of the studied headlines. While the same underlying concept was tested, the approach differed significantly from Porter et al., (2008).

2. Present studies

The present set of studies tested whether people possess a negatively biased collective schema pertaining to the future of the country, as evidenced by false memory for schema-consistent (i.e., negative) collective information. To this end, participants were presented with a series of stimuli pertaining to the collective future, namely fictional news headlines, of which half were positively biased, and the other half were negatively biased. Experiment 1 aimed to see whether people falsely recognize negative headlines that they never saw before (i.e., lures), above and beyond positive lures. In Experiment 2, the overall valence of the studied stimuli (i.e., biased positive, neutral, or biased negative) was manipulated to ascertain whether a false memory effect persists regardless of the net valence of information studied. Lastly, in Experiment 3, the domains of the personal and collective schema were pitted against one another to explore whether a valence-based dissociation occurs in the context of false memory effects for personally relevant and collective information. Specifically, personal-positive information and negative-collective information was predicted to be more likely falsely recognized as previously studied, due to the influence of respectively-valenced schema for each domain. Across all three experiments, it was expected that a top-down influence of schema (i.e., through spreading activation) on heightening the familiarity of novel, schema-consistent information would be observed. Taken together, results that align with these hypotheses would serve as compelling evidence in support for a schema account of collective future thinking.

II. PILOT STUDY

An initial pilot study was conducted to assess baselines levels of memory for news headlines. The aim of this pilot study was to ascertain people's performance in both free recall and delayed recognition tasks. Importantly, the pilot aimed to test whether the hypothesized false memory effects for negative news headlines would appear using this paradigm.

A. Methods

1. Participants

A power analysis was conducted utilizing prior work that found a negativity bias in false negative memory for news events (Porter et al., 2008). It revealed that a sample of 20 would be sufficient to replicate the false memory effect, d = 0.86, alpha = .05, power = .95. Given the novelty of the research project, a larger sample size was employed to ensure sufficient power. Thus, a total of 40 participants (N_{female} = 20, M_{age} = 19.09) were recruited from the undergraduate psychology research pool at the University of Illinois at Chicago. Six participants did not complete the delayed recognition task, leaving a final sample of 34 participants for analysis.

2. Materials

To minimize the likelihood that a given stimulus evokes a specific past experience in memory, novel headlines were created and normed rather than utilizing real headlines taken from real news sources. These novel headlines followed the format and content of real news headlines, without any mention of specific governments, nationalities, regions, or other culturally-specific information (i.e., news from a

hypothetical nation, see Cyr & Hirst, 2018). The use of novel headlines also allowed for a high level of experimental control over the nature of the stimuli, including their valence and plausibility.

a, Stimuli.

Headlines were created that fell under five categories or topics pertaining to current events. These categories were established based on content analysis of a prior dataset (Shrikanth et al., 2018). For each of the five categories – namely, business/economics, politics, science/technology, environment/climate issues, and social/civil issues) – twelve headlines were created. Six headlines were positively valenced (e.g., *The economy is showing signs of prosperity*), and six were negatively valenced spins of the positive headlines (e.g., *The economy is heading toward a recession*). Thus, there was a positive and negative counterpart to each news headline. To counterbalance whether a participant viewed either the positive or negative version of a given headline, half of the positive and half of the negative were presented together (i.e., Version A) to half of our participants, while the other halves of the headlines were presented together (i.e., Version B) to the other half of our participants. See Appendix A for a complete list of headlines utilized for the study.

b. Norming procedure

Norming was based on data collected from one hundred and twelve undergraduate students at the University of Illinois at Chicago who enrolled in the study through the psychology subject pool (N_{female} = 170, M_{age} = 19.87). Two separate surveys, each containing one of the two versions of the headlines, were randomly sent to the participants. In both versions of the survey, the respective headlines were presented

randomly across participants. They viewed each headline, followed by ratings for positivity, negativity, plausibility, familiarity, and background knowledge. Each rating was presented with a five-point Likert scale (1 = low, 5 = high). After rating all the headlines, participants also rated the level of prior knowledge they possessed about each of the domains of interest (i.e., business, politics, etc.).

To analyze the data from the norming study, paired samples t-tests were run to assess whether positive headlines were significantly more positive than negative headlines, and vice versa. Positive and negative headlines were reliably different from each other in terms of valence. That is, positive headlines were given a significantly higher positivity rating (M = 4.54) than negativity rating (M = 1.59, $t(39) = 30.68$, $p < .001$) while negative headlines were given a significantly higher negativity rating (M = 4.17) than positivity rating (M =1.43, $t(39) = 29.72$, $p < .001$). Further, there were no differences between positive and negative headlines on familiarity [$t(39) = 1.39$, $p = .167$] or detail [$t(39) = 0.114$, $p = .910$]. Interestingly, negative headlines were more plausible than positive headlines overall ($M_{neg} = 3.54$ vs. $M_{pos} = 3.21$, $t(39) = 2.24$, $p = .027$). This might be inevitable, since negative headlines are more prominent in the news cycle therefore rendered more believable.

Lastly, five one-way analyses of variance (ANOVA) were conducted to test whether there were any significant differences between each of the five headline categories on each of the ratings – positivity, negativity, familiarity, detail, and plausibility. Each rating was entered into a different ANOVA as the dependent variable of interest. Results showed no differences between the headline categories on the different ratings,

largest non-significant $F(5, 30.8) = 1.91$, $p = .122$. Further, one-way ANOVA was performed to test whether there were differences in the amount of background knowledge people possessed about each of the domains. There were again no differences in background knowledge across each of the domains, largest non-significant $F(5, 30.5) = 1.00$, $p = .431$.

Once the data were normed, the twenty most positive, and twenty most negative, headlines were chosen to be utilized in the study. Appendix A displays all headlines along with their respective ratings of positivity, negativity, familiarity, detail, and plausibility. For the pilot study, ten positive and ten negative headlines were used as the studied headlines for each participant, while the remaining twenty headlines were the lures for every participant.

3. Procedure

a. Study phase

After participants provided informed consent, they were instructed to sit in front of a computer screen that provided instructions to the participants about the first phase of the task. They were told that they would view a series of headlines from a hypothetical country, and that they were to read each headline and rate how believable the headline was. Participants viewed twenty headlines (ten positive, ten negative), presented in a random order. Each headline was presented on screen for ten seconds and was followed by the believability rating. While the headline remained on the screen, they were asked to rate on a five-point scale how believable each headline was (1 = not

believable at all, 5 = very believable) by entering a number on the keyboard. After the study phase, participants were given a five-minute maze distractor task. Following the distractor task, participants were given five minutes to recall as many of the headlines they viewed. They were instructed to type in whatever they remembered about the headlines they viewed, in a response box on ePrime. After completing the free recall task, they were debriefed on the first part of the study and given instructions on how to complete the second part of the study.

b. Recognition task

Finally, after a one-day delay, participants were sent the recognition task via a Qualtrics survey, to be completed remotely. For the recognition task, participants were randomly shown forty headlines, twenty of which were studied the previous day and twenty of which were novel headlines they had not seen before (ten positive, ten negative). They were tasked with identifying whether a given headline was one that they studied the previous session, or not. If they had previously studied the headline, they pressed “Yes”, and pressed “No” if they had not studied it before. They were also asked to rate the confidence of their decision for each headline on a 5-point Likert scale (1 = not confident at all, 5 = very confident).

c. Scoring

Prior work involving the coding of freely recalled sentences used coding procedures such as counting the number of words recalled (Wearing, 1973), while others scored the order in which words of a sentence appeared, (Miller & Isard, 1964; for review of coding methodology for open-ended responses, see Woike, 2007). Because of

the focus on participants' ability to remember text base-level, or gist-level, information from the headlines (Kinstch, 1989), a modified version of Koppel and Berntsen (2014)'s approach to coding free recall responses was used. To code whether a headline was correctly remembered during the free recall phase, two independent blind raters scored participants' responses in three steps. Raters first counted the total number of responses each participant generated. Then, each response was categorized as either accurate, partially accurate, or inaccurate/intrusion. Accurate responses resembled 75% or more of the original headline (i.e., the original studied headline was clearly identifiable). Partially accurate headlines contained less than half of the information in the original headline (i.e., original headline was ambiguous or only some part was recalled). If a participant merged two headlines together at recall, each headline was counted as a partially accurate response. Inaccurate responses were incoherent, incomplete, or incorrectly remembered intrusions (i.e., responses that did not appear to be derived from the studied headlines). Lastly, all responses were categorized as either pertaining to a positive or negative headline (i.e., original studied headline was positive or negative). Strong interrater reliability was achieved for this coding procedure, Cronbach's alpha = 0.93. Intrusions and inaccurate responses were not categorized.

Lastly, the recognition task was scored by taking the proportion of correctly recognized headlines (hits), and correctly rejected headlines. Misses (i.e., headlines that were studied but not recognized) were calculated by subtracting the hit rate from 1, while false alarms (i.e., headlines that were not studied but recognized) were calculated by subtracting the correct rejection rate from 1. The rates of hits, misses, false alarms, and correct rejections were calculated for both positive and negative headlines.

B. Results

Of primary interest was whether or not there were any differences in how well negative versus positive headlines were recalled or recognized. A two (valence, positive versus negative) by two (accuracy, accurate versus partially accurate) repeated measures analysis of variance (ANOVA) was conducted on the number of responses counted in each category. There was a significant main effect of accuracy such that people remembered a greater number of fully accurate *(M* = 3.85*, SD* = 0.61*)* than partially accurate (*M* = 2.19, *SD* = 0.61) responses, $F(1, 32) = 6.50$, $p = .016$, $\eta^2_p = 0.169$. However, there were no other significant main effects or interactions, indicating that there were no effects of valence on the accuracy of recalled information, largest non-significant $F(1, 32) = 2.19$, $p = .149$.

Further, there was no difference in the proportion of positive (*M* = 0.858, *SE* = 0.13*)* or negative (*M* = 0.855, *SE* = 0.11*)* headlines that were correctly recognized after a one-day delay [$t(32) = 0.133$, $p = .895$, *ns].* However, a significant difference in the proportion of lures that were falsely recognized emerged. Specifically, participants produced a greater number of false alarms for negative (*M* = 0.25, *SD* = 0.15*)* than positive (*M* = 0.17, *SE* = 0.16*)* headlines [$t(32) = 3.81$, $p < .001$, $d = 0.66$]. Analysis of the d prime (*d'*) scores (i.e., index of discriminability) further confirmed these results such that people were more sensitive to identifying positive ($M_{d'} = 0.73$, *SD* = 0.27*)* than negative headlines [($M_{d'} = 0.64$, *SD* = 0.23), $t(32) = 3.31$, $p = .002$, $d = 0.43$]. Lastly, these findings were corroborated by a significant difference in the rated believability of the headlines, such that negative

headlines were rated as more believable than positive headlines [M_{neg} = 3.72, SD_{neg} = 0.57 *vs.* M_{pos} = 3.24, SD_{pos} = 0.55, $t(32) = 3.46$, $p = .002$, $d = 0.86$]. See all means and standard deviations on Table 1.

C. Discussion

Results from the pilot study revealed that people falsely recognized a greater number of negative headlines than positive headlines, which aligned with our hypotheses and extended prior work (Porter et al., 2008). This observed false memory effect is an indicator of the existence of a negatively biased collective schema. This is further corroborated by the findings indicating that negative headlines were rated as more believable than positive headlines, which indicates fit with prior knowledge. It is important to note that the false memory effect emerged for fictional headlines pertaining to a hypothetical country, rather than a country that participants were familiar with headlines that they may have heard of before. These findings suggest that the prior knowledge we possess about the collective future of countries appears to render negative collective-relevant information not only more plausible but also more susceptible to being falsely remembered. Thus, it seems plausible that a collective schema, or some schematic information about the collective future, is driving the false memory effects found.

These promising results came with points of methodological improvement. The biggest change made in the following experiment pertained to the structure of the recognition task. While a dichotomous yes/no judgment is traditionally utilized in recognition task memory research, it insufficiently captures people's sensitivity given the

forced-choice that people have to make (see Grier, 1971). Take for instance two participants making a Yes/No judgment about whether they saw a studied item the previous day. Though one participant may be 100% confident in their response and the other only 50% confident about their "Yes" judgment, both would be given the same accuracy score. Yet their sensitivities are clearly different from one another, as reflected by different levels of confidence. Further, the calculation of *d'* and *β* are parametric estimates of sensitivity and bias, which make assumptions about the underlying distribution of hits and false alarm rates in the task (Grier, 1971; Pollack & Norman, 1964). To attain a truer estimate of sensitivity that accounts for differences in distributions, participants in Experiment 1 were asked to provide a recognition judgment on a five-point rating (1 = Definitely did not see, 3 = Unsure, 5 = Definitely saw), rather making than a binary choice. These ratings were used to calculate a non-parametric estimate of sensitivity, A_g (Pollack & Hsieh, 1969), which is an "estimate of the 'average' area of possible receiver operating characteristic (ROC) curves that are constrained by the experimental data (hits and false alarms)" (Zhang & Mueller, 2005, pg. 203). Analyses were conducted both on the A_g values and *d'* prime scores calculated from the recognition ratings.

In addition to the hypothesized false alarm rates, there should be differences in the bias exhibited in recognition responses. Recognition bias, or the tendency to respond to a given item as "New" (i.e., unfamiliar) or "Old" (i.e., familiar) can be an important index of schematic processes. Specifically, the tendency to perceive items as "Old" may reflect the influence of a schema on recognition, such that the stimulus' familiarity passes a

certain threshold and that a participant recognizes the item as consistent with prior knowledge, or that they explicitly recall studying it. Conversely, the tendency to respond "New" may reflect participants' inability to recognize a given item, either because they do not possess/cannot retrieve a specific episodic trace, or because it is unfamiliar in general. In the subsequent experiments, participants should exhibit a stronger liberal bias (i.e., higher recognition ratings) for negative headlines regardless of whether they were studied or not, and a stronger conservative bias (i.e., lower recognition ratings) for positive headlines. Effect sizes of people's biases, particularly in the negative headline condition, should be larger after a longer delay, indicative of greater reliance on schematic processes.

In addition to modifying the structure of the recognition task, Experiment 1 manipulated the length of time between study and recognition. It is worth noting that recognition performance after a one-day delay was near ceiling. Prior work on memory for schema-consistent versus schema-inconsistent information reveals that a longer delay may increase reliance on schematic processing (e.g., Kleider et al., 2008). Others have also found that false memory rates for schema-consistent information increased when recognition was instantiated after a one-week delay (Neuschatz et al., 2002). Thus, Experiment 1 included a one-week delay to test recognition performance in comparison to a one-day delay, thus creating a more desirable task difficulty and reducing the ceiling effects found.

Additional changes made to the study pertain to the items (i.e., headlines) themselves. First, I increased the number of items studied from twenty to thirty headlines (i.e., fifteen positive and fifteen negative), allowing for a more accurate measure of sensitivity. Also, in light of the COVID-19 pandemic, the stimuli items themselves were modified to not include any information that reflect news headlines in real-life current events (e.g., loss of jobs, widespread fear about virus, incompetent leadership). the manner in which the stimuli were counterbalanced for the study phase and recognition phase was modified to ensure that the lure headlines are comparable to study headlines while not inadvertently acting as a cue (i.e., recognizing a study item may enhance participants' ability to identify a lure item if they are too similar).

Lastly, the biggest change made to the following studies was the manner in which data were collected. Prior to the COVID-19 pandemic, these experiments were proposed as in-person studies to be run in a controlled lab environment. However, due to restrictions imposed in terms of allowing in-person studies to be safely conducted, all materials were converted to Qualtrics surveys, and participants completed both the study and recognition tasks remotely.

III. EXPERIMENT 1

The aim of Experiment 1 was to extend and replicate the findings of the pilot study utilizing a rating-scale recognition task protocol. The parameters of the experiment were optimized such that the stimuli viewed during the study and recognition phases were evenly counterbalanced across participants. The time duration between study and recognition between subjects was also manipulated to test whether the false alarm effect held up or was amplified after a longer delay. Performance on a memory task after a one-week delay should increase reliance on semantic memory at retrieval (Kleider et al., 2008; Neuschatz et al., 2002), thus making schema-consistent information more familiar whether it was studied or not (i.e., worse discriminability for negative lure headlines). Also, given that people did not appear to perform very well on the free recall task for positive or negative headlines, the free recall task was removed from this experiment.

A. Methods

1. Participants

Subjects were solicited from UIC's undergraduate psychology subject pool. To determine the appropriate sample size for this study, a power analysis was conducted utilizing the effect sizes of the significant difference between false memory for negative and positive headlines from the pilot study. Power analyses conducted on G*Power version 3.2.1 utilizing the effect size of the expected interaction between valence and delay indicated that ninety subjects would be needed (f = 0.15, alpha = .05, power = .95). A final sample size of 90 participants was obtained for this experiment (N_{female} = 41, M_{age} = 18.55).

