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Implicit Memory and Online Advertisement Priming

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ABSTRACT

Implicit Memory research has been investigating the attentional requirements needed for something to be encoded and accessible through implicit memory. So far, previous research has produced mixed results on attentional requirements for perceptual implicit memory, some studies citing evidence for the need of attention, others citing the opposite. As well, research has been consistent in producing results showing that conceptual implicit memory has higher attentional demands than that of its perceptual counterpart. Adopting Transfer-Appropriate Processing framework, the current paper investigates attention requirements for both a perceptual task (picture identification) and a conceptual task (category exemplar generation). Participants examine webpages with advertisements embedded in both an ad-engaged and webpage-engaged condition manipulation. Study 1 had participants perform speeded picture identification, whereas Study 2 had them perform a category exemplar generation task. Results were consistent with TAP framework and showed that, when not accounting for explicit contamination, the perceptual task did not significantly differ between conditional manipulations, whereas the conceptual task produced results highlighting the need for attention and deeper levels of encoding for conceptual implicit memory to be activated.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Introduction

Implicit memory (IM) and explicit memory (EM) are two commonly cited categories of the long-term memory. The use of IM occurs when an individual's past experiences facilitates performance on a test or activity that does not require the individual to deliberately or consciously recollect those experiences (Ramos, Marques, & Garcia-Marques, 2017; Roediger & McDermott, 1993; Schacter, 1987). Conversely, explicit memory (EM) is used when individuals consciously remember previous information or experiences to increase performance on a task (Craik, Moscovitch, & McDowd, 1994; Ramos et al., 2017; Roediger & McDermott, 1993; Schacter, 1987). Throughout this paper, the terms implicit and explicit will be used in reference to different tasks, distinguished operationally by the instructions participants are given during the test phase.

Tests of IM and EM share three general phases (Roediger & McDermott, 1993). The first phase – the study phase – consists of participants studying a set of study materials (usually a set of words or pictures). During this phase, participants study the material intently. Following this, participants then enter the distractor phase. This is a task or activity used to have participants shift focus from what they had just studied to remove ceiling effects and allay demand characteristics. For implicit measures, this distractor phase serves an additional function in that it is used as an attempt to avoid explicit contamination during the test phase (MacLeod, 2008; Mitchell & Bruss, 2003). Explicit contamination refers to participants' awareness of the relationship between the study phase and the test phase. The participants are presumed to explicitly remember stimuli between the study phase and the test phase when a study is contaminated with EM (MacLeod, 2008; Mitchell & Bruss, 2003). This will be discussed in greater detail in the next section. The third and final phase is the test phase. This is where participants' memory is tested, and responses are recorded. For an explicit test, the participant is given deliberate instructions to reflect on the study phase and use that knowledge to help performance. However, when testing implicitly, the participants are given no instructions to reflect on the study phase. Rather, they are asked to answer quickly or to the best of their abilities (Roediger & McDermott, 1993). Superior performance on studied items relative to new items suggests that memory rose to aid performance in the absence of explicit recollection, the operational definition. Particular methods revealing this follow.

Measuring IM and EM

While investigation of the two methods share three general phases, other aspects are quite different. The biggest difference, as established above, is the way in which participants are tested. For explicit tests, participants are allowed conscious recollection of prior study items. For implicit tests, the recollection is systematically precluded to the best of the researchers' ability (Roediger &

McDermott, 1993). EM is easier to measure because the researcher simply counts the correct number of responses given by the participant on any type of EM test (e.g. free recall, cued recall, recognition). Then, the participant is given a score for those responses, and in turn, creates the measure for the participants' EM.

Implicit tests are more complicated. In order to be sure implicit memory is being measured without explicit contamination, researchers have developed specific tasks (e.g. word fragment or stem completion) to assess the level of priming that occurs. These two tasks involve participants completing fragmented words (b_r_ or ba__) with the first word that comes to mind (e.g. bark, barn, etc.). These, among other implicit tasks, will be discussed in greater detail in the next section. The ability to perform better for old items – items seen during study - compared to new items has been coined *priming* (Isingrini, Vazou, & Leroy, 1995; McDermott & Roediger, 1994).

Perceptual Tests versus Conceptual Tests of IM

Previous researchers have classified two types of implicit tests: conceptual and perceptual (Blaxton, 1989; Jacoby, 1983; McDermott & Roediger, 1994; Tulving & Schacter, 1990). While the concepts of conceptual and perceptual priming can be applied to explicit tests, we focus here on implicit tests (Roediger, 1990; Roediger & McDermott, 1993). Conceptual and perceptual tests are broad categories. Within each of these categories there are various tests used. Mitchell and Bruss (2003) and Roediger and McDermott (1993) reviewed roughly 12 different implicit tests, both conceptual and perceptual. These tests include but are not limited to: word fragment or word stem completion, perceptual identification, and category exemplar generation. I have selected these four tests for specific reasons. Word fragment completion and word stem completion appear to be the most widely used perceptual tests of IM. Perceptual identification is the perceptual test of IM that will be used for this study, and category exemplar generation is a commonly used conceptual test of IM that will be implemented in the current study.

Perceptual tests of IM. Perceptual tests of IM challenge a participant's perceptual system. For example, participants might identify perceptually altered words or pictures (as in word fragment completion tests, or degraded picture identification; McDermott & Roediger, 1994). Perceptual priming occurs when the stimulus presented in the test phase is perceptually related to the partially degraded or briefly presented stimulus in the study phase (Isingrini et al., 1995). The remainder of this section reviews four different perceptual tests of IM.

Word fragment completion is a perceptual test of implicit memory. Words that were presented to participants as study items, are again presented to them in the test phase only this time they are partially degraded (e.g., elephant → e_e_h_n_; Mitchell & Bruss, 2003). Participants complete the fragmented word with the first word that comes to mind. A participant will show implicit priming when they are able to fill in the fragments with words that correspond to the study list at a greater rate than unstudied words that could complete the fragment (Parkin & Streete, 1988). The reader is reminded that the participant is not instructed to reflect on the studied list. Perceptual priming occurs because of the physical overlap of the letters between the word shown during the study phase and the words used during the test phase. Word fragment completion has been used to measure implicit memory by several different researchers (e.g. Mulligan & Hartman, 1996; Tulving, Schacter & Stark, 1982).