2. Materials and design

Like the pilot study, headlines were utilized in this study that mimic typical headlines found in the news without specific mention of any real-life current events. Because some of the stimuli changed in light of the COVID-19 pandemic, they were re-normed and matched before data collection along the same measures as the pilot study (i.e., positivity, negativity, plausibility, detail, familiarity). See Appendix A for mean norming ratings for the stimuli utilized in these experiments. Thirty headlines were presented at study and thirty novel headlines were presented during the recognition task. For both the study phase and recognition task, half of the headlines were positive and half were negative. Two versions of the study stimuli and lure stimuli were created and counterbalanced to ensure that any effects found were not driven by item-level effects. Each version contained headlines pertaining to the same topics, but of different valences (i.e., positive headlines in one set were negative headlines in the other set, and vice versa). This yielded four evenly counterbalanced sets of stimuli for the experiment – Study A/Lure A, Study A/LureB, StudyB/LureA, StudyB/LureB.

3. Procedure

To modify this experiment to be pandemic-safe, participants signed up for both parts of the experiment and were sent a link to complete part one via email. Upon opening the link, they were asked to provide informed consent. At the outset of the experiment, participants were randomly assigned either to the one-day delay or one-week delay condition of the experiment. This was evenly counterbalanced across participants. Then, each participant viewed fifteen positive and fifteen negative headlines following the same procedure as the pilot study. Namely, they viewed each headline on the screen for

ten seconds and then rated the believability of the headline on a five-point scale. Finally, participants completed a demographics questionnaire, where they provided information about their news consumption behavior, political affiliation, gender identity, and age. They were finally debriefed for this part of the study and received credit for their participation in part one.

a. Recognition task

Participants in the one-day delay recognition condition were sent the recognition task via a Qualtrics survey twenty-four hours after they completed the first experimental session. Participants in the one-week delay condition were sent the recognition task seven days after the first session. For the recognition task, participants viewed each headline and were asked whether they saw the headline during the first session of the experiment. However, rather than indicating their response as a yes/no judgement, they rated their judgement on a five-point scale (1 = Definitely did not see, 3 = Unsure, 5 = Definitely saw). After making their judgment, the survey automatically presented the next item in a random order until all thirty studied items and thirty lures were presented. Lastly, participants were debriefed and granted credit for their participation.

b. Calculating A_g

To calculate the non-parametric estimate of sensitivity, A_g, participants' ratings were turned into cumulative response probabilities. Each participant could have given a rating from 1-5 for each of 30 target items (15 positive and 15 negative) and 30 lure items (15 positive and 15 negative). For each participant, I counted the number of items to which a participant gave a rating of "1", "2", "3", "4", and "5" out of the

15 positive target statements, 15 positive lures, 15 negative target statements, and 15 negative lures. These counts were used to create a cumulative response probability table for each participant for positive-targets, positive-lures, negative-targets, and negative-lures. These probabilities were used to calculate cumulative hit and false alarm rates for positive and negative items. The measure of sensitivity, A_g (i.e., area under the ROC curve), was then calculated using the formula proposed by Pollack and Hsieh (1969; see also Macmillan & Creelman, 2005). See Appendix B for the formula.

c. Calculating *d' and b''*

Using the same rating scale, the hit rates and false alarm rates were calculated in two ways – a lenient criterion and a stringent criterion. With the lenient criterion, the proportion of items that received recognition ratings of 3, 4, and 5 were counted as hits for targets, and false alarms for lure items. With the stringent criterion, ratings of 3 were not included in analyses. Only the proportion of items that received ratings of 4 or 5 were counted as the hits for targets, and false alarms for lures. These two hit rates and false alarm rates were used to calculate lenient and stringent *d'* and *b"* estimates via the R Studio. This would give a sense of how strongly the inclusion of the "3" rating would disrupt the emerging pattern of results.

B. Results

To test the hypothesis that individuals display poorer sensitivity in recognizing negative news headlines than positive, and that this effect would be stronger after a one-week delay, a two (valence of headlines: positive or negative, within) by two (delay

condition: one day or one week, between) mixed measures analysis of variance (ANOVA), with the calculated A_g serving as the dependent variable. No significant main effects or interactions emerged, largest non-significant $F(1,88) = 1.38$, $p = 0.244$. It was further assessed whether the counterbalancing orders may have affected the attained results. However, upon running an ANOVA with counterbalancing order included as between-subjects variables, no significant main effects or interactions emerged, largest $F(3,82) = 2.56$, $p = .06$. Figure 1 depicts the mean A_g estimates and standard errors for each experimental condition, and Figure 2 shows plots of the ROC curve for each condition. An additional two by two mixed measures ANOVA was performed to test whether the lenient *d'* and stringent *d'* revealed any differences in discriminability between positive and negative headlines. No significant main effects of interactions emerged in either analysis, largest non-significant $F(1, 88) = 1.19$, $p = .32$. See Figure 3 for means and standard deviations. With regard to estimates of bias (*b'*), analyses revealed no further additional main effects or interaction, largest non-significant $F(1, 88) = 1.62$, $p = .206$. Figure 4 displays mean and standard errors for measures of bias, *b"*. Lastly, analyses of the stringent and lenient false alarm rates revealed no significant main effects or interaction, largest non-significant $F(1, 88) = 1.00$, $p = .320$. Average hit rates and false alarm rates and respective standard deviations per condition are shown in Table 1.

Figure 1. Mean A_g values and standard errors for Experiment 1 groups.

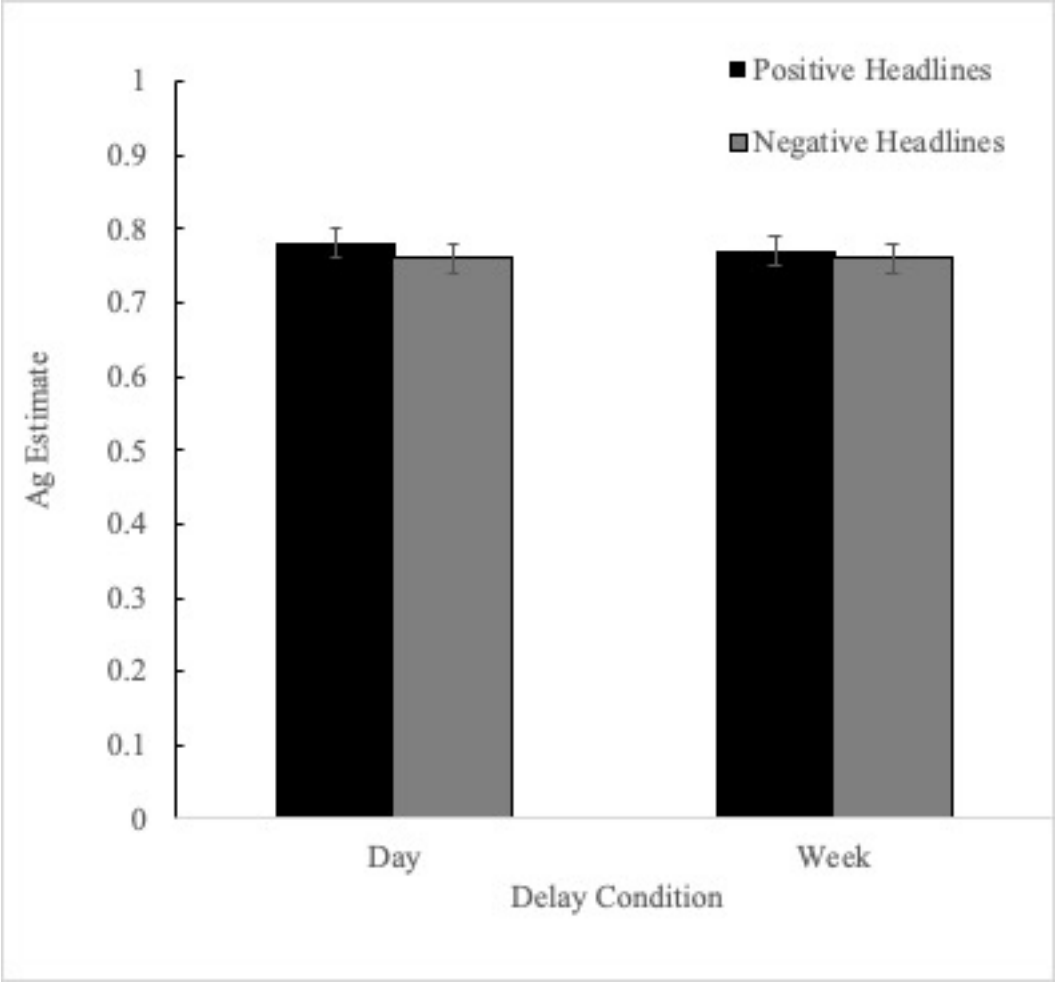


Figure 2. Receiver-operator characteristic curves for Experiment 1 groups. The ROC curve is built by plotting the cumulative hit rates and cumulative false alarm rates calculated based on recognition judgment ratings. The four conditions are superimposed to observe any differences in sensitivity. As a heuristic, flatter curves represent worse sensitivity.

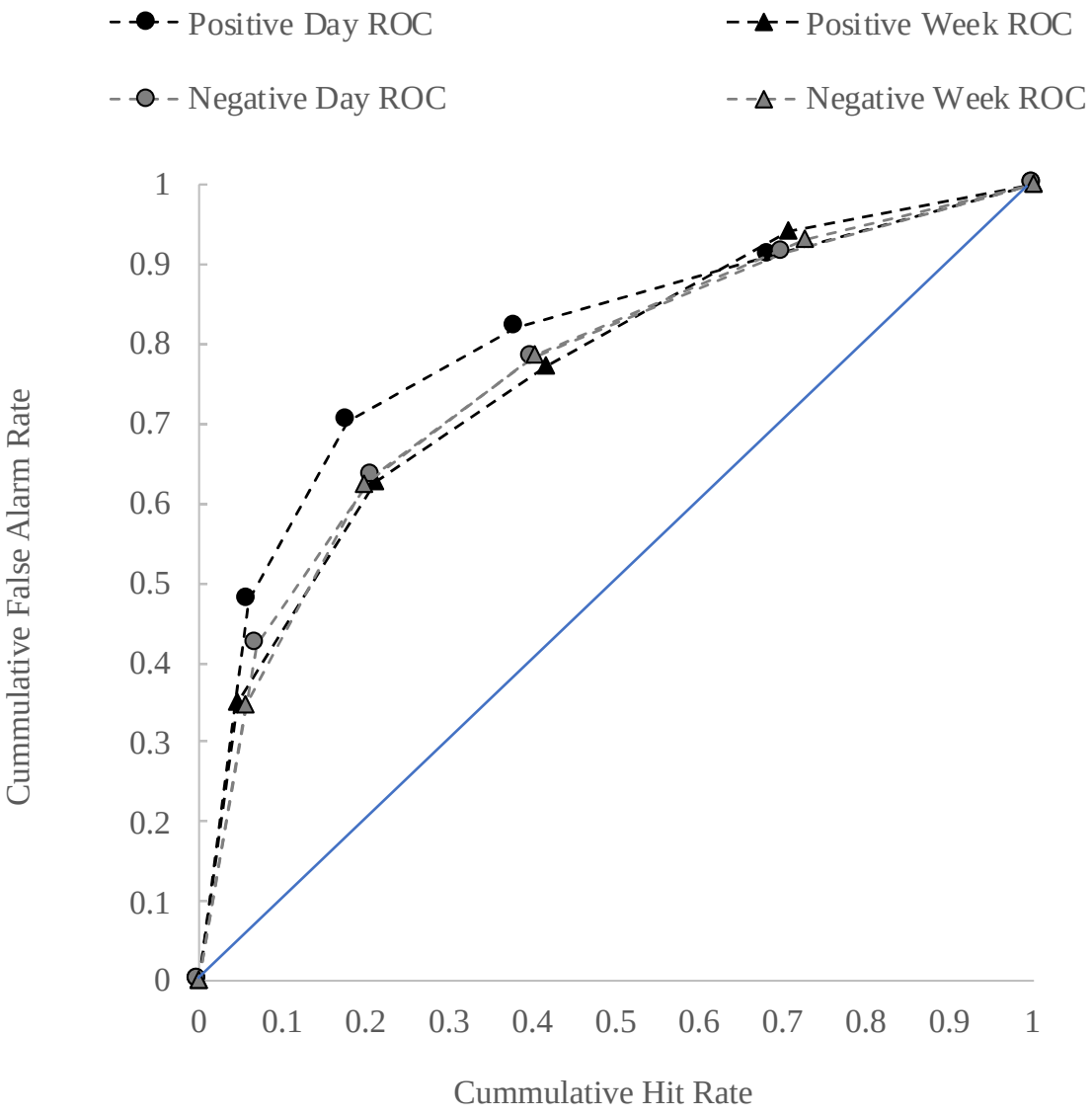


Figure 3. Mean *d'* values and standard errors for Experiment 1 groups.

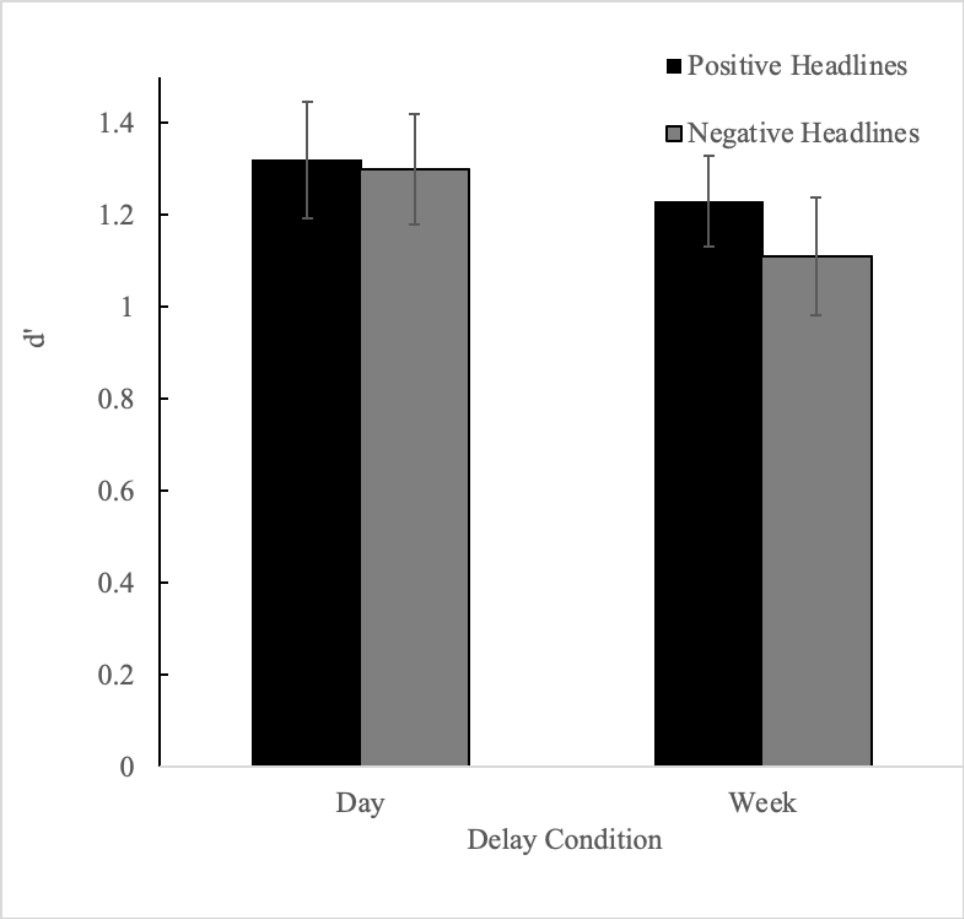


Figure 4. Mean *b"* values and standard errors for Experiment 1 groups.