Word stem completion is another perceptual test that is almost identical to word fragment completion. Word stem completion works the same as word fragment completion, except the missing letters are placed in order (blink → bl__). This is more challenging because the words are harder to identify – for example, participants could easily write in "blank" instead of "blink." Again, the similarities between the stimuli at study at test create perceptual priming, and priming occurs when participants are able to complete the word stem with a word that corresponds to the previously studied list (Mitchell & Bruss, 2003; Roediger & McDermott, 1993). Mitchell and Bruss (2003) found over 20 studies using word stem completion to research age differences. Graf, Squire, and Mandler (1984) used word stem completion to test the memory of amnesic patients. This test of implicit memory has been used immensely, and is still being used to research the extent of perceptual priming.

Perceptual identification priming is measured by the accuracy in which participants can name previously studied words relative to new words, when the words are briefly exposed to the participant (Crabb & Dark, 1999; Jacoby & Dallas, 1981; Mulligan, 2002; Warren & Morton, 1982). Jacoby and Dallas (1981) had test words (both old and new) flashed on a screen for 35ms. Participants reported each word immediately after its presentation. Their results showed significant priming for perceptual identification, with an astonishing effect size, $r^2 = .74$. Although using words for perceptual identification has shown positive results for priming (Crabb & Dark, 1999; Jacoby & Dallas, 1981; Mulligan, 2002; Warren & Morton, 1982), researchers have begun using pictures to gauge and test priming on perceptual identification (Park & Gabrieli, 1995; Mulligan, 2002).

Pictures have been used in implicit memory testing because they have shown to have superior priming abilities to that of words, a phenomenon known as *picture superiority* (Cherry & St. Pierre, 1998; Durso & Johnson, 1979; Mitchell & Bruss, 2003; Srinivas, 1993; Stenberg, 2006; Warren & Morton, 1982; Weldon & Roediger, 1987; Weldon, Roediger, Beitel, & Johnston, 1995). According to Park and Gabrieli (1995), because of the development of the Transfer-Appropriate Processing theory (see below), early picture priming studies were focused on the nature of the mental processes engaged at study and revealed at test. Researchers have shown strong support that picture priming is heavily perceptually based by comparing word-picture priming (cross-modal) and picture-

picture priming (Durso & Johnson, 1979; Srinivas, 1993; Warren & Morton, 1982; Weldon & Roediger, 1987). These studies showed greater priming effects when participants were presented with the same modality at study and test (picture-to-picture), relative to a cross-modality presentation (words-to-pictures). They also showed that pictures produce higher priming rates relative to words. Also, McDermott and Roediger (1994) showed that pictures primed picture fragment identification, whereas words did not; words primed word fragment completion, whereas pictures did not; and imagining a picture when given a word enhanced picture fragment identification but not word fragment completion; imagining a word when given a picture enhanced word fragment completion but not picture fragment identification. Again, this highlights the perceptual overlap needed for strong priming to occur with pictures. For this reason, as well as because Transfer-Appropriate Processing theory supports the use of pictures, the current study will use perceptual identification with pictures as the stimuli.

Conceptual tests of IM. Contrary to perceptual tests of IM, participants in a conceptually based test draw on their general knowledge to answer semantic based questions (e.g., “what is the largest animal on Earth?”) or to freely associate to semantic cues (e.g., “Name the first six car brands that come to mind; McDermott & Roediger, 1994)**.** Conceptual tests provide stimuli information that is conceptually related to stimuli in the study phase, however there are little to no perceptual similarities. Because of the lack of perceptual similarities, stimuli require substantial semantic processing before priming occurs (Isingrini et al., 1995). The most commonly used conceptual test of IM is the category exemplar generation task (Mitchell & Bruss, 2003).

Category exemplar generation is strictly a conceptual test of implicit memory (Mitchell & Bruss, 2003; Roediger & McDermott, 1993). When using category exemplar generation as a test of implicit memory, participants are typically shown a list at study of different names that correspond to any number of categories (e.g. *Lexus* from *car brands*.). Upon entering the test phase, participants are given a category heading – such as *car brands* – and told to list a few items that fit in to that category. Priming occurs if participants list items under the category heading that correspond to previously studied items and omit non-studied items. This test is conceptual because there is no overlap of surface features between study and test materials and because test performance relies on the recapitulation of conceptual processing engaged at study (McDermott & Roediger, 1994; Park & Gabrieli, 1995).

Explicit Contamination in IM Tests

One thing to be aware of when assessing priming is the potential of explicit contamination (as noted above). Again, explicit contamination occurs when participants become aware of the relationship between the test phase and study phase, and then use this knowledge to boost their performance on the implicit test as formally diagnosed with study-awareness questionnaires

(MacLeod, 2008; Mitchell & Bruss, 2003). For example, in a word fragment completion task, participants complete the fragmented word (b_i_k) with the first word that comes to mind (b_i_k -> blink; Mitchell & Bruss, 2003; Roediger & McDermott, 1993). If the participant completes the fragment with the first word that comes to mind, and if the word corresponds to a previously studied item more often than a non-studied item, then priming has occurred. However, explicit recognition of the fragments as suggestive of the words studied would represent an explicit contamination.

Roediger and McDermott (1993) and MacLeod (2008) have outlined nine recommendations for researchers to avoid contamination: 1.) test amnesiac individuals; 2.) obtain a (double) dissociation; 3.) meet the retrieval intentionality criterion; 4.) disguise the test; 5.) use test-awareness questionnaires; 6.) minimize the value of conscious recollection; 7.) use process dissociation procedures; 8.) use speeded tests; and 9.) employ relearning and savings techniques. For the purpose of this paper, we will focus on recommendations 2, 3, 4, 5, and 8 (for a full review see MacLeod, 2008; Roediger & McDermott, 1993).

This first recommendation is to obtain a dissociation between the explicit and implicit measures through an experiment. Jacoby and Dallas (1981) demonstrated this by manipulating the levels of processing of words during study. Half of the participants were tested using word fragment completion and the other half tested using explicit recognition. Generally, their results showed that deeper levels of processing had a large effect on the recognition task, but no effect on the priming of the word fragments (Jacoby & Dallas, 1981). Dissociations between implicit and explicit tests will be discussed in detail in the next section.