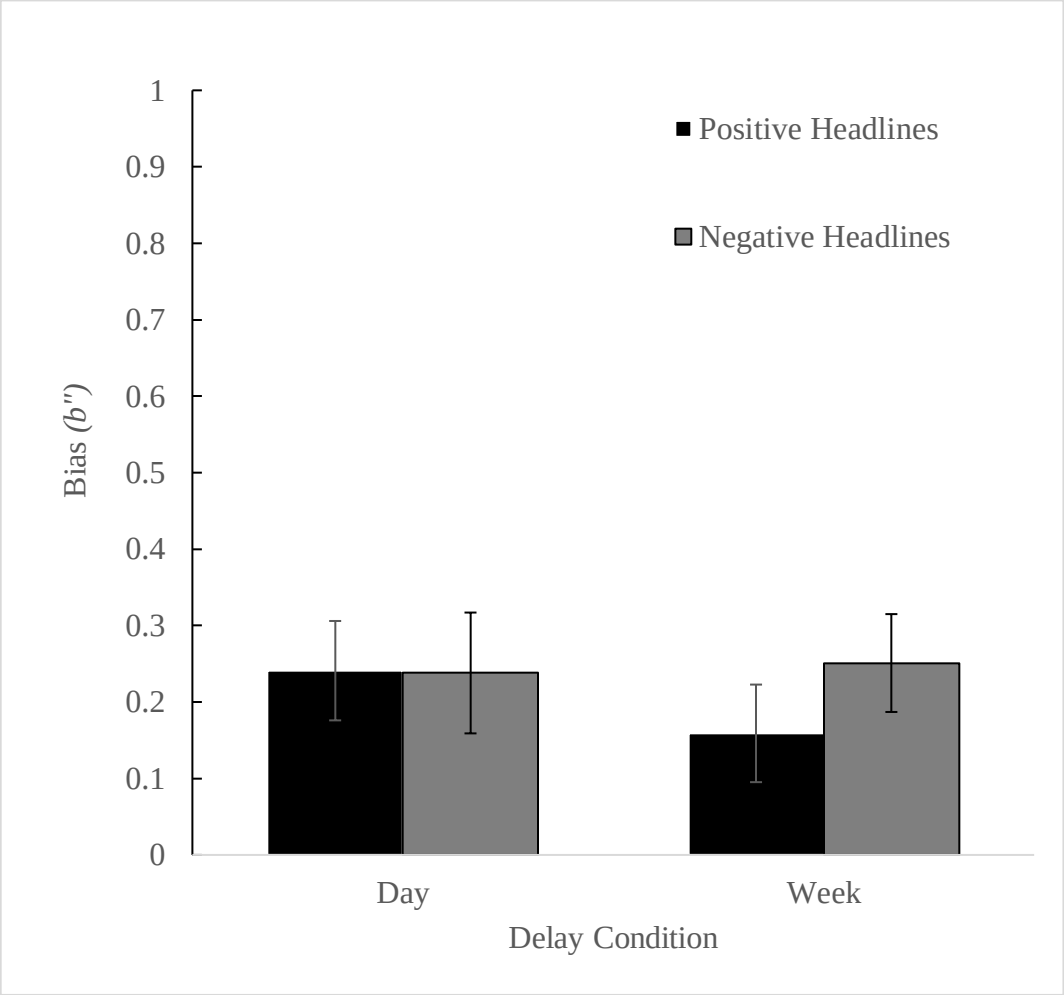


TABLE I

EXPERIMENT 1 HIT RATES AND FALSE ALARM RATES

	Positive Headlines		Negative Headlines	
	Hit Rate	False Alarm Rate	Hit Rate	False Alarm Rate
	M(*SD*)	*M*(*SD*)	*M*(*SD*)	*M*(*SD*)
Day	0.69 (0.21)	0.18 (0.16)	0.65 (0.22)	0.20 (0.19)
Week	0.64 (0.20)	0.21 (0.17)	0.61 (0.24)	0.21 (0.18)

C. Discussion

Experiment 1 failed to replicate the false-memory effect for negative news information. Further, a delay did not influence the magnitude of the effect. Indeed, memory for positive and negative news information appeared to be remarkably consistent with one another in this experiment, and did not decline after a one-week delay. It is important to note that there were several departures from the pilot study, including running the study online, increasing the sample size, and changing the stimuli, that could have plausibly contributed to the null effects. For instance, it is possible that the inclusion of the recall task in the pilot study immediately after study could have facilitated recognition performance, and its removal in Experiment 1 could have contributed to the present results. Though an important first step in testing the schema account of collective future thinking, Experiment 1 falls short in clearly delineating whether a negatively biased schema influences the encoding and recognition of news headlines.

Despite the lack of evidence, it is still possible that the results could differ if participants viewed stimuli with an unbalanced number of positive or negative stimuli. If recognition of valenced headlines is driven by an inherently negative collective schema, participants who view more negative headlines at study should display a greater false alarm rate for negative headlines than those who view neutrally-valenced or more positive headlines at study. However, if recognition performance is influenced by the bias of the information studied (i.e., more positive or more negative), then participants should display false memory for both negative *and* positive headlines in the negatively-biased and positively-biased conditions respectively, reflecting the influence of exposure rather than

schema. Thus, the positively-biased study condition is key to clarifying how the mechanisms of interests influence recognition performance. These hypotheses can be expanded by testing recognition at a one-day and a one-week delay. Presumably, recognition performance at a shorter delay will be more greatly influenced by the representation of the information at study (i.e., susceptible to biases). After a longer delay, however, reliance on schematic information should increase. Therefore, if recognition is influenced by a negatively-biased schema, poorer discriminability, a more liberal bias, and higher false alarm rates would emerge for negative headlines regardless of people's initial representation of the information (i.e., across all study conditions).

IV. EXPERIMENT 2

Experiment 2 assessed the false memory effect for negative news information as a function of the bias of the stimulus set. This was tested by varying the number of positive and negative items presented during study (i.e., positively-biased, neutral, or negatively-biased). This approach has several advantages. One, it allows for the two aforementioned competing hypotheses to be tested against each other, which would clarify whether people relied on a representation of knowledge acquired during study or on pre-existing schema that is not influenced by biases within information studied. Additionally, this manipulation allows for the testing of the generalizability of these findings by the inclusion of a positively-biased stimulus condition. Further, the delay time between study and test was manipulated to assess whether a negative false-memory bias is more likely to appear after a longer delay.

A. Methods

1. Participants

Because this experiment employed a similar paradigm as Experiment 1 with the inclusion of a new manipulation, the proposed sample size of the present study was approximately fifty-percent greater than Experiment 1 (N = 135). After excluding participants who did not complete both parts of the study and/or did not follow task instructions, a final sample size of 126 participants was obtained from the University of Illinois at Chicago undergraduate psychology subject pool (N_{female} = 83, M_{age} = 19.1).

2. Materials and design

The same novel headlines used in Experiment 1 were utilized in the present study. Three sets of stimuli were developed for the study phase, each comprised of thirty headlines. For the positively-biased set of headlines, twenty of the thirty headlines were positively-valenced while the remaining ten were negatively valenced; and vice-versa for the negatively-biased set of stimuli (i.e., twenty negative and ten positive headlines). The neutral set of stimuli had fifteen positive and fifteen negative stimuli. The stimuli for the recognition task included ten positive and negative headlines that were presented at study across all three conditions, plus ten positive and ten negative lures unrelated to the headlines presented at study. Thus, the same twenty headlines were target items during recognition, and were present in all three sets of stimuli at study with the addition of positive and/or negative headlines to create the valence biases. The same lure items as Experiment 1 were utilized in this study.

3. Procedure

Participants were randomly assigned to one of the three valence-bias conditions — positive, neutral, or negative – as well as to one of the two delay conditions – one-week or one-day delay. They were given the same instructions as in Experiment 1, such that they viewed the thirty headlines in a random order for ten seconds each on the screen and then rated the believability of the headline on a five-point scale. After viewing all thirty headlines, participants completed a demographic questionnaire and were debriefed for this part of the experiment.

a. Recognition

Because the delay between study and recognition was also manipulated in this study, half the participants were sent the recognition task after a one-day delay while the other half were sent the recognition task after a one-week delay. Participants viewed the twenty headlines from the study phase and twenty novel lures, of which ten each were positive and ten negative. In accordance with the recognition task in Experiment 1, each headline was presented along with a five-point rating scale for participants to indicate whether they saw the headline in the previous session (1 = Definitely did not see, 3 = Unsure, 5 = Definitely saw). After viewing and rating all forty headlines, participants were debriefed and granted credit for their participation.

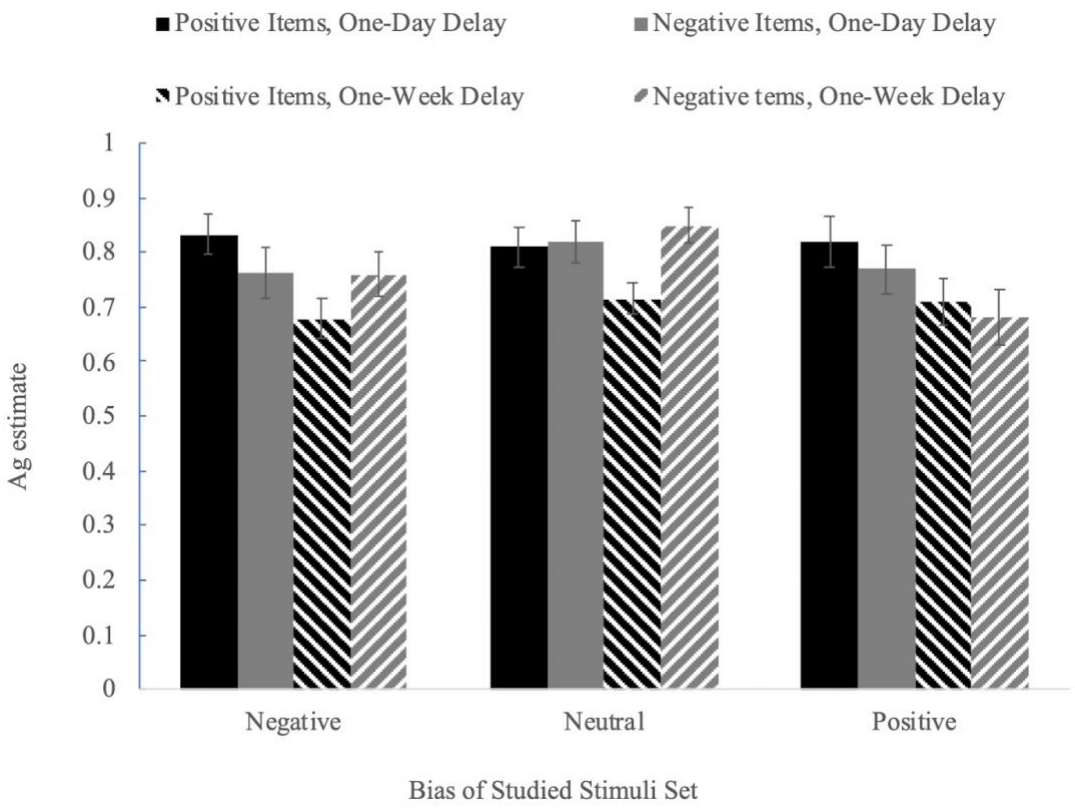
b. **Scoring**

The recognition task was scored identically to the previous experiment, in terms of proportions of headlines from each condition that were given a rating of 1, 2, 3, and so on. Cumulative hit rates and false alarm rates were again used to derive a non-parametric A_g estimate based on the aforementioned equation (See Appendix B). Further, given that there was no difference between the stringent and lenient *d'* calculations in Experiment 1, *d'* and total false alarm rates were calculated based on the stringent criterion (i.e., Ratings of 3 were not included in analyses).

B. Results

A two (Valence of headline: Positive, Negative) by three (Bias of stimuli during study: Positively-biased, Neutral, Negatively biased) by two (Delay: One-day, one-week) mixed measures ANOVA was conducted for each of the dependent variables A_g, *d'* (stringent) and *false alarm rates* (stringent). Figure 5 shows the results for A_g.

Figure 5. Mean A_g values and standard errors for Experiment 2 groups



There was a significant main effect of the delay condition, $F(1, 120) = 8.84$, $p = .004$, $\eta_p^2 = .069$: Sensitivity was overall better after a one-day delay ($M = .80$, $SD = .12$) than a one-week delay ($M = .73$, $SD = .14$). Further, a significant interaction between valence and delay emerged, $F(1, 120), = 4.69$, $p = .032$, $\eta_p^2 = .038$. Pairwise comparisons revealed that this interaction was driven by the fact that sensitivity for positive items was better after a one-day delay ($M = 0.82$, $SD = 0.18$) than after a one-week delay [($M = 0.70$, $SD = 0.16$, $t(124) = 3.91$, $p < .001$, $d = 0.70$]. There was no significant difference in sensitivity for negative items between the one week and one day delay condition, and no other significant main effects or interactions emerged. Figures 6a, 6b, and 6c provide the ROC curves for each of the bias conditions.

Figure 6a. ROC curves for participants in the negatively-biased study condition in Experiment 2.

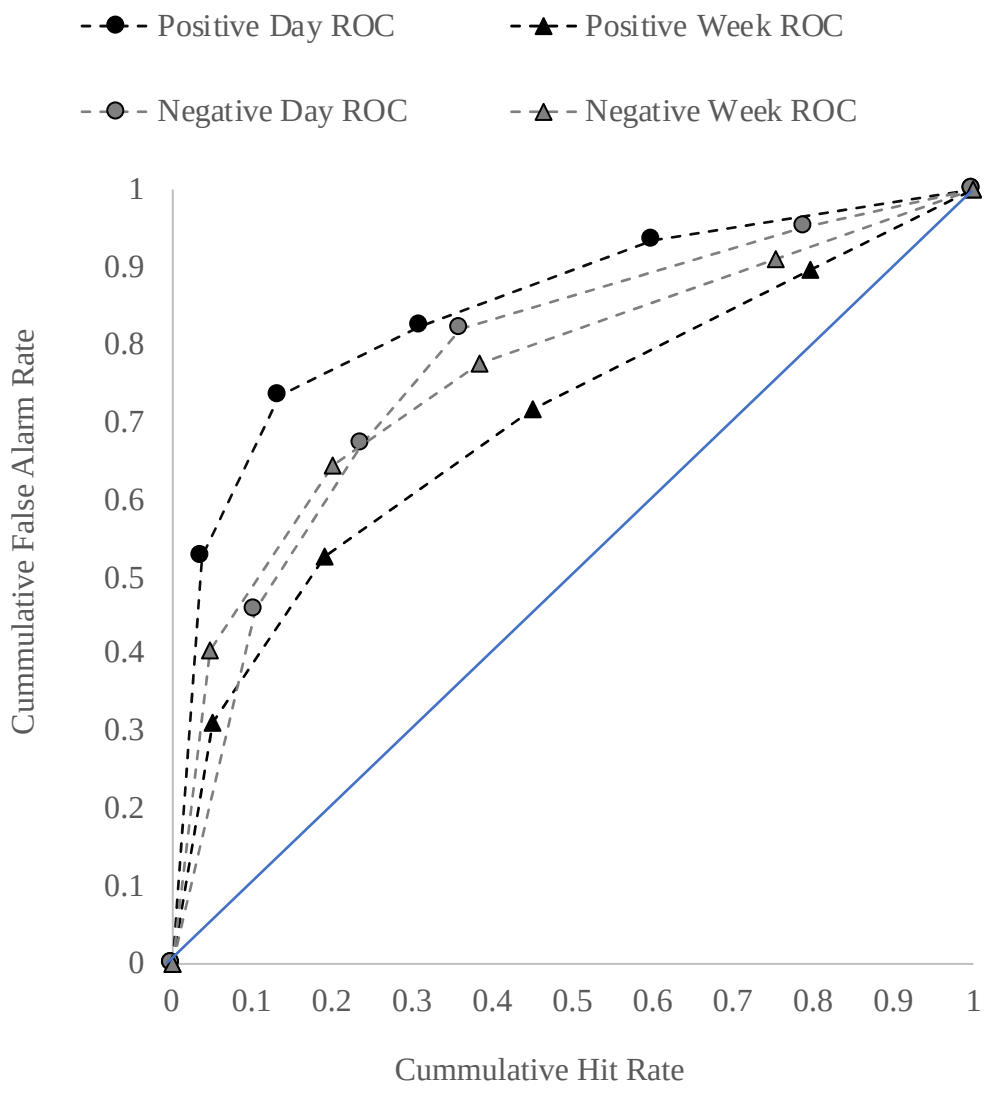


Figure 6b. ROC curves for participants in the neutral study condition in Experiment 2.