The second recommendation has been coined the “retrieval-intentionality criterion” (Shacter, Bowers, & Booker, 1989). The basic idea of this method is to hold all conditions that would affect participants constant at study and test, except for instructions given during test (MacLeod, 2008; Roediger, 1993). Graf and Mandler (1984) conducted a study similar to that of Jacoby and Dallas (1981). They manipulated the levels of processing at study by having participants rate words for semantic features or non-semantic features. All participants were given three-letter word stems. Half were told to say the first word that comes to mind (implicit test) whereas the other half were told to reflect on their studied list and use those words to fill in the stems (explicit test). Under these conditions, the only thing that varied between the participants was the instructions given at test. Their results, like Jacoby and Dallas (1981), produced a dissociation between the explicit and implicit test, showing that evinced deeper processing affected the explicit form of the test but had little effect on the priming of the implicit test (Graf & Mandler, 1984).

The third recommendation is to merely disguise the implicit test, so that participants are not aware that it is a memory test. This method will be implemented in the current study. Bowers and Schacter (1990) used a title that did not cause demand characteristics. MacLeod (1989) told his participants that the test they were taking was for another one of his colleagues, and that it was not the memory test for which they had be recruited. Others represented the implicit task as a “filler” task before they were to take the actual memory test. MacLeod (2008) advocates for the use obscuring the study material in some sort of larger context, for example, embedding target ads in to a webpage (Northup & Mulligan, 2014). This would reduce the single focus of the study material and decrease – if not eliminate - explicit contamination because it would make conscious retrieval less tempting and presumably less successful (MacLeod, 2008).

The fourth, and one of the most commonly used recommendations to reduce explicit contamination is the use of test-awareness questionnaires. This method is straightforward. Following the memory tests, subjects are given questionnaires to gauge “awareness” of the overlap of material between study and test (MacLeod, 2008; Roediger & McDermott, 1993). According to Schacter and Bowers (1990), “test-aware” participants were ones who said, that at some point during the test, they realized that some of the words they were producing on test appeared during study. Conversely, “test-unaware” participants denied any awareness of similarities between study stimuli and test stimuli (Schacter & Bowers, 1990). Test-awareness questionnaires have their flaws (see Roediger & McDermott, 1993), however, many researchers have found them to be useful and recommend using them as an attempt to avoid explicit contamination or at least to qualify the results of a presumably contaminated study (McAndrews & Moscovitch, 1990; Richardson-Klavehn, Gardiner, & Java, 1994; Schacter & Bowers, 1990).

The fifth and final recommendation used to catch and or avoid explicit contamination is the use of speeded tests, particularly relevant to the current study. Speeded tasks effectively preclude the conscious study-task reflection that portends explicit contamination. Typically, researchers have use speeded naming (for words) as the implicit test (MacDonald & MacLeod, 1998; MacLeod, 1996; MacLeod & Daniels, 2000; MacLeod & Masson, 2000). For these experiments, researchers recorded the time needed for participants to read aloud words presented to them. Other studies have leaned towards measuring the accuracy of naming a word or picture presented to participants at extreme speeded presentation intervals, barely at the threshold of perception (Jacoby & Dallas, 1981; Warren & Morton, 1982; Crabb & Dark, 1999). For example, Jacoby and Dallas (1981) asked participants to name stimuli that were flashed to them on a screen for 35ms. When words or images are presented at such high speeds, and participants name the first thing that they see, this leaves little room for explicit contamination to take place. The current study will use speeded picture naming (also referred to as perceptual picture identification) because of its presumed ability to preclude explicit contamination (Brown, Jones, & Mitchell, 1996; Brown, Neblett, Jones, & Mitchell, 1991; Mitchell, Brown, & Murphy, 1990; Mitchell & Bruss, 2003).

Potential of Attention to Dissociate of IM and EM

To combat explicit contamination, researchers attempt to find a dissociation between explicit and implicit tests. A dissociation occurs when variables that effect one type of test have opposite or no effects on the other type of test (Weldon et al., 1995). A groundbreaking dissociation was found for amnesic patients (Graf et al., 1984; Graf & Schacter, 1985; Warrington and Weiskrantz, 1970). Amnesic patients showed preserved priming on implicit tests, such as word fragment completion, but they had vastly impaired performance on explicit measures, such as free recall. Warrington and Weiskrantz (1970) showed that amnesic patients could not deliberately recall words they had been presented in the study phase but would complete the word fragments with words they had previously studied. Since then, numerous variables have been tested involving implicit and explicit memory. Due to the sheer volume of studies, we have omitted mention of the studies involving implicit *procedural* memory that are beyond the scope of this paper (see Roediger, 1993 for a full review). An unresolved dissociation that has been researched is the effects of manipulating attention at encoding. This is a topic that has produced mixed results regarding how attention affects implicit tests, specifically perceptually driven tests.

Debate over Attentional Requirements of IM

Early attention requirement studies showed effects similar to those of the amnesic patient studies – performance on explicit memory tasks, but not implicit memory tasks, was decreased due to divided attention at encoding (Isingrini et al., 1995; Jacoby, Woloshyn, & Kelley, 1989; Mulligan, 1998; Mulligan & Hartman, 1996; Parkin, Reid, & Russo, 1990; Parkin & Russo, 1990; Schmitter-Edgecombe, 1996; Szymanski & MacLeod, 1996). However, further investigation showed that attention manipulations had variable effects across different implicit memory tasks, reducing priming on some tasks (e.g., Crabb & Dark, 1999; Gabrieli et al., 1999; Light, Prull, & Kennison, 2000; Mulligan & Hartman, 1996; Rajaram, Srinivas, & Travers, 2001; Schmitter-Edgecombe, 1999), but not on others (e.g., Bentin, Kutas, & Hillyard, 1995; Mulligan & Hartman, 1996; Mulligan & Peterson, 2008; Smith & Oscar-Berman, 1990; Spataro, Mulligan, & Rossi-Arnaud, 2010; Spataro, Mulligan, & Rossi- Arnaud, 2011). Of those studies that found reduced priming, many of them were in the context of a conceptual task (Crabb & Dark, 1999; Gabrieli et al., 1999; Mulligan & Hartman, 1996).