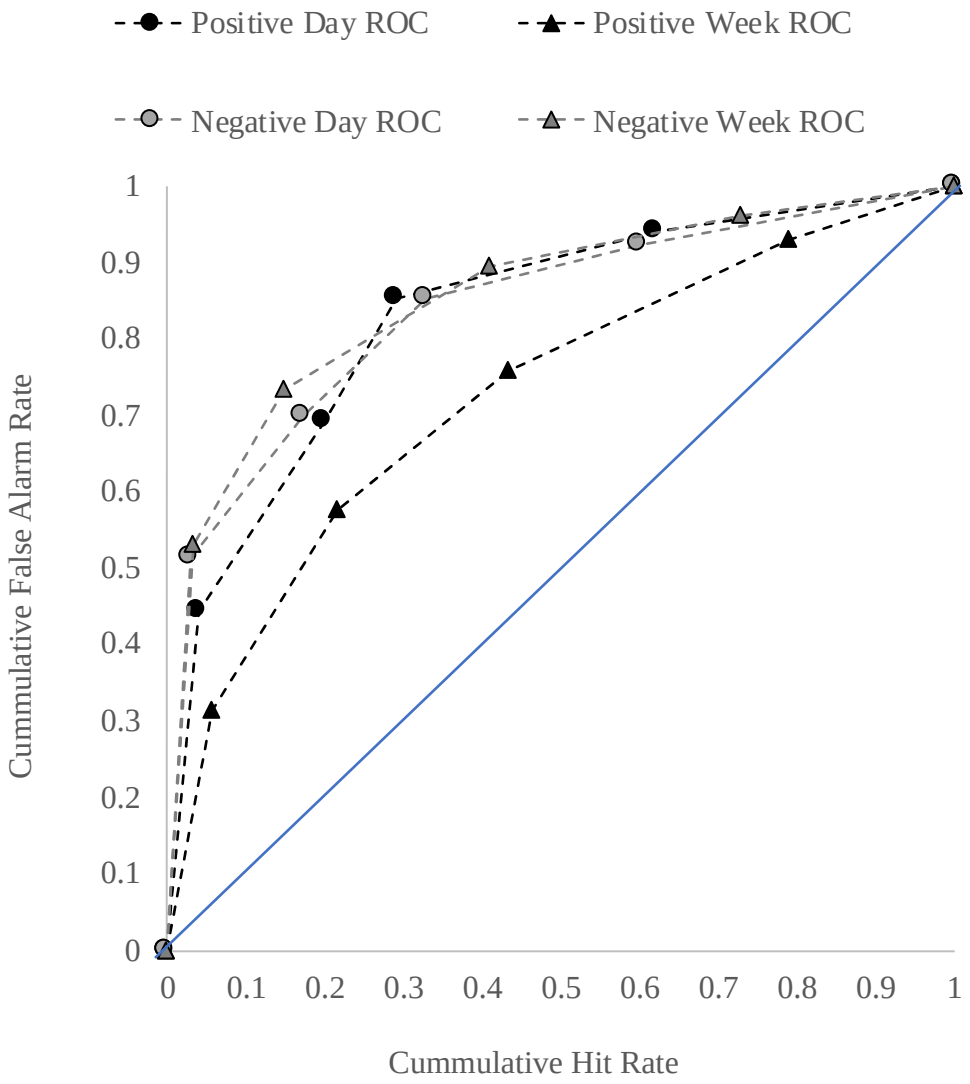
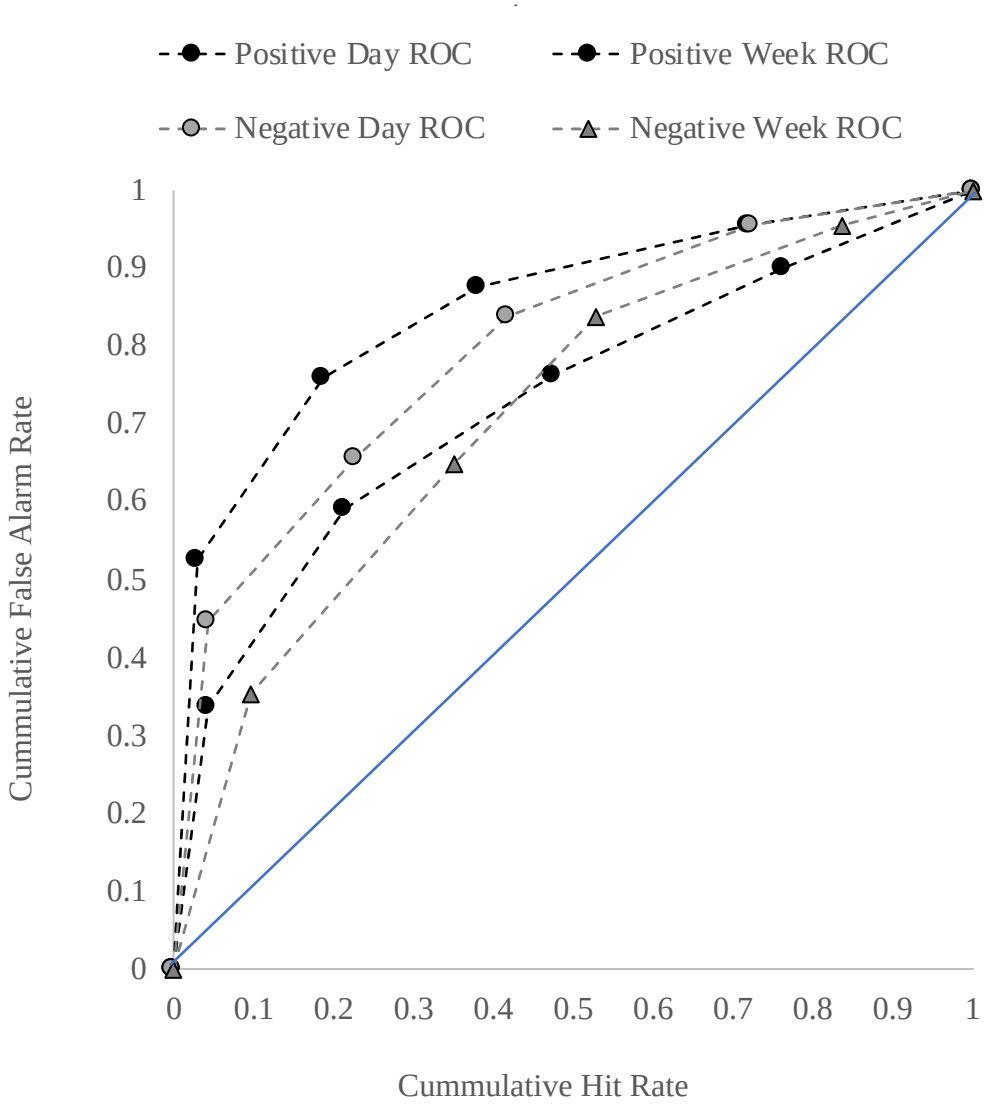


Figure 6c. ROC curves for participants in the positively-biased study condition in Experiment 2.



Analysis of *d'* revealed the same pattern of results, such that there was a significant main effect of delay, $F(1, 120) = 6.04$, $p = .015$, $\eta_p^2 = .048$, and a significant interaction between valence and delay condition, $F(1, 120) =$` 4.61, $p = .034$, $\eta_p^2 = .037$, but no further significant effects. Again, while discriminability was overall worse after a one-week delay ($M = 0.53$, $SD = 0.33$) compared to a one-day delay ($M = 0.67$, $SD = 0.35$), this was driven by a significant decrease in discriminability for positive headlines after one week ($M = 0.47$, $SD = 0.37$) compared to one day [$M = 0.73$, $SD = 0.45$, $t(124) = 3.56$, $p < .001$, $d = 0.63$). The means and standard errors for *d'* are provided in Figure 7. As with the analyses for the sensitivity measure A_g, there was neither any significant difference in sensitivity for negative items between the one week and one day delay condition, nor any other significant main effects or interactions. With regard to measures of bias, *b"*, there were no significant main effects nor any interactions, largest non-significant $F(1, 116)=\_2.88$, $p = .092$. Figure 8 displays means and standard errors for bias.

Figure 7. Mean *d'* values and standard errors for Experiment 2 groups.

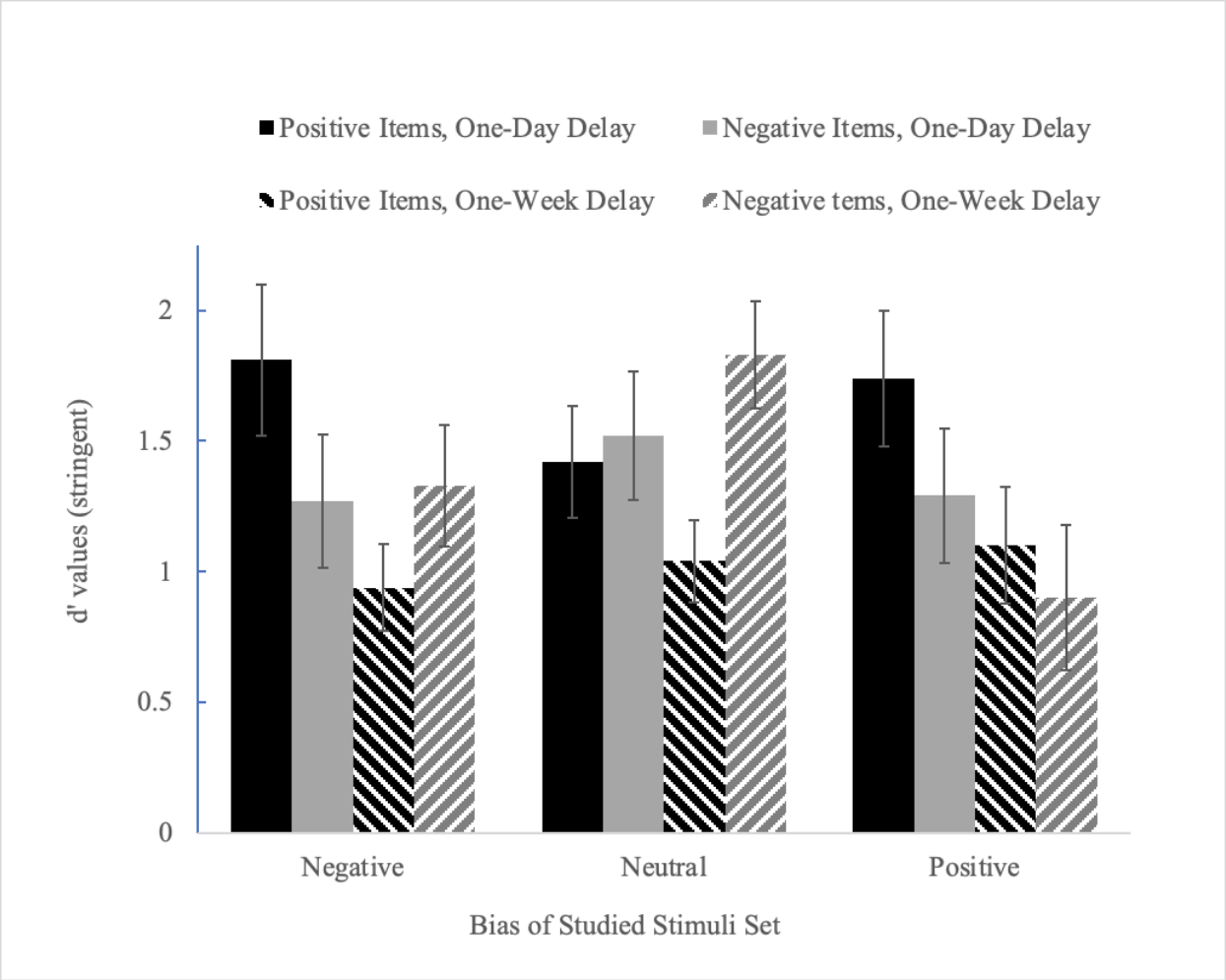
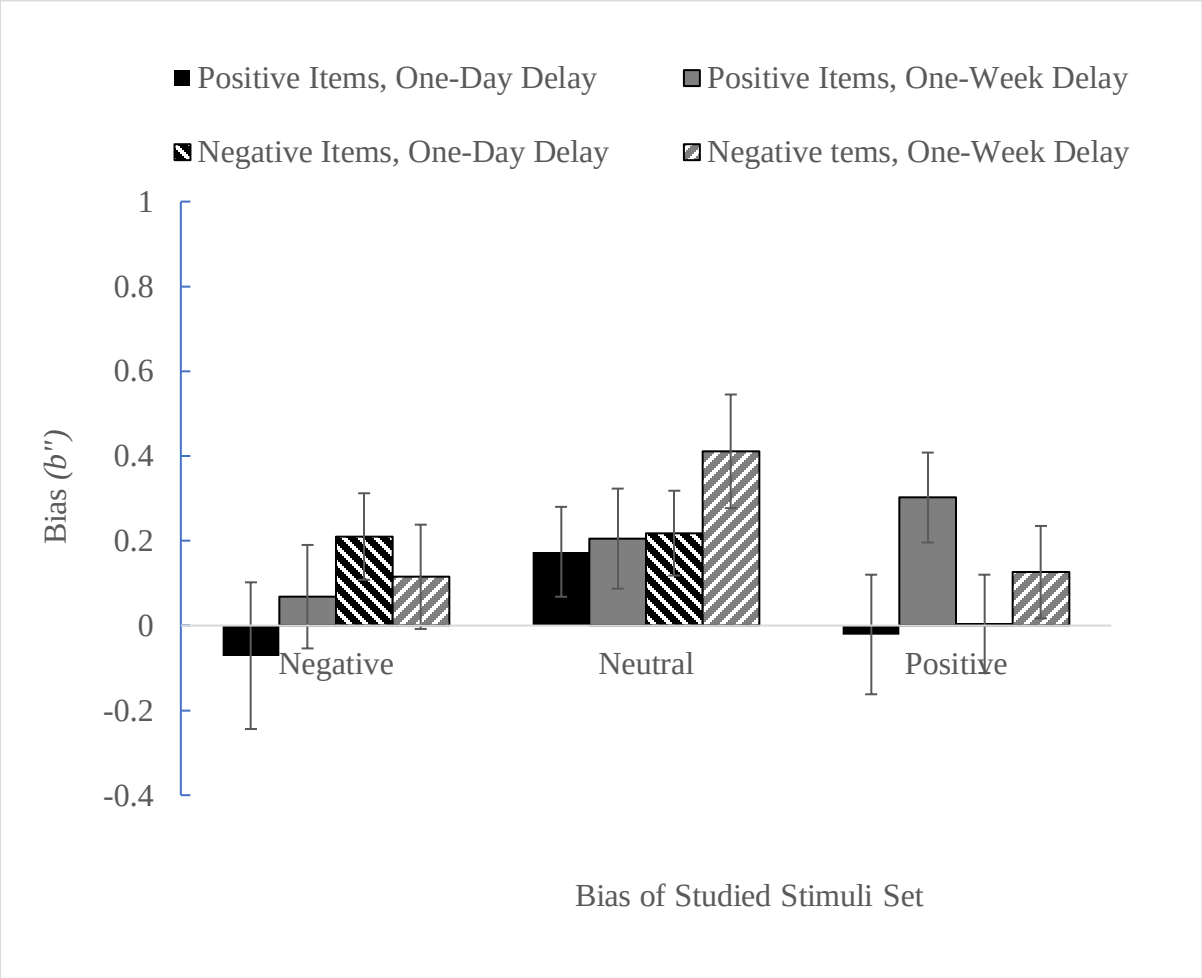


Figure 8. Mean *b"* values and standard errors for Experiment 2 groups.



Finally, analyses of the false alarm rates were conducted to examine whether there were differences in false alarm rates between positive and negative headlines. The stringent false alarm rate was used as the dependent variable in the same two by three by two repeated measures ANOVA. Interestingly, a significant interaction between study condition and valence was found, $F(2, 120) = 3.22$, $p = .04$, $\eta_p^2 = 0.051$. Follow-up one-way ANOVAs compared false alarm rates on positive headlines across study conditions and another compared false alarm rates on negative headlines across study conditions. The false alarm rate was significantly different across study conditions for negative headlines [$F(2,79.4) = 3.97$, $p = .021$], but not for positive headlines [$F(2,81.4) = 0.83$, $p = .44$]. Post-hoc comparisons of the significant one-way ANOVA further revealed that this effect was driven by a significant difference in false alarm rates in the positively biased as compared to the neutral condition. That is, there was a higher false alarm rates for negative headlines in the positively biased study condition ($M = 0.29$, $SD = 0.26$) than in the neutral study condition [$M = 0.16$, $SD = 0.17$, $t(123) = 2.77$, $p = .018$]. There was, however, no difference between positively and negatively biased study conditions in false alarm rates for negative headlines [$t(123) = 1.51$, $p = .29$]. False alarm rates and hit rates for all conditions in this experiment can be found in Table 2.

TABLE 2.

EXPERIMENT 2 HIT RATES AND FALSE ALARM RATES

	Positive Headlines		Negative Headlines	
Delay	Hit Rate *M (SD)*	False Alarm Rate *M (SD)*	Hit Rate *M (SD)*	False Alarm Rate *M (SD)*
			Negatively Biased Stimuli Set	
Day	0.73 (0.28)	0.14 (0.17)	0.67 (0.26)	0.24 (0.24)
Week	0.52 (0.24)	0.19 (0.14)	0.64 (0.27)	0.20 (0.19)
			Neutral Stimuli Set	
Day	0.69 (0.21)	0.20 (0.18)	0.70 (0.21)	0.17 (0.17)
Week	0.57 (0.22)	0.21 (0.18)	0.73 (0.21)	0.15 (0.16)
			Positively-Biased Stimuli Set	
Day	0.76 (0.23)	0.19 (0.17)	0.66 (0.23)	0.23 (0.23)
Week	0.59 (0.25)	0.21 (0.20)	0.65 (0.24)	0.35 (0.27)

C. Discussion

Experiment 2 aimed to break down the false memory phenomenon for negative collective-relevant information to better delineate the nature of the underlying representation influencing recognition performance. Unlike in Experiment 1, main effects of delay emerged such that a decline in overall sensitivity and discriminability was observed after a one-week delay. Delay further interacted with valence such that positive headlines were worse recognized after a one-week delay, regardless of whether the valence of information at study was biased positively, biased negatively, or neutral. Further, an unexpected false memory effect emerged for negative headlines: Although it was hypothesized that the negatively-biased study condition would produce greater false alarms, the false memory effect for negative headlines was found in the positively-biased study condition, irrespective of delay condition.

V. EXPERIMENT 3

Experiment 3 compared the collective schema to the personal life script by assessing whether the false memory effect for domain-specific information that is respectively negative or positive in valence. While prior work has described a valence-based distinction between the personal and collective future in terms of dissociable schema (e.g., Shrikanth et al., 2018, Shrikanth & Szpunar, in preparation), there is a lack of stringent evidence of such a dissociation outside of the context of an event fluency measure. Thus, Experiment 3 assessed whether people exhibit false memory effects for positive information consistent with a positively-biased cultural life script and a false memory effect for negative information consistent with a negatively biased collective schema.

Though prior work has suggested that the events pertaining to the personal future, such as cultural life scripts, and events pertaining to the collective future are dissociable by valence (Shrikanth et al., 2018), comparing false memory effects for personal positive versus negative collective information would more compellingly demonstrate that dissociation at a mechanistic level. Crucially, Koppel and Berntsen (2014) found initial evidence showing that people are susceptible to falsely remembering life-script information, their argument being that the life script displays the qualities of schema (i.e., which contribute to false memories). They presented stories containing schema-consistent and schema-inconsistent information to participants. Interestingly, their manipulation of schema-consistency was yoked to their manipulation of valence such that schema-consistent events were positive (e.g., marriage) while schema-inconsistent

events were negative (e.g., divorce). After a two-day delay, participants were shown a series of events that they had either viewed in the story or were novel lures, and were asked whether a given event was present in the story they read.