According to Transfer-Appropriate Processing (TAP), implicit memory tasks drawing heavily on conceptual priming should be affected by attention, whereas tests drawing on perceptual priming should be less affected by manipulations of attention. This is because a conceptual implicit task acts in the same manner as an explicit task, wherein deeper encoding evinces priming (Roediger, 1990). However, as mentioned previously, the global importance of attention at encoding is unresolved because studies focused on perceptual forms of priming have produced mixed results – some finding no effects of divided attention on perceptual priming (e.g., Mulligan, 1998; Mulligan & Hartman, 1996; Parkin et al., 1990; Parkin & Russo, 1990; Russo & Parkin, 1993; Schmitter-Edgecombe, 1996; Szymanski & MacLeod, 1996), with others reporting substantial reductions (e.g., Crabb & Dark, 1999; Hawley & Johnston, 1991; Light & Prull, 1995; Stone, Ladd, Vaidya, & Gabrieli, 1998). Because of this, the current study will manipulate attention at study and use a perceptual method (perceptual identification) of testing.

TAP Explains Perceptual and Conceptual Attentional Difference

Currently there is debate concerning which theoretical framework better explains the occurrence of dissociations between IM and EM. The two frameworks that are currently in debate are: *dual memory systems* (e.g., Cohen & Squire, 1980; Schacter, 1989; Squire, 1986, 2016; Tulving, 1983, 1985; Weiskrantz, 1987, 1989) or *transfer-appropriate processing approach* (Craik, 1983; Graf & Mandler, 1984; Jacoby, 1983, 1988; Kolers & Roediger, 1984; Masson, 1989; Roediger, 1990; Roediger & Blaxton, 1987a, 1987b; Roediger & McDermott, 1993; Roediger, Weldon, & Challis, 1989). In Roediger's seminal

1990 article, he limits his discussion of the theories of implicit memory to TAP and a few neurological implications, but broadly allows the dissociation between perceptual and conceptual task to drive the discussion of theory, a practice we will emulate here. As mentioned previously, this study will be based on the TAP framework and will aim to add further support for this theory governing the dissociations between IM and EM.

Rather than there being two (or more) memory systems at play, TAP implies that dissociations occur because different types of tests (perceptual vs. conceptual) require different cognitive processes to be used during study (Ramos et al., 2017; Roediger, 1999). More specifically, most explicit tests are considered to be *conceptually-driven* tests, whereas most implicit tests are considered to be *data-driven* (Ramos et al., 2017). However, as stated previously, there can be data-driven explicit tests as well as conceptually-driven implicit tests. Conceptually-driven tests rely on the conceptual and semantic processing of the stimuli, whereas data-driven tests rely on the perceptual and superficial processing of the stimuli (Ramos et al., 2017; Roediger, 1999). Jacoby (1983) depicts these differences well. Jacoby (1983) had participants engage with the study words in three different manners: no context (xxx-*cold*), with context (hot-*cold),* or generating context (hot-????). In accordance with TAP, the "no-context" condition was assumed to produce the most implicit priming because reading a word out of context maximizes data-driven processing. This should occur because the perceptual/surface features of the stimuli remain constant between study and test. The “with-context” condition was assumed to reduce data-driven processing due to differences in perceptual/surface features from study to test. The “generating context” condition was assumed to lead to greater conceptual elaboration than reading the word in context, which, in turn, should provide greater elaboration than reading it out of context. Their results reflected this ordering (Jacoby, 1983).

In sum, the state of the literature suggests disagreement on perceptual priming. Some say that attention is necessary (e.g. Crabb & Dark, 1999) while others would suggest that divided attention at study/exposure will suffice (Mulligan & Hartman, 1996). Further, TAP suggests conceptual priming relies on attention. However, we might be able to imagine a context in which attention is naturally divided/degraded to test that idea versus gradations of attention wherein attention is paid. This brings us to the implicit memory work involving online advertisements embedded in websites, a recent focus of study that may lend itself to the study of both perceptual and conceptual implicit memory.

Conceptual Priming of Online Advertisements

Previous research, focusing on advertisements and the effects of implicit memory, has yielded a strong emphasis on perceptual methods of testing. Northup and Mulligan (2014, 2013) make a strong case for using conceptual priming in the realm of advertising, specifically online advertisements. They used a category exemplar generation task as a means of testing implicit memory. In line with TAP (see above), category exemplar generation was confirmed to be a conceptually based test because studies have shown that category exemplar generation produces higher levels of priming when there are deeper, more conceptual means of encoding (Northup & Mulligan, 2014, 2013). Northup and Mulligan (2014) tested the effects of manipulating the levels of encoding/attention at study on category exemplar generation. Their participants interacted with screenshots of news websites that had not been altered other than the superimposition of an ad. One example was the main page of CBSnews.com, though the authors are reticent about the gamut of the website captures used. The participants engaged with the multiple aspects of the webpage. For instance, they were specifically instructed to click on and rate their familiarity with the online advertisement embedded. Upon completion of the website evaluations, participants were then instructed that they would be partaking in a second experiment to gauge what brands were most popular among undergraduate students. This was done as an attempt to mask/disguise the memory test and aid in the avoidance of explicit contamination in the form of explicit memory of the brands shown. However, the results of their “awareness” questionnaire revealed that 35% of their participants became aware of the connection between the website evaluations and the brand-generation task for Experiment 1, 55% for Experiment 2, and 24% in Experiment 3. Experiment 1 had participants engage with the embedded ad on either a deep or shallow level of encoding/attention. The shallow-encoding group was told prior to ad exposure to focus on how “readable” the brand name was in the ad, whereas the deep-encoding group was asked to rate how familiar they were with the brand depicted in the ad. Experiments 2 and 3 separated the levels of encoding as either forced-encoding or incidental-encoding. The forced-encoding group was identical to the deep-encoding group in Experiment 1, however, the incidental-encoding group were told to merely “find and click on” the embedded at. Their results, after filtering out all “test-aware” participants, yielded significant priming effects relative to the control condition, regardless of the manipulation of encoding across all experiments. Surprisingly, the forced-encoding and incidental-encoding groups produced similar priming results, bringing in to question the need for direct attention or deeper levels of encoding at study.

Based on the studies described above, the current study will examine the effects of attention/encoding on conceptual priming of online advertisements. Northup and Mulligan (2014, 2013) emphasize ecological validity, yet, to our knowledge no one has investigated the effects of a more diffuse engagement condition. In all three experiments (Northup & Mulligan, 2014), participants engaged in the embedded ad. A more diffuse engagement condition would act as a more ecologically valid condition because typically people are not forced to engage with any specific aspect of a website, rather they scroll through and examine the webpage at their leisure. As well, we are interested in examining whether the more diffuse engagement condition will yield similar results to the deep-engagement condition, as did Northup and Mulligan's (2014) incidental- and forced-encoding groups. Northup and Mulligan's (2014) control group produced a baseline measure (*M* = .17) for brands generated without previous viewing of these ads. This will be used as a baseline for the current study as well.

The current study will examine the role of attention in both sorts of implicit memory, perceptual and conceptual. Using Northup and Mulligan (2014, 2013) as a foundation, the current study will improve upon their methodology to examine variables that are, or have been known to, effect the role of implicit memory and online advertisements.

Current Study

Based on the information above, and in line with TAP theory, the current studies examined several things. The first is the role attention plays in the perceptual implicit priming, specifically to that of online advertisements. This will be achieved by having participants view ecologically valid news websites, with online advertisements embedded. Attention will be manipulated by having a more diffuse engagement condition and an engaged-with-ad condition. The following hypotheses pertain to Study 1 – Investigating Perceptual IM.

H_1A: A webpage-engaged condition (to be defined below) will recognize previously embedded ads at a significantly higher rate than ads they were never exposed to.

H_1B: Regardless of attention allocated to the embedded ad, participants will be significantly primed for previously studied ads relative to unstudied ads. The ad-engaged condition will show greater, but not significant, levels of priming against the webpage-engaged condition.

These hypotheses will further support the argument that stimuli do not need to be directly engaged to be perceptually primed. In addition to perceptual priming, this study is also interested in the effects of attention on a conceptual priming task, category exemplar generation. In accordance with TAP theory, conceptual priming tasks act similar to explicit priming tasks in the sense that deep encoding is necessary during study in order to produce priming during test. Modifying and improving upon the methods used in Northrup and Mulligan (2014), the current study wants to examine the extent to which attention must be paid to embedded advertisements for them to be conceptually primed. The following hypotheses pertain to Study 2 – Investigating Conceptual IM.

H_2A: Participants in a webpage-engaged condition will name a brand as an exemplar at a higher rate for ads to which they have been exposed versus ads to which they have not been exposed.

H_2B: Participants in an ad-engaged condition (to be defined below) will name a brand as an exemplar at a higher rate for ads to which they have been exposed versus ads to which they have not been exposed, with a greater difference between ad-engaged and webpage-engaged conditions due to the depth of the engagement.

Method

Participants

Participants included 143 undergraduate students enrolled in General Psychology courses at Stephen F. Austin University. Demographic composition of the sample follows: 77.9% female (M_{age} = 20.0, *SD* = 3.1), 73.2% Not Hispanic or Latino, 67.6% Caucasian, 14.1% African American, and 8.5% other. Political Affiliation of the sample was 27.3% Republicans, 29.4% Democrats, and 43.4% no affiliation/independent. None of the demographics are considered to affect the study involving major American brand names. Compensation included partial course credit for participation in this study.

Stimuli

Captured websites. Stimuli included 40 screenshots of popular and presumably reliable websites that would reveal a sophistication and coherence commensurate with the organizations. For example, we used a capture from CBSNews.com, as Northup and Mulligan (2014) did. While there is no absolute standard for coherence of these pages, we have decided the very nature of their being mainstream and heavily trafficked recommends their use. One screenshot was taken of the 40 different websites (see Appendix A for full list and Appendix B for screenshot example). Our greater concern is for external/ecological validity. However, we would like to address the mild threat to internal validity incurred by using real captures. The intent was to capture the web pages of interest on a "slow news day" which was done on January 8th and 9th 2019, when there had been no major world events. With that in place, one might argue that the websites will vary even with attempts to constrain their variability. To that end, we constrained the appearance to the greatest degree possible to sites that have a similar number of vertical columns (three) and avoided those sites that deviate from the others fundamentally in appearance. Further, we would suggest that there is a range of sheer vividness when considering any stimuli, be they line drawings from Snodgrass and Vanderwart (1980) or Paivio's (1969) words that varied on vividness. Further, and most stridently, the captures were rendered black-and-white to reduce vividness.

Embedded ads. Advertisements corresponding to the list of 40 critical brands (and categories) adopted from Northup and Mulligan (2013) were embedded in to the screenshot of the webpage (see Appendix C for brands and their categories; see Appendix D for to be embedded logos; see Appendix E for ad-embedded webpages). All ads are nationally recognized brands. There are no local or regional only businesses included. All ads were rendered to take up roughly 1/32nd of the webpage screenshot and were placed in either the bottom-right or bottom-left corner of the webpage. With the use of Inquisit, webpages and embedded ads were randomized in every manner. With a universe of 40 ads and 40 captured webpages, there are 1600 potential permutations that participants could have seen. Also, to help ensure internal validity all webpages with embedded ads were rendered black and white.

General Procedure

Two studies were conducted, one perceptual study and one conceptual study. The studies were separated by method of test. For the perceptual priming task, we used perceptual picture identification; for the conceptual priming task, we used category exemplar generation. The independent variable for both studies was the level of engagement to the advertisement (see below).

Passive engagement condition. Each study included a webpage-engaged condition in which the participants did not engage the ad directly. The reader is reminded that the participant is engaging the webpage globally, and the embedded ad represents a fraction of the total. For this webpage-engaged group, a webpage with an advertisement embedded was displayed (see Stimuli above) for 20s apiece. Following each webpage, participants were asked to rank the attractiveness of the overall webpage on a scale of 1-“Not attractive” to 5-“Extremely attractive.” This was done as an attempt to get them to focus on the overall layout of the page rather than focusing on one specific aspect of the webpage, like the embedded advertisement. Participants were told that the rating they gave would be used as an aid for a future memory recognition task. Hastened or aborted answers did not compromise the study. The goal was to diffuse engagement with the site, wherein the ad is merely a part. The attractiveness rating for the overall page was consistent between studies.

Engagement condition. Each study also featured an engagement condition in which the participants were instructed to interact with the embedded ad deliberately and not the entire page, as described above. Participants in this group were instructed to interact with the embedded ad by rating the advertisement on a scale of 1-5 relative to study task (attractiveness for perceptual, familiarity for conceptual; see below). As in the webpage-engaged condition, participants were instructed that this rating of the advertisement will be used on a later recognition task of memory.