Importantly, they found that people consistently falsely recognized positive schema-consistent information above negative. These results speak to the possibility that the life script functions as a schema, and is positively biased. However, Koppel and Berntsen (2014)'s methods were significantly different from that used in the present studies, making difficult the ability to directly compare their false memory effects to the effects presently attained. Thus, in order to serve as evidence for the valence-based dissociation between personal and collective cognition, identical methodology needs to be used to compare the false memory effects between these two domains.

In this experiment, false memory served as a proxy for the influence of differentially valenced-schema pertaining to each respective domain. Specifically, stimuli reflecting statements about a hypothetical person that were either consistent or inconsistent with a cultural life script, as well as news headlines that were schema consistent versus inconsistent. In both cases, schema consistency was equated to the associated valence of that particular schema (i.e., cultural life script-consistent as more positive and collective schema-consistent as more negative). Importantly, people should falsely remember a greater number of negative than positive headlines and a greater number of positive than negative personal-relevant statements (i.e., replication of Koppel & Berntsen, 2014) to confirm the valence-based dissociation. Notably, for for the purposes of the present study,

the time interval between study and test was not manipulated. Rather, all participants received the one-week delayed recognition task in order to stay consistent with Koppel and Berntsen (2014)'s procedure, and to better facilitate any it was hypothesized that higher false alarm rates, lower indexes of discriminability, and a stronger liberal bias would occur for negative information related to the collective schema. Conversely, for information related to a positively-biased cultural life script, it was hypothesized that there would be less discriminability, stronger liberal bias, and higher false alarm rates for positive than negative statements. This pattern of results would provide compelling evidence in support of a valence- based distinction between personal and collective schema underlying prospection in those domains.

A. Methods

1. Participants

Koppel and Berntsen (2014) had a sample of forty-eight participants in their study. A power analysis conducted on G*Power using the effect sizes attained in their study *(d* = .41, *alpha* = .05, power = .95) yielded a desired sample size of sixty-seven participants. Given that this study was comparing two memory performance across two domains (i.e., personal and collective) rather than just one, the proposed sample size was doubled to a total of 134 participants to ensure sufficient power. Of the students recruited, thirty-six participants did not return for part two or did not appropriately follow task instructions, yielding a final sample size of ninety-eight participants *(N_{female}* = 59 *; M_{age}* = 19.4 years).

2. Materials and design

a. Norming life-script statements

To compare the hypothesized negatively biased collective schema to the positively biased personal schema (i.e., life script), normed stimuli that contained information relevant to cultural life scripts were generated. Koppel and Berntsen (2014) developed statements about a woman's life containing nine "critical events" that corresponded to major events in a life script. They manipulated valence, such that schema-consistent events had the same emotional valence as would be expected (i.e., marriage as positive and divorce as negative), while schema-inconsistent events had the opposite emotional valence (e.g., marriage as negative and divorce as positive). In the present study, there were similar life statements about a fictional person named "Sal," a gender-neutral individual. Similar to the headlines, each life statement about Sal had a plausible positive and negative counterpart. For example, if a positive statement is *"Sal hopes to get married in the future"*, the negative counterpart was *"Sal hopes to never marry in the future."* Thus, thirty-two positive statements and their thirty-two negative counterparts were developed and normed for the same criteria as the headlines, except changing "familiarity" to "relatability" (i.e., positivity, negativity, plausibility, relatability, and detail). The norming protocol previously described was followed identically (see pg. 13 for detailed norming procedure).

Paired samples t-tests tested whether positive statements were significantly more positive than negative statements, and vice versa. Positive statements were given a significantly higher positivity rating (M = 4.48) than negativity rating (M = 1.76, $t(63)$ =

38.16, $p < .001$) while negative headlines were given a significantly higher negativity rating (M = 3.75) than positivity rating (M =1.48, $t(63) = 30.74$, $p < .001$). While there were no differences in believability ratings between positive and negative statements [$t(63) = 1.28$, $p = .209$], there were significant differences between statements on ratings of relatability [$t(63) = 6.33$, $p < .001$] and level of detail [$t(63) = 2.69$, $p = .011$]. Interestingly, positive statements were both more relatable (M_{pos} = 3.22 vs. M_{neg} = 2.44) and detailed (M_{pos} = 3.28 vs. M_{neg} = 3.15) than negative statements overall. Indeed, these ratings align with the predictions of life script theory, such that people tend to expect and remember more positive than negative life script events (e.g., Rubin & Berntsen, 2003).

The top thirty most positive and thirty most negative statements were utilized for the experiment, after being matched for believability, relatability, detail, and word count. See Appendix C for all statements and ratings. Thus, like the headlines, fifteen positive and negative statements were studied and fifteen of each were presented as novel lures in the delayed recognition task. The counterbalancing procedure described in Experiment 1 was also used, such that participants viewed one of two versions of the study items, and one of two versions of the lure items (i.e., negative statement in one version was a positive statement in the other).

3. Procedure

a. Study

Half of the participants began by completing the personal version of the study task, while the other half began by completing the collective version of the task. Task order was evenly counterbalanced across participants, as was what version of the

stimuli participants viewed as study items versus lure items. Those beginning with the personal version of the task viewed instructions very similar to the collective task. However, rather than viewing headlines from a hypothetical country, they viewed statements about a typical non-gendered person, named Sal. Because prior work has found that asking people to think of the future of a typical person actually gave rise to a positivity bias (Shrikanth & Szpunar, in preparation) the conceptions of the "typical person's future" essentially were equated with responses associated with the cultural life script or personal schema. The procedure followed that of the previous study. Each statement was presented on screen for ten seconds, followed by the believability rating identical to Experiment 1, that they will make utilizing the keyboard. After viewing all thirty personal statements, participants who began with the personal version of the task completed the collective version, and vice versa if they began with the collective version of the task. Again, the procedure for the collective version of the study task was identical to Experiment 1.

b. Recognition

The recognition task was sent to participants exactly one week after the first session, via a Qualtrics survey. For the recognition task, they viewed the thirty personal and collective stimuli that were presented to them during study, as well as thirty novel personal lures and thirty novel collective lures that were not presented to them. The personal and collective versions of the recognition task were presented separately, and the order in which participants complete the tasks was evenly counterbalanced. Like before, they viewed each stimulus one at a time, and provide a rating on a five-point Likert

scale as to whether they saw the stimulus in the previous session (1 = Definitely did not see, 3 = Unsure, 5 = Definitely saw). After completing both the personal and collective versions of the recognition task, they were debriefed on this part of the experiment.

c. Scoring

As previously described, the proportions of headlines and statements that were given each of the five ratings were calculated and converted into hit rates and false alarm rates, which were then used to derive non-parametric measures of sensitivity (A_g) and stringent estimates of discriminability (d').

B. Results

A two (valence, positive/negative) by two (domain, collective headlines/personal life script statements) repeated measures ANOVA was performed on each of the three dependent variables of interest – the A_g estimate, stringent d', and false alarm rates. With regard to the measure of sensitivity A_g, results revealed a statistically significant main effect of domain [$F(1, 97) = 15.07$, $p < .001$, $\eta_p^2 = 0.134$] and an interaction between domain and valence [$F(1,97) = 5.76$, $p = .018$, $\eta_p^2 = 0.06$]. Pairwise comparisons of the main effect and interaction showed that while sensitivity for recognizing personal-relevant items ($M = .68$, $SD = 0.18$) was better than sensitivity for collective-relevant items [$M = .60$, $SD = 0.24$, $t(97) = 3.88$, $p < .001$] overall, the magnitude of that difference varied by valence. That is, the mean difference in sensitivity between positive personal items and positive collective items [respectively, $M = 0.70$, $SD = 0.18$ vs. $M = 0.59$, $SD = 0.24$, $t(97) = 4.41$, $p < .001$, $d = 0.45$] was larger than the mean difference between negative personal and negative collective items [respectively, $M = 0.67$, $SD = .20$ vs. $M = 0.61$, $SD = 0.25$,

t(97) = 2.74, *p* = .007, *d* = 0.28]. These effects were primarily driven by superior sensitivity in recognizing positively-valenced life statements (*M* = 0.70, *SD* = 0.19). There was no significant main effect of valence [*F*(1, 97) = 0.64, *p* = 0.42]. Figure 9 depicts means and standard deviations for each condition and Figure 10 provides the accompanying ROC curves.

Figure 9. Mean A_g values and standard errors for Experiment 3 groups.

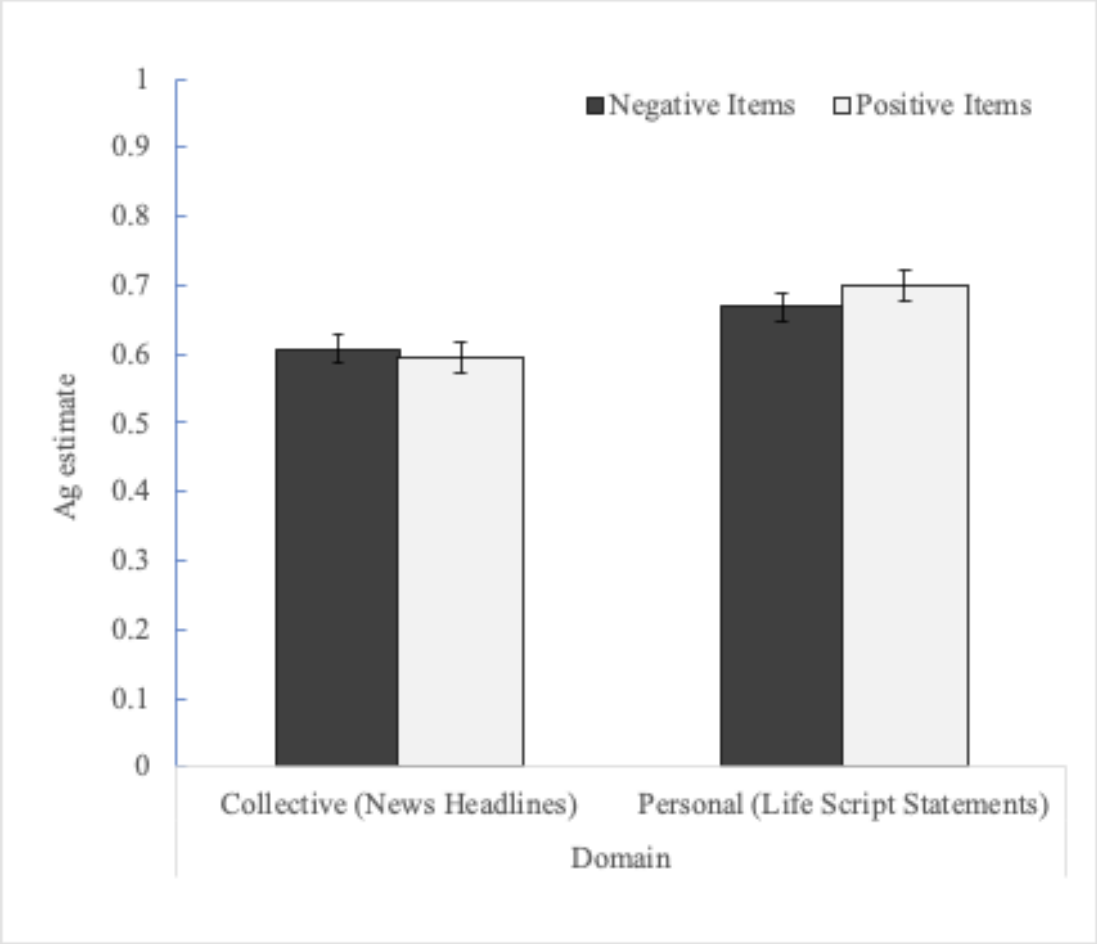
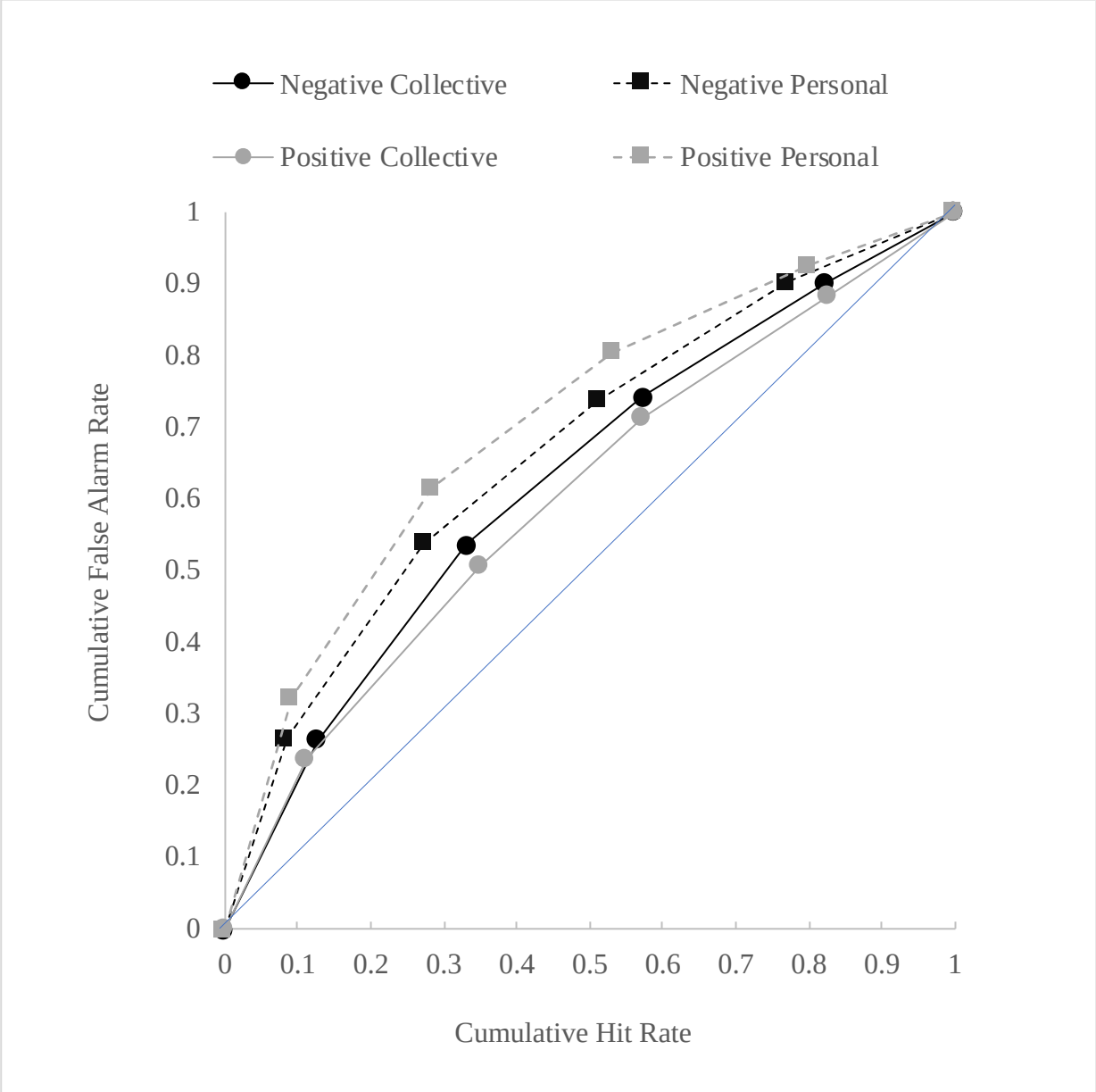


Figure 10. ROC curve for participants in Experiment 3.



The analysis of *d'* measures yielded comparable results to the A_g measure of sensitivity. Specifically, there was a main effect of domain [$F(1, 97) = 5.8\ 4$, $p < .001$, $\eta_p^2 = 0.06$] and a significant interaction between domain and valence [$F(1, 97) = 14.66$, $p < .001$, $\eta_p^2 = 0.13$]. Once again, follow-up tests revealed that discriminability for life script statements ($M = 0.42$, $SD = 0.32$) was again higher than discriminability for news headlines [$M = 0.33$, $SD = 0.41$, $t(97) = 2.42$, $p = .018$]. Further, a crossover interaction emerged. In relation to news headlines, discriminability appeared to have been higher for negative ($M = 0.44$, $SD = 0.43$) than positive items [$M = 0.22$, $SD = 0.60$, $t(97) = 3.45$, $p < .001$, $d = 0.22$], while discriminability for positive items ($M = 0.49$, $SD = 0.40$) was higher than discriminability for negative items ($M = 0.35$, $SD = 0.44$) in relation to life script statements ($t(97) = 13.88$, $p < .001$, $d = .85$). Again, there was no significant main effect for valence ($F(1, 97) = 1.20$, $p = .267$). With regard to measures of bias, *b"*, there were no significant main effects nor any interactions, largest non-significant $F(1, 92)= .821$, $p = .367$. Figure 11 shows mean *d'* and standard errors while Figure 12 shows mean *b"* and standard errors for each condition.

Figure 11. Mean *d'* and standard errors for Experiment 3 groups.