"Distractor" phase. Following the webpages, participants moved in to what they were told was a "game" to lengthen the time from webpages to their test of memory. This "game" is the IM priming task of interest, the nature of which depended on the sort of priming being investigated (perceptual [study 1] or conceptual [study 2]). This test was nominally misrepresented as an attempt to avoid explicit contamination through demand characteristics, as was advocated for earlier (MacLeod, 2008). Details follow in respective sections for the perceptual priming and conceptual priming tasks.

“Test” phase. Following the “distractor” phase, participants from either study entered what they believed to be the memory test component of the study. This was an explicit memory task of recognition. Participants answered 60 yes/no identification questions pertaining to advertisements that were either studied (had been embedded in the webpages), unstudied (tested over in task but not embedded in webpages), or untested (ads that were neither embedded in webpages nor tested over in the implicit memory task). Twenty questions pertained to the studied advertisements. Twenty questions pertained to the unstudied advertisements. And the last 20 pertained to the random advertisements. To protect against any potential order effects these questions were randomized for all participants. All 60 questions were the same yes/no question of “Do you remember seeing an advertisement for (insert brand/company name)?”

Test-awareness questionnaire. Upon completion of the “test” phase, participants answered open-ended questions in a modified version of Northup and Mulligan’s (2014, 2013) “test-awareness” questionnaire (see Appendix I) directly on screen via Inquisit. This was to test for participants’ level of explicit contamination. Following the questionnaire, participants were debriefed and exited the laboratory. See Appendix H for a flow chart depicting the methodology.

Study 1: Procedure Investigating Perceptual IM

Study 1 was the perceptually based study, testing IM using perceptual picture identification. Upon completing the consent form, participants were taken int the testing room where the computer for which the study was administered was located. Once seated, the researcher informed them of the overall instructions and then left the room to allow them to complete the study. On screen, participants read detailed instructions informing them of what is to come in the following section of the study. As well, they were presented with any instructions needed to understand and complete any and all tasks prior to those tasks being administered. For those in the perceptual study, after viewing a webpage for 20s they were asked to rate either the overall webpage (webpage-engaged condition) or the embedded advertisement (ad-engaged condition) on an attractiveness scale of 1-5. This persisted for 20 trials. Attractiveness is a perceptually based rating because the participant must analyze the surface features of the ad, rather than interact with the ad in a more conceptual manner.

“Distractor” phase – perceptual picture identification. Once the participants completed viewing the websites, they entered the “distractor phase.” Again, the distractor phase is actually the implicit memory test relative to the experiment. In the context of the perceptual IM study, we implemented the perceptual IM task of perceptual picture identification. For this task, participants were presented a total of 45 pictures. Of these 45 pictures, five pictures were practice images to allow participants to get acclimated to the speeded presentation intervals, 20 pictures were ads that were previously embedded in the captured webpages (studied), and 20 pictures were never-seen advertisements (unstudied). Studied ads were perceptually identical to the ads they were exposed to during the study phase. To protect against order effects, and as an attempt to avoid explicit contamination, the studied and unstudied images were randomized. These pictures were flashed one at a time at a presentation interval of 33ms for each of the 40 trials (akin to Crabb & Dark, 1999; Crabb & Dark 2003; Jacoby & Dallas, 1981; Mulligan, 2002; Warren & Morton, 1982).

Each trial began with a fixation point (+ + +) for 500ms. Following fixation, an advertisement was flashed on screen for 33ms. The speed of 33ms is long enough of a duration to be seen by a majority of participants. This 33ms duration constrained correct recognition but engendered differences in the dependent variable of accuracy as a function of the independent variable. A speed of 50ms tends to engender ceiling effects. A 2018 pilot by this author found that 33ms performed well (d = 1.34) and 17ms engendered floor effects, in which few ads were recognized. Each picture was followed by a mask. The mask is an image of densely overlapping "squiggly" lines presented for 500ms to make perception more difficult. Once the mask desisted, the participants were given 7.5 seconds to type the name of the brand they saw, though the image was not qualified as a brand. If they did not answer in the allocated time, they were forced to move to the next item. Once participants completed the implicit measure, the remainder of the study was identical to what was described in the general procedure.

Study 2: Procedure Investigating Conceptual IM

Study 2 used the conceptual IM test of category exemplar generation. Upon entering the laboratory, everything was identical to that of the perceptual task, except for the rating scale following each webpage. For the conceptual study, participants in the passive engagement condition were still asked to rate the attractiveness of the overall webpage on a scale of 1-5. Again, this is to keep them from focusing on one specific aspect of the webpage. Those in the ad-engaged condition were asked to rate their familiarity with the advertisement on a scale of 1-5. Familiarity is used because it forces the participant to engage with the displayed ad in a more conceptual manner. Rather than encoding only the surface features of the ad, participants must conceptually engage with the overall company and think about how often or how little they are exposed to or interact with the displayed brand.

"Distractor" phase – category exemplar generation. As in the perceptual task, once they completed viewing and rating websites, participants were instructed that they would be participating in a "game" to lengthen the time between the study phase and the test of memory. Again, this is done in order to mask category exemplar generation as the IM test, and in hopes to avoid explicit contamination. Participants were presented with 40 category headings one at a time (see Appendix C,) and were asked to type the first exemplar that comes to mind of a product category, such as “frozen pizza” or “airline,” for example. Of the 40 category headings, 20 will be category headings relative to the ads displayed on the webpages (studied), and 20 will be category headings not relevant to embedded ads - but they are congruent to Appendix C. Participants were given 7.5 seconds to record their response in a provided text box on screen. If they did not respond during that time, they were automatically forced to the next screen with the next category heading. After completing the implicit measure, the remainder of the experiment is identical to the general procedure and perceptual study procedure.

Measures for Studies 1 and 2

IM score. The dependent variable for this study was the participant’s overall implicit memory score. For this variable, the terms “Old” and “New” are referencing “studied” and “unstudied” advertisements displayed to participants. This score was determined by subtracting the number of Total New Correct Items from the number of Total Old Correct Items. Both Total New Correct Items and Total Old Correct Items were calculated by first determining which ads were new and old for all participants. After that, participants’ responses to their IM test were examined for correctness. If the correct brand name was entered then they were allocated a 1 in the corresponding column for that specific brand (New Correct or

Old Correct). If the wrong answer, or no answer was entered, then the participants were given a 0 in both columns (New Correct and Old Correct). A total score was then calculated for both New and Old items. A higher score of implicit memory score indicated higher levels of Implicit Memory use.

Explicit contamination score. The reader is reminded that explicit contamination is the idea that participants discern the connection between the study phase and the implicit memory task, and then use this to their advantage in completing the implicit memory task. A total explicit contamination score was calculated for each participant based on their answers to these contamination measures. The scores ranged from 0-3. A score of 0 is someone who has no contamination, a score of 1 is someone with little to no contamination, a score of 2 is someone with mild contamination, and a score of 3 is considered highly or completely contaminated.

Along with the modified explicit contamination questionnaire (see Appendix I), we included an additional explicit contamination check. Following the contamination questionnaire, four additional explicit memory questions were asked prior to the participants viewing their random 20 webpages, all participants viewed the same four webpages. These webpages each included an embedded ad that was special to that webpage, and the four webpages were viewed in the same order by all participants (see Appendix E for two examples of the four pages). These questions were identical to the explicit memory questions, "Do you remember seeing an ad for (insert brand name)?" If participants answered yes, they were also prompted to fill in a text-box with the name of the website that the advertisement was embedded in.

Results

Of the 143 participants collected, 137 were included in the analyses. Four were removed due to lack of implicit task data. All four of those participants reported a 0 score for both stimuli studied (old), and stimuli only presented at task (new) in respective experiments. An additional two participants were removed because their implicit memory score were deemed outliers of the sample. Their basic priming score, as will be defined below in respective studies, was very high in which performance on studied items was near ceiling and performance on unstudied/new items presented only at task, was near zero. Leaving them in the sample caused implicit memory scores not to meet the statistical assumptions of normality, skewness, and kurtosis.

Covariates

We collected two covariates to gauge the explicit contamination of each participant on two separate levels. The first covariate is a barometer of explicit "contamination" (see explicit contamination score calculation above). Blum & Yonelinas (2001) set a precedent that has allowed for a conservative interpretation of contamination, wherein self-professed contamination is taken at face value. If a participant claimed he/she were contaminated in any way, researchers accepted that claim at face value. We follow that precedent here. Indeed, as a maximum score of 3, the mean self-professed contamination score was *M* = 1.49 (*SD* = 1.14) for 71 participants in the conceptual priming experiment and 66 participants *M* = 1.56 (*SD* = 1.22) in the perceptual priming experiment.

The second and more objective covariate is the explicit memory score (EM) in which the participant, across 60 trials, a) indicated whether he/she recognized ads that were embedded in webpages at study; b) correctly rejected ads that were not embedded but were part of the priming aspect of the experiment; and c) correctly rejected ads that were not presented at any time prior. Incorrect recognition of these wholly new ads would represent false alarms. This EM suggested great participant discernment, significantly above chance for each experiment. The mean EM score across 66 participants in the perceptual task was high ($M = .78$, $SD = .10$), $t(65) = 22.21$, $p < .001$ (inference test performed against chance level of .50); the 71 participants in the conceptual task also demonstrated high levels of EM ($M = .81$, $SD = .12$), $t(70) = 21.77$, $p < .001$.

It should be noted that there was a second, informal indicant of EM as described in the Method. Participants were asked, in four separate trials, to reconcile the specific webpage with a product seen. Across 137 participants in the analyses, at four trials apiece, totaling 548 total trials, *none were completed successfully.*

Analyses

In addressing each of the two studies designed to address perceptual and conceptual implicit memory respectively, we completed five analyses within the context of the General Linear Model, a mixed-model Analysis of Variance (ANOVA), three Repeated Measures Analyses of Covariance (RM ANCOVAs), and a hierarchical regression. Given the presumed influence of each covariate, we ran a mixed-model ANOVA (with the status of the ad as studied or not as a within-participants independent variable, level of engagement as the between-participants independent variable, and correct-answer responding/category exemplar generation for studied and unstudied ads as the dependent variable). Then, three RM ANCOVAs were run. In the first, a RM ANCOVA was run with explicit contamination as a covariate. Then, explicit contamination was used as a covariate with those most severely contaminated with a maximum score of "3" removed. The purpose of the nominal levels of contamination is to introduce levels of gradation in claimed contamination that is more refined and sensitive than the all-or-none method of Blum and Yonelinas (2001), who excluded the majority of their participants. Finally, a RM ANCOVA was run with explicit memory as a covariate. While all models will address homogeneity-of-variance concerns, we do not have to satisfy sphericity concerns, as addressed by

Mauchly’s Test of Sphericity, because there are precisely two levels of the within-participants independent variable (Field, 2013).

Perceptual Task Results

Participants engaged only to the ad by way of rating it yielded respective means of studied ads recognized (*M* = 9.97, *SD* = 4.88) and unstudied ads recognized (*M* = 6.27, *SD* = 4.48), yielding a priming score (*M* = 3.70*, SD* = 2.38). Participants in the webpage-engagement condition, wherein they rated the entire webpage, yielded respective means of studied ads recognized (*M* = 10.67, *SD* = 5.51) and unstudied ads recognized (*M* = 8.64, *SD* = 4.47). This resulted in a priming score (*M* = 2.03*, SD* = 3.20). Inferential statistics follow.

Mixed Model ANOVA. We begin with a mixed model ANOVA with a between-participants variable of engagement level and a within-participants variable of whether the ad was studied or not. There are no covariates treated. Box’s Test of Equality of Covariance Matrices was not violated, *F* = (3, 737,280.00) = .94, *p* > .05 and Levene’s test of equality of error variances was satisfied, *p* > .05. With the ad-engaged (*n* = 33) and webpage-engaged conditions (*n* = 33) serving as levels of the between-participants independent variable, and ad-studied versus ad-not-studied serving as both levels of the within-participants independent variable, we launched a mixed-model ANOVA and did not find a main effect for engagement on speeded-identification performance, *F*(1, 64) = 1.73, *p* > .05, *r* = .03. This suggests that level of engagement with the studied ad did not affect the participant's ability to identify studied and unstudied items through speeded perceptual picture identification. However, we did find a main priming effect, the within-participants variable, $F(1, 64) = 68.19$, $p < .001$, $r = .52$, such that, regardless of level of engagement, studied ads were identified on the perceptual picture identification more than those that were not studied or "new," the definition of priming.

Lastly, we observed a significant interaction between whether or not the ad was presented and level of engagement, $F(1, 64) = 5.78$, $p < .05$. This suggests that direct attention to the advertisement did not engender priming more than engagement to webpage.