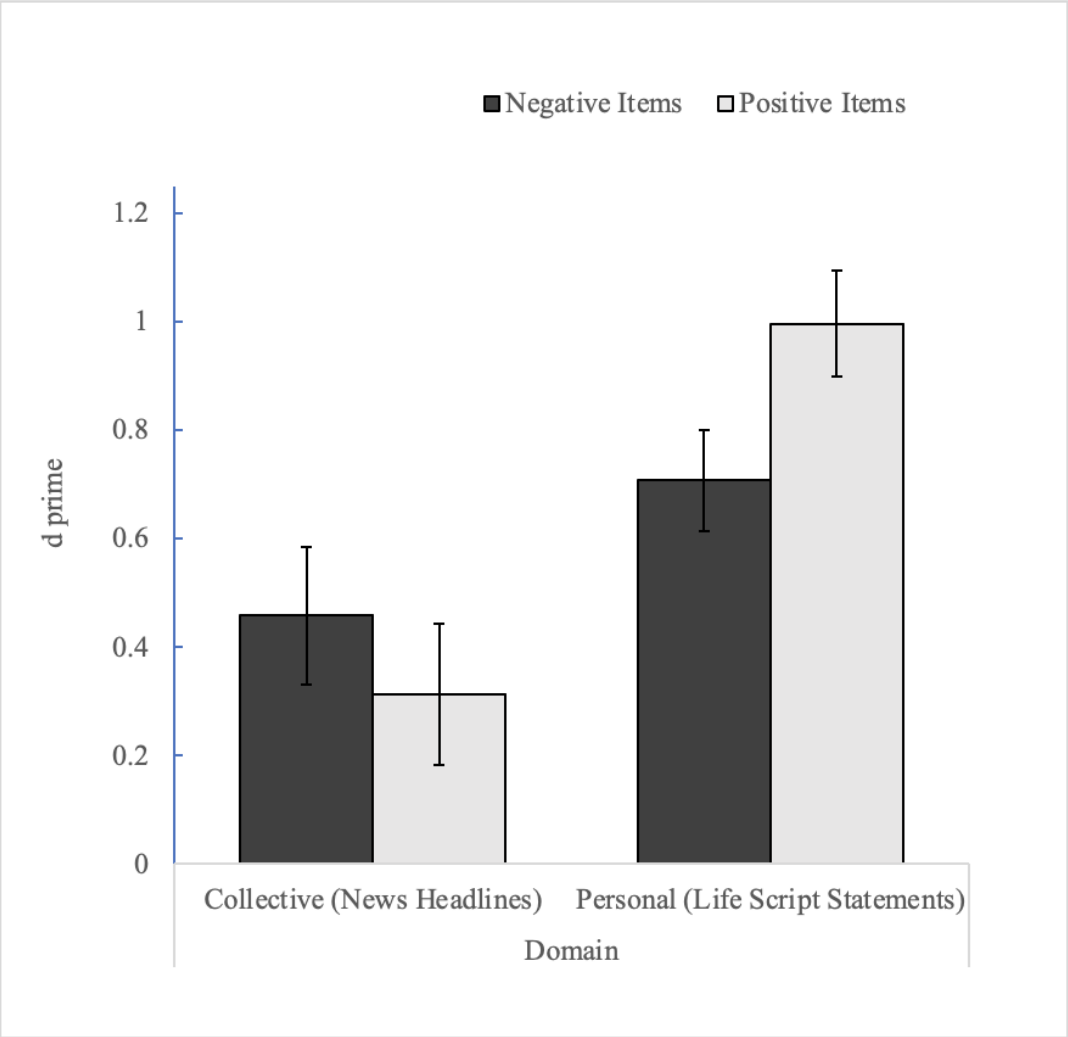
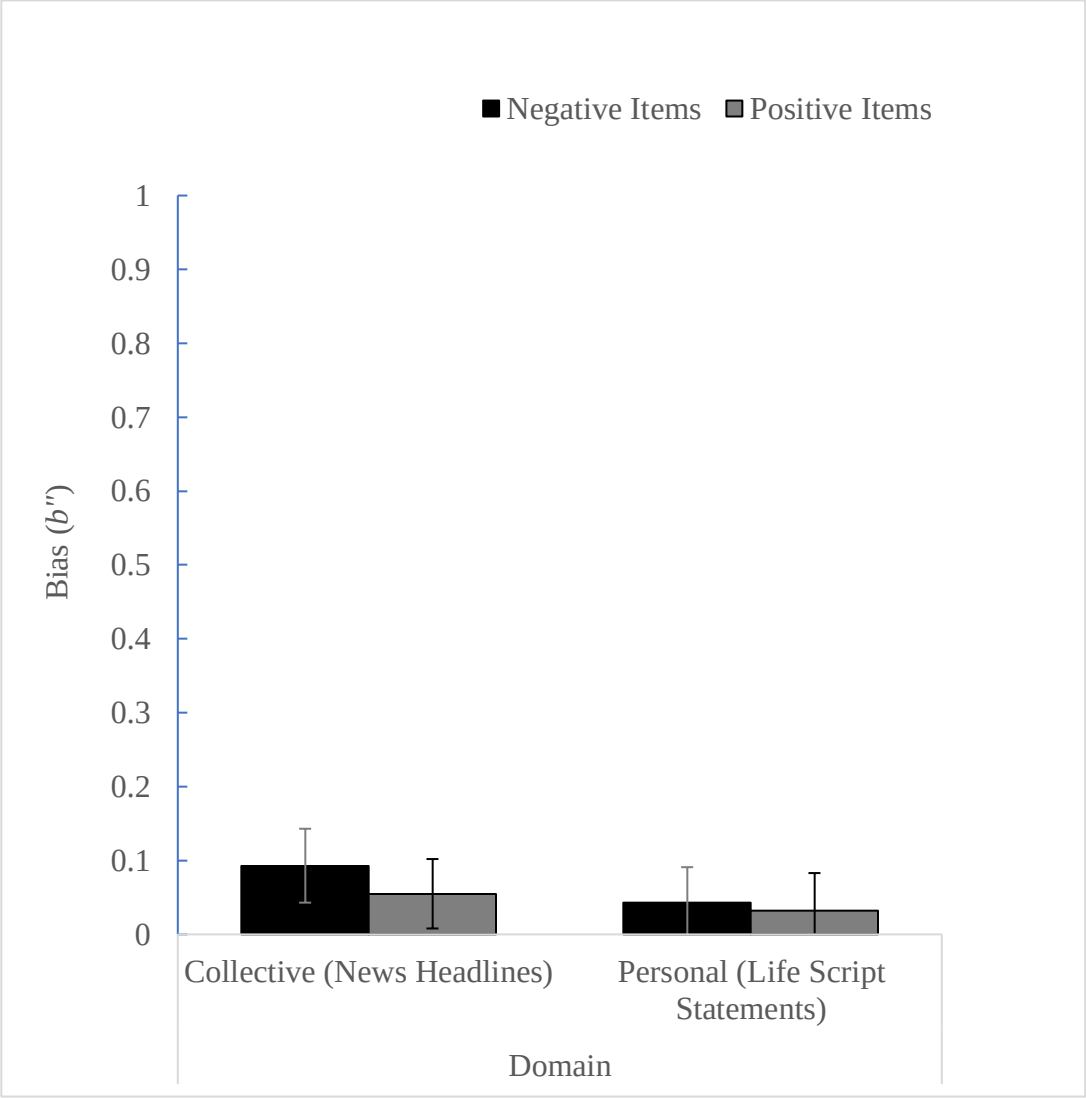


Figure 12. Mean *b"* values and standard errors for Experiment 3 groups.



With regard to false alarm rates there was a significant main effect of domain [$F(1, 97) = 12.17$, $p < .001$, $\eta_p^2 = 0.11$] such that the false alarm rate was greater for collective items than personal items [respectively, $M = 0.38$, $SD = 0.27$ vs. $M = 0.28$, $SD = 0.21$, $t(97) = 3.49$, $p < .001$). However, neither a significant main effect of valence [$F(1, 97) = 0.92$, $p = .34$] nor a significant interaction [$F(1, 97) < .001$, $p = .92$] was found. False alarm rates and hit rates for all conditions are displayed on Table 3.

TABLE 3

EXPERIMENT 3 HIT RATES AND FALSE ALARM RATES.

	Negative Items		Positive Items	
	Hit Rate	False Alarm Rate	Hit Rate	False Alarm Rate
	M(*SD*)	*M*(*SD*)	*M*(*SD*)	*M*(*SD*)
Collective	0.54 (0.28)	0.37 (0.28)	0.50 (0.27)	0.38 (0.27)
Personal	0.54 (0.27)	0.27 (0.23)	0.64 (0.25)	0.28 (0.23)

VI. GENERAL DISCUSSION

The series of experiments presented herein attempted to test a schema theory account of the negativity bias toward the collective (i.e., country's) future by gauging people's memories, using measures of sensitivity, discriminability, and bias for positive and negative news headlines related to a hypothetical country. It was hypothesized that a false memory effect would emerge, such that people would display worse discriminability and a greater number of false alarms for negative news headlines, indicating the influence of underlying negatively-valenced collective schema on recognition memory. These experiments also tested for a false memory effect for positive personal life statements, indicating the influence of an underlying positively-biased personal schema (i.e., life script; Koppel & Berntsen, 2014) on recognition memory. Taken together, it was predicted that these results would support a schema account for the valence-based dissociation between collective and personal future thinking (Shrikanth et al., 2018; Shrikanth & Szpunar, 2021).

Across three experiments, partial support may have been found for a negatively biased schematic representation, though not as predicted. Experiment 1 was an extension and replication of a pilot study, wherein I tested whether a false memory effect for negative news information would be stronger (i.e., worsened sensitivity after a delay). Instead, results both failed to replicate the false memory effect for negative news information, and showed no influence of a one-week delay on measures of sensitivity or false memory effects. In Experiment 2, I looked at whether biasing the valence of the studied set of stimuli influenced sensitivity and propensity for false memories (i.e., testing

competing hypotheses of influence of schema versus exposure to biased information). Not only was a general main effect of delay on sensitivity and discriminability, which did not appear in the previous study, but also an interaction such that recognition of positive items worsened after a week while there was no difference in recognition for negative items after a week. Additionally, results showed increased false alarm rates for negative information when positively biased information was studied. Lastly, in Experiment 3, when comparing memory for headlines with memory for life script events, results showed (a) that sensitivity for personal positive information is strongest of all conditions, (b) discriminability was better for negative collective information compared to positive, but better for positive personal information compared to negative, and (c) there was a greater false alarm rate for collective information than personal, but no interaction with valence.

Results from across these experiments demonstrate that there are observable differences both in how negative and positive information about the collective is remembered, and in how personal versus collective-relevant schematic information is remembered. However, these results also deviated considerably from what was hypothesized. In the following sections, these results are interpreted, and light is shed onto possible reasons why the predicted false memory effects were not found, noting some potential methodological and theoretical limitations that can be addressed in future work. Finally, the papers concludes by discussing the implications and contributions of this work to the field of cognitive psychology and beyond.

A. Results in Context

Despite the fact that the present findings did not support the hypotheses, they do provide preliminary evidence for the influence of a negatively-biased schema pertaining to the collective on recognition memory. The finding that people are relatively better at recognizing negative than positive headlines may be viewed through a schema theory lens. One way to interpret these results is through examining the way schema-consistent versus inconsistent information is remembered. When people are exposed to information that fits with prior knowledge, it can be more easily encoded or appear more familiar at test (Bower et al.,, 1979; Brewer & Treyens, 1981; Graesser et al., 1979; Rojahn & Pettigrew, 1984; Smith & Graesser, 1981; Thorndyke & Hayes-Roth, 1979). Conversely, when exposed to schema-inconsistent information, people may face difficulty encoding it into prior knowledge given the necessity to form new associations with more unfamiliar information. Schema-inconsistent information, therefore, is rendered susceptible to poorer recognition due to worsened encoding. Indeed, work in both experimental psychology and cognitive neuroscience shows that information that is consistent with an existing schema is better remembered due to the fact that schema facilitate the encoding of relevant information into memory (Ghosh & Gilboa, 2014; Sweegers et al., 2015; Tse et al., 2007, 2011; van Kesteren et al., 2010). There are exceptions to this phenomenon, as in the case of exceptionally distinctive schema-inconsistent stimuli being better recognized (see Pezdek et al., 1989). Largely, however, schema-consistency appears to play a facilitative role in learning and retaining information.

Though this was not explicitly tested, a memory advantage for schema consistent information (i.e., negative headlines) may have emerged instead of a false memory effect. Specifically, the results could reflect the fact that participants were worse at remembering schema-inconsistent information (i.e., positive headlines) across extended delays. Taking the valence by delay interaction in Experiment 2, for example – when participants studied headlines in the first session, co-activation of relevant prior knowledge presumably took place. Re-exposure to negative and positive headlines at retrieval after a longer delay, thus, could have resulted in reactivation of this negatively-valenced prior knowledge, rendering positive headlines less familiar and negative headlines more familiar and accessible due to a top down influence of schematic processes. Thus, if negative information is consistent with existing schema about the collective, that information may be better remembered (i.e., integrated with prior knowledge) while inconsistent information may be susceptible to poorer encoding and subsequent retrieval. Experiment 3 corroborated these finding with a reduced measure of sensitivity for positive headlines compared to negative headlines after a one-week delay. Again, though not the predicted effect, these results do fit with past work that showed better recognition for schema-consistent information. Further, no main effects of valence emerged, indicating that none of the observed effects can be attributed to a general effect of the valence of stimuli on memory (i.e., better memory for negative information overall, see Baumeister et al., 2001).

With respect to false memory effects for negative headlines, the anticipated effects were observed, although not as robust as expected, in Experiment 2 when participants

viewed a greater number of positive items at study. While it was hypothesized that this false memory effect would appear regardless of the bias of the study condition, the finding that emerged is not incompatible with what schema theory would posit. As with the finding above, a schema-consistency effect could have plausibly played a role in how the headlines were remembered. Exposure to a greater number of schema-inconsistent information at study (i.e., more positive headlines) could have biased recognition of schema-consistent information (i.e., negative headlines) by increasing reliance on schematic information, leading to a greater number of false alarms. That is, despite being exposed to more positive headlines at study, a negatively-biased collective schema exerted a top-down influence such that participants expected that more negative headlines had been presented than was actually the case. Indeed, Rojahn and Pettigrew (1984)'s meta-analysis of schema-consistency effects in impression formation found that recognition of items consistent with impression schema is bolstered when participants are presented with a greater number of schema-inconsistent items at study. Thus, these findings do fit with prior work and indicate that people view negative news information as more familiar, or consistent with prior knowledge, than positive news information.

Another consistent finding was that participants displayed superior sensitivity and discriminability in recognizing personal information, especially positive-personal information, compared to positive-negative information and collective information. Results from Experiment 3 largely align with prior work on memory for life scripts (e.g., Rubin & Berntsen, 2003). Indeed, Koppel and Berntsen (2014)'s found that schema consistent life-script events were better remembered than schema inconsistent life-script events,

aligning with the present findings as well. The fact that there was a significant difference between discriminability for personal and collective-relevant information further indicates that these underlying representations do differ. Specifically, the crossover interaction found in Experiment 3 is the most compelling data thus far in support of a valence-based dissociation between schemas underlying personal and collective cognition (Shrikanth et al., 2018). It was predicted that the positivity bias with which people imagine their personal future would influenced by a positively-biased life-script schema, while the negativity bias toward the collective future is influenced by a negatively-biased collective schema. Again, this could be viewed as evidence for a schema-consistency effect on facilitating recognition of negative information relative to impoverished recognition for inconsistent information. Superior discriminability for positive versus negative life script statements, in conjunction with superior discriminability for negative versus positive headlines, could be viewed as evidence that negative information respectively comprise the life script and collective schema. It is worth noting that the *d'* values in Experiment 3 were significantly lower overall compared to the previous two. This is likely attributable to increased task demands and/or fatigue effects. Participants had to view double the number of stimuli at study (30 headlines and 30 statements) as well as at recognition (60 headlines and 60 statements), possibly leading to fatigue effects that reduced performance. These effects were nevertheless above floor and represent sufficiently powered and statistically significant findings.

B. Limitations and Alternate Accounts to the Collective Schema Hypothesis

All-in-all, these results reveal differences in how negative and positive collective versus personal information is remembered and can be interpreted within a schema theory lens, notwithstanding the post-hoc interpretation and lack of direct evidence. This may be cause for concern not only as to the theoretical utility of these findings, but also whether the schema account of both a negativity bias toward the collective future and its dissociation from personal future thinking is a valid, falsifiable account. In what follows, these concerns are addressed by revisiting some of the assumptions about the mechanisms driving the hypothesized false memory effects versus what was found, and by highlighting limitations in methodology and theory. As explained below, the assumptions of schema theory do have critical boundary conditions (i.e., implausible patterns of results) and false memories can, indeed, be used as a proxy for collective negativity bias, given the appropriate experimental paradigm and theoretical considerations.

1. Methodological limitations

Earlier, elaborated on a spreading activation account of the influence of schematic processes on false memory effects. Given that false memory for negative headlines did not emerge as a robust effect, what then can be said about the role of schematic processing in the pattern of results that were obtained, and the mechanisms underlying these and other patterns of results? The present findings can neither directly falsify, nor lend strong support to, a schema account of the collective negativity bias. As such, it is worth taking a closer look at why these effects did not emerge, beginning with the methodology employed. A notable methodological difference between this study and

previous studies pertains to the means of stimuli presentation. Both studies upon which this work was based (Koppel & Berntsen, 2014; Porter et al., 2008) presented information to participants in the form of a story, where schema consistent and schema inconsistent information were embedded into a narrative paragraph. In contrast, participants here were presented stimuli individually in isolation. Though a subtle difference in methodology, some work has shown that engaging in narrative processing leads to greater activation of, and integration of information into, prior knowledge (Ghosh & Gilboa, 2014; Graesser & Nakamura, 1982; Recht & Leslie, 1988; Yarkoni et al., 2008). A future iteration of this study could modify the stimuli from headlines and life statements to news stories and autobiographical stories, to give participants a richer study experience (i.e., more activation of prior knowledge). This change in methodology would increase the likelihood that information presented to participants taps into existing schema.

Relatedly, the task used during the study phase of these experiments may not have been sufficiently engaging to have allowed participants to deeply encode what they studied. Rather than simply rating each headline and statement for believability and relatability respectively, participants could have been given some sort of goal or motivation to study the information to induce deeper processing of information at study. In instances where people are provided with some goal or motivation during the study phase, researchers have found that false memory effects appear for schema-consistent information (Greenberg et al., 1998; McDonough et al., 2015; Rojahn & Pettigrew, 1992; Tuckey & Brewer, 2003). Thus, this experiment could be improved by incorporating a

study task that necessitates deeper levels of processing, such as introducing a goal at study.

2. Is schema theory necessary?

Methodological considerations aside, one might wonder whether schema theory is even a necessary, or valid, explanation of the negativity bias toward the collective future. Indeed, it is crucial to avoid over-interpreting these results within a schema framework (for relevant discussion see Fiske & Linville, 1980). If schematic processes were treated as a catch-all construct that accommodates any and all patterns of results, it becomes both impossible to falsify and invalid as a theory upon which to build this work. This point may also raise the question as to whether the schema is a necessary construct to explain the phenomenon of the collective negativity bias. It can be argued that there are other alternate accounts that do not necessitate the schema or spreading activation of knowledge.

However, there are certainly patterns of results that can be clear indications that schematic processes are not playing a role in the phenomenon of interest. Take the schema-consistency of a target or lure items. Given the role of schema in discerning whether information fits or does not fit with prior knowledge, it would be implausible to observe false memory effects for schema-inconsistent information. From a spreading activation perspective, schema-incongruent information would not be as strongly activated at retrieval, thus significantly reducing the likelihood that such information would be falsely recognized. Conversely, it would be unusual and implausible to obtain worse

recognition for schema-consistent information. Obtaining poorer recognition of negatively valenced information about the life script and positively valenced information about the collective (i.e., information that is incongruent with prior knowledge), as found in this study, fits within the purview of a spreading activation model of schema theory.

Even if schema theory and schematic processes, such as activation of prior knowledge at encoding and retrieving, are viable accounts of the present findings, the question may still arise as to whether other processes, which were not accounted for in these studies, may be playing a role. Several studies have found that the memory processes underlying the encoding and retrieval of information go beyond schema-consistency and activation of semantic prior knowledge. Specifically, in Meade et al. (2007)'s study on the role of spreading activation on false memory effects in a DRM paradigm, they discussed an alternate account for false memory effects that includes both spreading activation as well as *episodic retrieval processes*. Referred to as the activation monitoring theory (AMT; see also McDermott & Watson, 2001; Roediger, Balota, & Watson, 2001), this framework posits that encoding and retrieval processes differ in terms of relative contribution from schematic versus episodic processes.

According to AMT views on false memory, spreading activation of information plays a stronger role in the encoding of information than retrieval. However, when viewing items at retrieval, both schematic *and* episodic processes are equipped to facilitate recall or recognition (i.e., monitoring during retrieval). In terms of predictions based on these models, false memory effects would arise when the episodic trace of studying an item

was not accessible (i.e., cannot explicitly recall), *and* when spreading activation of related constructs renders an item more familiar. This contrasts starkly with the theory and general approach used to formulate the hypotheses and design of these experiments. As stated in the introduction, the focus of this work was on the influence of spreading activation of schematic information, at both encoding and retrieval, in driving the results. As such, the crucial role that episodic processes (i.e., recalling specific instantiation of learning) play at retrieval was not accounted for in these experiments.

While this activation monitoring framework applies to both recall and recognition, recognition paradigms, like what was used here, are more likely than free recall tasks to activate episodic memory processes at retrieval (Meade et al., 2007; Smith & Graesser, 1981). This is because a given item presented at test (i.e., target or lure) can serve as a memory cue to re-instantiate the encoding event and facilitate recognition. Notably, these cued episodic memory processes may be occurring in parallel with spreading activation. The perception of an item as familiar or recognizable then depends on whether cue was strong enough to versus the strength of the association between the cue and schemata (Roediger et al., 2001), rather than solely on spreading activation as previously hypothesized. For example, if one viewed a highly distinctive or bizarre cue at test that they explicitly recall seeing at study, spreading activation of schematic knowledge would not be needed to make a judgment (i.e., cue strength). The episodic trace of first encountering the stimulus would form the basis of their judgment. However, if an item does not evoke an explicit episodic trace, then its recognizability may be more strongly

influenced by the extent to which the item is activated in prior knowledge (i.e., associative strength).

Distinguishing between these processes could shed light on alternate accounts of how we represent information about the collective, particularly in the context of the present study's results. If episodic retrieval processes were acting parallelly to schematic processes at recognition, it is possible that participants in the present study were making their recognition ratings based off episodic traces (i.e., recognizing it from study) rather than based on their prior knowledge. This could have happened if a headline or statement, either positive or negative, was distinctive enough to have been encoded into episodic memory. In this case, contributions of episodic memory processes would reduce the explanatory necessity of a collective schema. Unfortunately, the extent to which spreading activation of associated knowledge versus retrieval of episodic information influenced memory performance in these experiments was not measured. The closest proxy to measuring reliance on schematic versus episodic processes would have been measures of bias, which did not yield any significant results.

3. Remember/Know

Ultimately, direct evidence for a negative collective schema via false memory effects did not emerge because (a) some aspects of the design were suboptimal and/or, relatedly, (b) it was not possible to tease apart the role of episodic processes at retrieval from schematic processes. For there to be decisive evidence of a collective schema in influencing how information about the collective is remembered, a clearer

delineation of the extent to which episodic versus schematic processes play a role in recognition of headlines. The best way to attempt teasing this apart, without utilizing free recall, would be to employ a remember-know (R/K) recognition paradigm (Gardiner 1988; Rajaram, 1993; Tulving, 1985). In such paradigms, participants respond to a given item (i.e., target or lure) in terms of whether they "Remember" seeing it at study based on an explicit episodic memory (i.e., recollection), or whether they "Know" they saw it based on some heuristic or fit with prior knowledge (i.e., familiarity). This distinction between familiarity and recollection is said to reflect dissociable memory processes (Jacoby et al., 1997; Long & Prat, 2002). Respectively, familiarity is associated with implicit, semanticized memory processes while recollection is associated with explicit, episodic memory processes. Past work has shown that participants report "remembering" items if they possess a specific episodic trace, and a "know" rating when items simply feel familiar without explicit recollection of seeing the item before (Gardiner, 1988; Long & Prat, 2002; Rajaram, 1993; Tulving, 1985). This is not unlike measurements of bias that were utilized in the present study, with additional data on the processes used to inform participants' Yes/No judgments.

There have been some interesting prior findings with regard to schema consistency effects using a R/K paradigm. After a delay, schema-consistent information becomes more "familiar" (i.e., more "Know" judgments), while distinctive information becomes easier to "recollect" (i.e., more "Remember" judgments). Therefore, if negative lure headlines were highly consistent with prior knowledge (i.e., negatively-valenced schema), one would expect negative lures to receive a greater number of familiarity

judgments, particular after a longer delay. However, a greater number of recollection judgments would indicate that participants are utilizing a specific episodic trace to guide their judgments and rule out schematic processes. On the other hand, schema-inconsistent information can be easily recalled due to its distinctiveness from prior knowledge, such as positive news headlines. This approach would allow for a more precise measurement of the underlying representation that is the hypothesized collective schema in relation to supporting mechanisms such as episodic memory.

4. COVID-19 pandemic

Finally, it is important to acknowledge the socio-cultural context within which these data were collected. The past six to eight months of data collection included several major news events including accusations of voter fraud during a presidential election, drastic increases in the spread of COVID-19 around the holidays, and an attempted coup at the nation's capital. It is both difficult to predict, and to measure, what effects such a drastically changing news cycle may have on the way people process and remember fictional news headlines. Thus, utilizing news headlines as stimuli proved to be challenging, as it would necessitate understanding and measuring the way current events are influencing one's schema. Additionally, though intended to be run as in-person study in the laboratory, these data were collected in an online setting, where there was virtually no control over any environmental factors that could have influenced participants' attention to the stimuli both at study and recognition. To further confirm the validity of these results, a replication in a controlled laboratory environment incorporating the aforementioned methodological modifications would be beneficial.

C. Future Directions

The findings from the present study, at least those focused on veridical memory, point to the conclusion that a negatively biased schema representation may guide how we remember information about the collective, and that this schema is indeed distinct from a positively-biased personal schema. Given some of the denoted challenges of disentangling schematic from other memory processes, and related methodological limitations, there is clearly work needed to more precisely investigate the nature of this underlying representation. These points notwithstanding, there are myriad future directions to take this line of research.

While this study has shed light into the memory mechanisms that may support collective future thinking, a stronger link needs to be found to better assess how these memory mechanisms directly influences thoughts about the country's future. Specifically, the contents of a collective schema need both to be more clearly defined and mapped onto thoughts about the collective future. As mentioned in the introduction regarding life script events, it is unclear whether a collective schema is similarly comprised of events that transpire in a specific temporal sequence. This line of work would benefit from future research that incorporates qualitative methodology to better define the specific contents and natures of the schema. For instance, early work on cultural life scripts for Danish and American participants utilized qualitative coding methodology to delineate the contents of life scripts across cultures (Berntsen & Rubin 2002; 2004; Rubin & Berntsen, 2003). Perhaps a similar undertaking is necessary to better define what is the "collective schema." While the focus of the research has been on distinctions between positive and

negative thoughts, the specific content that comprises the thoughts of the collective future, as it pertains to the schema, needs more examination.

Another natural extension of this line of work, that would build further support for the schema account of collective future thinking, is to expand the scope of what the "collective" entails. It is crucial to understand how different schematic representations of any given collective group, be it a different country or groups representing smaller levels of analysis, differ based on socio-cultural contexts. There exist, for instance, societies where news information is not negatively biased or where people may not have the freedom of speech to openly discuss collective events, such as in China and Russia where media is state-run (Walker & Orttung, 2014). This likely would lead to starkly different collective schema than the observed negativity bias, in turn leading individuals of that collective to make different predictions about the collective future. Further, there are interesting hypotheses to be made about how a collective future schema manifests in collectivistic cultures, wherein group identity is more strongly tied to personal identity (Bochner, 1994; Chao et al., 2009; Markus & Kitayama, 1991; Singelis, 1994; Triandis, 1988).

Expanding on this point, how does a collective schema manifest in contexts where the personal and the collective schemata may overlap, as in the context of relational or collective identities (Brewer & Gardner, 1996; Markus & Kitayama, 2003; 2010) or collective selves (Greenwald & Pratkanis, 1984; Trafimow et al., 1991)? Prior work suggests that the extent to which collective identity is represented in one's own personal

identity fosters a more positive evaluation of an entity (Brewer & Gardner, 1996). Shrikanth et al., (2018) already demonstrated that people are more optimistic about the future of their family, which is a “collective” to which one presumably shares strong relational identity, and that identification with the country is negatively correlated with the exhibited negativity bias. Thus, examining this phenomenon across groups will be an important avenue for future research.

D. Contributions to Literature

The finding that a negatively-biased collective schema in relation to the country, that is also distinct from a positively-biased personally-relevant schema, has several important implications across social sciences. As a theoretical contribution to the field of cognitive psychology, this research can be applied to studying relevant questions about processing news information. For example, the collective schema lens of memory for news could be applied to understanding susceptibility to acquiring fake news (Blair, 2021; Sindermann et al., 2020). The findings that negatively-valenced fake news is more susceptible to being endorsed as true (Blair, 2021) could be interpreted as an example of the top-down influence that a negatively-valenced schema exerts on relevant information. Fake news, in fact, tends to be more negatively valenced overall (Zhou & Zafarani, 2020). Thus, applying a schema account to understanding the mechanisms underlying susceptibility to negative fake news could prove useful, particularly if and when researchers are developing interventions to prevent such misinformation from occurring.

Aside from the ways to apply this research within cognitive psychology, there are myriad applications of this work to fields across the social sciences. Exposure to news that is strongly negatively biased clearly has an influence on our lives, from impacting our mental health (Ahern et al., 2004; Dougall et al., 2005) to swaying public opinion (Hester & Gibson, 2003; Jain & Winner, 2013) and covertly setting political agendas (Iyengar et al., 1982). Crucially, and central to the motivation of this research, what is remembered about the collective has enormous implications about the way people think about the collective future, just as what is remember from people's lives guides how they think about their personal futures. In particular, the dissociation of a personally-relevant schema from a collective-relevant schema can shed light onto why the way we imagine the futures of these domains differ (Bo & Wolff, 2019; Shrikanth et al., 2018).

Indeed, an important function of future-oriented thoughts is to motivate actions in the present toward a future goal (Gilbert & Wilson, 2007; Suddendorf & Corballis, 2007). Individuals engaging in collective action, such as voting, protesting, and even recycling, could have a very salient impact on the collective future. Yet one of the least explored, and most pressing, applications of this line of work is to understand how a collective schema perspective can be harnessed to encourage civic engagement and other forms of collective action to garner social change (Bain et al., 2012; Bandura, 2003; Garrison, 1992; Miller, 1992; Szpunar et al., in preparation; van Zomeren et al., 2008). Thus, an important contribution of the present research is to provide a foundation upon which future research can build an understanding of the influence of collective future thinking on behavior in the present, especially in tandem with its dissociation from personal future

thinking. This undertaking would create opportunities to instantiate vital, real-world interventions with the potential to cultivate a better future.

E. Conclusion

The faculty to think about the future is complex, as are the memory processes underlying this faculty. By focusing on the relationship between personal memory and personal future thinking up to now, the literature represented only a narrow understanding of how memory informs predictions about the future. Over the past five years, work on collective future thinking has shown that it is negatively biased, despite personal future thinking being positive. Yet the precise mechanisms that governed this dissociation had not been investigated. The present research is the first in the field to use elements of false memory paradigms to pinpoint memory mechanisms contributing to the valence-based dissociation between personal and collective future thinking. These results provide insights not only into the value of applying schema theory to studying collective future thinking, but also into the efficacy of methodological factors in studying this phenomenon. There is still vast uncharted territory left to explore, and ample opportunity to develop a deeper understanding of how and why we think about the future of the country, and other collectives, the way we do.

APPENDICES

APPENDIX A
Normed Headlines

Valence	Headline	Word Count	Positivity		Negativity		Familiarity		Detail		Plausibility	
			M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Negative	Competing with foreign companies, nation no longer global leader in innovation	11	1.86	0.82	3.47	0.84	2.41	1.16	3.03	1.04	2.79	0.99
Negative	Foreign leaders disband international trade alliance, shaking global economy	9	1.23	0.85	4.21	0.81	2.68	0.97	3.07	0.91	3.27	0.85
Negative	Satellite images show shrinking polar ice caps	7	1.34	0.96	4.26	0.88	3.58	0.85	3.96	1.13	3.77	0.92
Negative	Dangerous carcinogen found in popular mobile device	7	1.11	0.75	4.42	1.08	2.34	0.85	2.92	1.17	3.14	1.02
Negative	Widely divisive government official elected, indicating tension across party lines	10	1.67	0.83	3.56	0.88	3.1	0.77	3.37	1.06	3.16	0.84
Negative	Civil liberties groups lose funding, unable to provide legal support	10	1.26	0.81	4.19	1.13	2.48	0.73	3.12	1.02	3.05	0.82
Negative	College admission criteria more strict, increasing competition	7	2.11	0.77	3.33	1.06	3.26	0.77	3.55	0.91	3.51	0.83
Negative	Revised national budget cuts funding for scientific literacy groups	9	1.42	0.81	3.79	0.82	2.32	0.84	3.05	1.06	2.86	0.74
Negative	Setbacks in renewable energy increases need for fossil fuels	9	1.33	0.90	4.21	0.91	2.74	1.19	3.07	0.92	3.28	0.73
Negative	Nation's global GDP rankings lower than ever before	8	1.26	1.07	4.44	1.19	3.58	1.02	3.75	0.71	3.9	0.80
Negative	Government revokes scholarships to fund secondary education	7	1.32	1.08	4.03	0.95	2.44	0.96	2.82	1.02	3.07	0.77
Negative	Federal youth outreach program does not reduce street violence	9	1.39	0.82	4.29	0.87	2.23	0.92	2.76	1.16	3.01	1.01
Negative	Local town halls see decrease in attendance, less civic participation	10	1.32	1.16	4.27	0.90	2.77	1.07	3.13	0.85	3.13	0.75
Negative	Number of endangered species increasing, fewer animals populating wild	9	1.17	0.78	4.73	0.86	2.89	0.92	3.2	0.87	3.34	1.15
Negative	Scientists unable to find solution to overflowing landfills	8	1.2	0.89	4.41	0.96	2.68	1.03	3.23	0.76	3.28	0.96
Negative	New discovery in stem cell research concerns scientific community	9	2.31	0.94	3.23	0.79	2.51	1.13	3.14	0.94	3.15	0.73
Negative	Economic indicators are unhealthy, newly enacted policies to blame	9	1.65	1.16	3.83	0.87	2.32	0.98	2.86	1.01	2.68	0.81
Negative	Trade barriers imposed on foreign competitors, relations between countries strained	10	1.5	1.06	3.93	0.81	2.79	0.91	3.24	1.04	3.2	0.89
Negative	Funding for economic initiative to create green jobs has been cut	11	1.41	1.05	4.14	1.10	2.62	0.89	3.03	0.76	3	0.79
Negative	Nation unable to provide aid to war-torn ally, new democracy destabilizing	11	1.57	0.79	3.91	0.92	2.57	0.90	2.97	1.04	3.1	0.83
Negative	Government disagrees on budget, allowing federal debt to accrue	9	1.34	0.77	4.23	0.76	2.77	1.13	3.07	1.04	3.06	0.94
Negative	New bill makes path to citizenship more difficult for immigrants	10	1.41	1.02	4.43	0.96	3.5	1.00	3.3	0.77	3.6	1.19
Negative	Breaches in cyber-security makes citizens more vulnerable to identity theft.	10	1.25	0.77	4.35	0.90	2.9	0.88	3.35	0.83	3.28	0.93
Negative	Government task force working to block plan for universal health care	11	1.27	0.94	4.42	0.83	2.75	0.80	3.04	0.83	3.14	1.11
Negative	Failure to pass comprehensive tobacco control policy leads to higher smoking rates	12	1.2	0.72	4.37	1.15	2.72	1.09	2.92	0.89	3.11	0.71
Negative	Federal bank makes purchasing homes more difficult, slowing economy	9	1.3	1.14	4.14	0.91	2.5	1.07	2.96	1.03	3.09	1.20
Negative	Citizens protesting as new bill threatens freedom of speech	9	2.38	1.19	3.62	1.03	2.67	0.90	3.12	0.90	3.39	0.76
Negative	Average college tuition reaches new high, enrollment suffers	8	1.16	1.07	4.55	0.87	3.31	1.12	3.57	0.96	3.7	0.72
Negative	Gun legislature fails to reduce national crime rate	8	1.25	1.02	4.19	1.17	2.94	1.03	3.04	1.11	3.32	0.99
Negative	Recall of electric cars a major setback for environmentally friendly vehicles	11	1.64	1.00	3.70	0.85	2.43	0.92	2.93	0.89	2.96	1.10

APPENDIX A (continued)

Valence	Headline	Word Count	Positivity		Negativity		Familiarity		Detail		Plausibility	
			M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Positive	Government subsidizes solar panel installments to promote clean energy	9	4	1.14	1.37	1.14	2.51	0.97	3	1.06	3.14	0.83
Positive	Millions of trees planted around country as part of green initiative	11	5	0.78	1.18	1.06	3.14	0.90	3.48	0.71	3.86	1.12
Positive	Latest findings show decreasing pollutant-levels in oceans	7	4	1.19	1.55	1.17	2.67	0.72	2.88	1.07	3.41	0.87
Positive	College entrance exam scores break all-time high record	8	4	0.91	1.54	0.90	2.28	1.04	2.87	0.75	3.04	0.97
Positive	Young leader becomes new face of politics, inspires hope	9	4	1.15	1.45	1.03	2.32	1.13	2.87	0.85	2.99	0.94
Positive	Minimum wage raised, blue collar workers rejoice	7	4	1.02	1.62	0.77	2.58	0.93	2.93	1.06	3.13	0.92
Positive	CEO donate millions in aid to natural disaster fund	9	5	1.12	1.28	1.06	2.68	0.83	3.25	1.10	3.26	0.89
Positive	College admission criteria less strict, increasing accessibility	7	4	0.79	1.71	0.97	2.44	0.85	2.72	0.71	3.11	0.98
Positive	Revised national budget adds funding for scientific literacy groups	9	4	1.08	1.38	0.89	2.22	0.87	2.78	1.07	2.85	0.78
Positive	Financial services industry experiencing gains, job opportunities increasing	8	5	1.13	1.16	1.07	2.62	0.96	2.97	1.10	3.03	1.17
Positive	Factories agree to providing fair compensation, unions celebrate	8	5	1.00	1.42	0.82	2.7	1.20	3.17	1.12	3.15	1.09
Positive	News outlets fact-checking to prevent spread of misinformation online	9	4	0.77	1.56	0.81	2.84	0.86	3.27	0.98	3.37	1.18
Positive	Pharmaceutical companies call for more ethical research practices	8	4	0.94	1.65	0.87	2.52	0.89	3	0.71	3.1	1.01
Positive	Environmental advocacy groups push new laws limiting coal companies	9	4	1.05	1.92	1.07	2.42	0.86	2.89	0.88	2.89	0.73
Positive	Water rations lifted after rain relieves worst drought in decades	10	4	0.87	1.48	0.75	2.39	0.81	2.94	0.81	3.06	1.04
Positive	Increases in oil regulations leads to competitive market, lower gas prices	11	4	1.06	2.06	0.99	2.75	0.99	3.08	1.06	3.04	0.92
Positive	Leading scientists predict exciting possibility of life on Mars this century	11	4	0.80	1.63	0.92	3.04	1.08	2.92	0.98	3.34	0.92
Positive	Ambassador plays crucial role in United Nations, strengthening foreign relations	10	4	0.87	1.63	0.75	2.8	0.97	3.32	1.13	3.07	1.13
Positive	CO2 emission restrictions aim to reduce carbon footprint	8	4	0.70	1.41	0.83	3.24	1.13	3.55	1.16	3.37	1.06
Positive	Renewable energy sources more accessible, fossil fuel consumption decreases	9	5	0.71	1.37	1.14	2.96	1.05	3.39	0.93	3.51	1.05
Positive	Simplified voting process leads to high voter turnout	8	4	1.02	1.62	0.92	2.85	0.88	3.35	1.09	3.45	1.20
Positive	Monumental court decision significant progress for civil liberity and human rights	11	5	0.80	1.37	1.00	2.92	0.97	3.45	1.04	3.39	1.07
Positive	Advanced cyber-security protects citizens from identity theft	7	4	0.98	1.45	0.98	3.14	0.96	3.65	0.95	3.54	1.04
Positive	Summit meeting with neighboring country a success, peace offerings exchanged	10	5	0.97	1.25	0.87	2.79	1.19	3.2	0.71	3.23	1.17
Positive	New reports show economic inequality gap shrinking	7	4	0.88	1.45	0.87	2.25	1.12	2.68	1.18	3	1.11
Positive	Nation's leaders donate annual bonus to funding education initiative	9	4	1.11	1.76	0.75	2.38	1.10	3.07	0.70	2.99	0.99
Positive	In animal rights victory, meat industry standards tighten	8	5	0.92	1.14	0.71	2.25	1.13	2.85	1.11	3.01	1.13
Positive	Reproductive rights expanding, with more health clinics opening nationwide.	9	5	1.14	1.35	0.90	2.89	1.04	3.21	0.82	3.39	0.84
Positive	Federal government acquires 2 million acres of land for national parks and forests	13	4	1.12	1.37	1.06	2.56	0.86	3.17	0.83	3.24	1.18
Positive	Foreign leader protects rights of refugees, sparking international praise	9	5	0.87	1.14	1.00	2.45	0.98	3.1	0.73	3.11	1.10

APPENDIX B

A_g estimate equation

The area under the curve can be quantified by calculating a sensitivity index for each student for each statement type. To do so, we can use the formula proposed by Pollack and Hsieh (1969) for the most straightforward way of assessing the area under the ROC using a linear extrapolation and calculating the area of the polygon (see Pollack & Hsieh, 1969; or Macmillan & Creelman, 2005, p. 64, for details):

$$A_g = \frac{1}{2}\sum (F_{i+1} - F_i)(H_{i+1} + H_i),$$

Where Ag is the sensitivity index, F is the cumulative false alarm rate (or cumulative proportion of invalid statements), H is hit rate (or cumulative proportion of valid statements), and the index *i* tracks the ROC points along each response (1 = Definitely did not see it, 5 = Definitely saw it). The first point of false alarm and hit rates (F1, H1) is (0, 0). The second point (F2, H2) is the false alarm and hit rates for the most liberal response option, Definitely Saw It. From there on, the index *i* tracks the cumulative response rates for false alarms and hits for each subsequent response option (i.e., "Most likely saw," "Unsure," etc.) and includes those values into the equation. These calculations were performed using an Excel spreadsheet where the formula was entered.

APPENDIX C

Normed Life Statements

Valence	Statement	Word Count	Positivity		Negativity		Relatability		Believability		Detail	
			M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Positive	Sal's mother has been in great health despite her age.	10	4.79	0.97	1.26	0.92	3.41	1.03	4.18	1.38	3.56	1.19
Positive	Sal is not afraid of their own death.	8	4.73	1.01	1.29	1.09	3.16	1.23	3.86	1.11	3.42	1.47
Positive	Sal’s first kiss was after a fun date.	8	4.67	0.94	1.29	1.03	3.55	1.24	3.95	1.23	3.47	1.33
Positive	Sal looks forward to a relaxing retirement.	7	4.67	1.26	1.30	1.48	2.27	0.96	3.99	1.10	3.26	0.85
Positive	Sal has developed healthy strategies to cope with difficult times	10	4.61	1.19	1.31	1.28	3.82	1.05	4.04	1.16	3.58	1.05
Positive	Sal's major in college was interesting to them	8	4.62	1.40	1.31	1.42	3.75	1.16	3.87	1.28	3.36	1.48
Positive	Sal had a wonderful time when they first began school.	10	4.53	1.47	1.33	0.80	2.08	0.98	3.56	1.37	2.91	1.09
Positive	Sal wants to get married to a partner someday soon.	10	4.65	0.89	1.34	1.35	3.37	1.39	4.12	0.94	3.45	1.04
Positive	Sal’s first job was a well-paid internship.	7	4.66	0.96	1.35	1.38	3.85	1.46	3.93	0.98	3.37	1.14
Positive	Sal is seeking ways to become more spiritual	8	4.60	1.23	1.36	0.85	3.36	1.10	3.99	1.26	3.60	0.89
Positive	Sal was very responsible when first entering adulthood.	8	4.61	0.88	1.38	1.07	3.42	0.96	3.76	1.06	3.36	1.02
Positive	Sal is looking forward to travelling to a different country.	10	4.65	1.44	1.40	0.97	3.79	0.90	4.01	1.16	3.54	0.84
Positive	Sal is making progress towards achieving their life goals.	9	4.52	1.24	1.41	1.19	3.51	1.34	3.76	0.87	3.25	0.85
Positive	Sal had a great relationship with their first love.	9	4.59	0.90	1.43	1.16	2.84	1.18	3.67	0.94	3.24	0.92
Positive	Sal had great social skills as a teenager	11	4.32	1.31	1.44	1.47	2.89	1.07	3.80	0.89	3.32	1.01
Positive	Sal was a good student and liked going to school.	10	4.59	0.94	1.44	0.94	3.29	1.27	3.76	0.96	3.31	1.28
Positive	Sal found healthy ways to deal with frustration	8	4.45	1.11	1.44	0.84	2.64	1.08	3.79	1.43	3.19	1.48
Positive	Sal accepts that they will lose their parents one day	9	4.54	0.94	1.45	0.97	3.56	0.88	3.92	1.17	3.39	1.00
Positive	Sal would love to have children and looks forward to it.	8	4.61	0.96	1.46	1.11	3.24	0.93	3.92	0.99	3.39	1.50
Positive	Sal doesn't experience feelings of loneliness	9	4.52	1.06	1.46	1.40	2.69	0.92	3.73	1.18	3.23	1.32
Positive	Sal feels encouraged about pursuing graduate school	8	4.45	1.13	1.47	1.00	3.08	1.07	3.84	0.96	3.09	1.46
Positive	Sal knows what they are passionate about	6	4.48	1.20	1.48	0.82	3.78	1.40	3.99	1.03	3.39	1.26
Positive	Sal has a few lifelong friends	9	4.59	1.04	1.49	0.83	2.97	0.84	3.84	1.11	3.14	1.20
Positive	Sal never experienced bullying as a child	9	4.53	1.07	1.51	0.87	4.04	0.92	4.20	0.94	3.51	1.33
Positive	Sal is where they would like to be in life	9	4.37	1.16	1.51	1.34	2.76	1.06	3.76	1.48	2.64	1.24
Positive	Sal will be able to afford buying a house anytime soon	6	4.34	1.12	1.53	1.39	3.36	1.11	3.52	1.11	3.11	1.21
Positive	Sal is not worried about the possibility of getting divorced someday	8	4.39	0.89	1.56	1.47	3.58	0.97	4.03	1.11	3.45	0.91
Positive	Sal never felt isolated from their peers in college	7	4.40	0.98	1.57	1.13	3.39	1.18	3.95	1.41	3.34	1.08
Positive	Sal stayed in the same place throughout childhood	7	4.39	1.04	1.60	0.81	2.81	1.02	3.95	1.48	3.17	1.29
Positive	Sal's parents provided a stable home environment as a child	8	4.07	0.92	1.86	1.29	3.28	1.47	3.96	0.84	3.59	0.94

APPENDIX D

Approval Notice
Initial Review (Response To Modifications)

January 8, 2019

Sushmita Shrikanth, B.A., B.S.Psychology
Phone: (408) 598-5336

RE: **Protocol # 2018-1503**
"Memory for News Headlines"

Dear Ms. Shrikanth:

Please note that stamped .pdfs of all approved recruitment and consent documents have been uploaded to OPRSLive, and you must access and use only those approved documents to recruit and enroll subjects into this research project.

Your Initial Review (Response To Modifications) was reviewed and approved by the Expedited review process on January 8, 2019. You may now begin your research

Please note the following information about your approved research protocol:

Protocol Approval Period: January 8, 2019 - January 7, 2022
Approved Subject Enrollment #: 5000
Additional Determinations for Research Involving Minors: The Board determined that this research satisfies 45CFR46.404, research not involving greater than minimal risk. Therefore, in accordance with 45CFR46.408 ', the IRB determined that only one parent's/legal guardian's permission/signature is needed. Wards of the State may not be enrolled unless the IRB grants specific approval and assures inclusion of additional protections in the research required under 45CFR46.409 '. If you wish to enroll Wards of the State contact OPRS and refer to the tip sheet.
Performance Sites: UIC
Sponsor: None
PAF#: Not applicable

Research Protocol(s):

a) Memory for News Headlines (Initial Review Application);01/03/2018

Recruitment Material(s):

a) No recruitment materials will be used - UIC Psychology Subject Pool procedures will be followed and MTurk subjects will only view the name of the study in order to access the consent document

Informed Consent(s):

a) Online Norming Consent Form; Version 2; 01/03/2018
b) Online Study Consent Form; Version 2; 01/03/2019
c) Lab Study Consent Form; Version 2; 01/03/2019
d) Consent Form (Norming); Version 2; 01/03/2019
e) Debriefing Form; Version 2; 01/03/2019
f) A waiver of documentation of informed consent has been granted under 45 CFR 46.117 and an alteration of consent has been granted under 45 CFR 46.116(d) for recruitment the online research activities only; minimal risk; subjects will be provided with and information sheet and electronically agree to participate.

Parental Permission(s):

a) A waiver of parental permission has been granted for minors in the UIC Psychology Subject Pool under 45 CFR 46.116(d) and 45 CFR 46.408(c); however, as per UIC Psychology Subject Pool policy, as least one parent must sign the Blanket Parental Permission document prior to the minor subject's participation in the UIC Psychology Subject Pool.

Your research meets the criteria for expedited review as defined in 45 CFR 46.110(b)(1) under the following specific category(ies):

(7) Research on individual or group characteristics or behavior (including but not limited to research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

Please note the Review History of this submission:

Receipt Date	Submission Type	Review Process	Review Date	Review Action
11/26/2018	Initial Review	Expedited	11/30/2018	Modifications Required
01/04/2019	Response To Modifications	Expedited	01/08/2019	Approved

Please remember to:

→ Use your **research protocol number** (2018-1503) on any documents or correspondence with the IRB concerning your research protocol.

→ Review and comply with all requirements on the OPRS website at,
"**UIC Investigator Responsibilities, Protection of Human Research Subjects**"
(http://tigger.uic.edu/depts/ovcr/research/protocolreview/irb/policies/0924.pdf)

Please note that the UIC IRB has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

Please be aware that if the scope of work in the grant/project changes, the protocol must be amended and approved by the UIC IRB before the initiation of the change.

We wish you the best as you conduct your research. If you have any questions or need further help, please contact OPRS at (312) 996-1711 or me at (312) 355-0816.

Sincerely,

Alison Santiago, MSW, MJ
Assistant Director, IRB # 2
Office for the Protection of Research Subjects

Enclosure(s) are accessible via OPRS Live:

1. **Informed Consent Document(s):**
   a) Online Norming Consent Form; Version 2; 01/03/2018
   b) Online Study Consent Form; Version 2; 01/03/2019
   c) Debriefing Form; Version 2; 01/03/2019
   d) Lab Study Consent Form; Version 2; 01/03/2019
   e) Consent Form (Norming); Version 2; 01/03/2019

cc: Michael E. Ragozzino, Psychology, M/C 285
Karl Szpunar (Faculty Advisor), Psychology, M/C 285

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