RM ANCOVA with all levels of explicit contamination as covariate. In this RM ANCOVA, we test the effect of both independent variables with the covariate of explicit contamination with all levels included, 0-3. The homogeneity-of-variance term was not significant $F(1, 62) = 3.45$, $p > .05$. Further, Box's Test of Equality of Covariance Matrices was not violated, $F = (3, 737{,}228.00) = 0.94$, $p > .05$. As well, Levene's test of equality of error variances was satisfied, $p > .05$. Thus, we proceeded with analysis. Independent and dependent variables for the RM ANCOVA were consistent with those in the mixed-model ANOVA, except for including explicit contamination as a covariate.

The first observed effect for this analysis was for whether or not the ad was presented, with explicit contamination as a covariate. We found a main effect for whether or not the ad was presented in that context, $F(1, 63) = 20.75$, $p < .001$, $r = .25$. We also observed no main effect for level of engagement in this context, $F(1, 63) = 2.14$, $p > .05$, $r = .03$. There was a main effect for explicit contamination on priming, $F(1, 63) = 6.22$, $p < .05$, $r = .09$, suggesting that those who had higher levels of explicit contamination had higher priming levels than those with lower levels of explicit contamination, regardless of level of engagement.

Lastly, we observed two interactions using explicit contamination as a covariate. We observed a significant interaction between whether or not the ad was presented and engagement, $F(1, 63) = 5.60$, $p < .05$. Participants in the webpage-engagement condition showed better performance identifying both studied and unstudied advertisements than those in the ad-engaged condition. As well, we did not find a significant interaction between whether or not the ad was studied and explicit contamination, $F(1, 63) = .36$, $p > .05$, suggesting that levels of contamination did not affect the implicit memory score of one condition more than the other.

RM ANCOVA with level-3 contamination scores removed. The reader is reminded that those who had an explicit contamination score of 3 (self-described as highly contaminated) were removed from this analysis. This removed 18 participants, causing the sample to drop from 66 to 48 total participants. The homogeneity-of-variance term was not significant $F(1, 44) =$

0.02, $p > .05$. Further, Box's Test of Equality of Covariance Matrices was not violated, $F = (3, 499{,}628.41) = 1.41$, $p > .05$. As well, Levene's test of equality of error variances was satisfied, $p > .05$. Thus, we proceeded. Independent and dependent variables were identical to the previous RM ANCOVA. As well, results for this RM ANCOVA are similar to that of the previously described RM ANCOVAs.

Similar to the RM ANCOVA with all contamination levels included, we found a main effect for whether or not the ad was studied, $F(1, 45) = 20.85$, $p < .001$, $r = .32$. We also did not find an effect for engagement, $F(1, 45) = .000$, $p > .05$, $r = 0.01$, in this context. The main effect of contamination, although reduced, was still significant, $F(1, 45) = 5.27$, $p < .05$, $r = .10$.

Upon removal of highly contaminated participants, the interaction variable effects were identical to the previous RM ANCOVAs. We did observe a significant interaction between whether or not the ad was presented and engagement $F(1, 45) = 5.12$, $p < .05$. We did not find a significant interaction between whether the ad was presented and the covariate explicit contamination for levels below 3, $F(1, 45) = .15$, $p > .05$.

RM ANCOVA using EM as a covariate. A third RM ANCOVA was conducted to assess the effect of EM. The homogeneity of variance term was not significant $F(1, 62) = 0.82$, $p > .05$. Further, Box's Test of Equality of Covariance Matrices was not violated, $F = (3, 737{,}280.00) = .94$, $p > .05$. As well, Levene's test of equality of error variances was satisfied, $p > .05$. Thus, we proceeded. Independent and dependent variables were identical to both previous RM ANCOVAs, the only difference is EM being used as the covariate rather than explicit contamination.

The RM ANCOVA revealed that there was not a main effect for whether or not the ad was presented, $F(1, 63) = 2.10$, $p > .05$, $r = .03$, suggesting a lack of a basic priming effect in this context. Similar to the previous RM ANCOVAs, there was no main effect for engagement, $F(1, 63) = 3.25$, $p > .05$, $r = .05$. However, unlike the previous analyses there was no main effect for the covariate EM, $F(1, 63)$ 2.61, $p > .05$, $r = .04$. A plausible reason is the high percentage correct of EM scores and homogeneity of variance therein.

When implementing EM as the covariate, the interactions between variables were identical to the previous RM ANCOVAs. We did observe a significant interaction between whether or not the ad was presented and engagement, $F(1, 63) = 5.74$, $p < .05$. We did not observe a significant interaction between whether or not the ad was presented and EM, $F(1, 63) = .19$, $p > .05$, suggesting that a participant's performance on the EM task did not influence their implicit memory score in one condition more than the other.

Hierarchical regression. For these hierarchical regression models and those describing conceptual priming, assumptions against collinearity were not violated as no two predictors were correlated near $r = 0.9$ (Field, 2013). However, each model was affected by the strong relation between priming and the EM and contamination scores, ranging from $r = 0.58$ to $r = 0.33$. We also monitored levels of variance inflation factors (VIFs). Though they did exceed the recommended levels of 1, no tolerances dipped below 0.2 (Field, 2013).

A hierarchical regression was run to analyze predictors of perceptual priming including the highly correlated explicit variables of explicit contamination and EM on priming as well as engagement. The justification for entering engagement first was that it had the strongest relation with priming, $r = 0.29$, $p < .05$. Conversely, respective Pearson r coefficients for contamination and memory were 0.08 and 0.05 respectively, *ns*.

As was strongly suggested in the process of our ANCOVAs, explicit processes apparently had relatively little influence over priming. In the model, engagement was predictive of priming, $\beta = 0.29$, $p < .05$ when entered alone, $R^2 = 0.08$ ($F_{change} = 5.78$, $p < .05$), which, of course, is the just the square of the Pearson r of 0.29. The two explicit measures were positively correlated at $r = 0.33$, $p < .01$, which does not threaten collinearity assumptions as the coefficient is well below $r = 0.9$ (Field, 2013). However, given the robust coefficient, limited marginal variance explanation was yielded with the new predictor of contamination added to the model, $R^2 = 0.09$ ($F_{change} = 0.36$, *ns*), though it was significant. In the model, explicit contamination was not predictive of priming, $\beta = 0.07$, *ns*.

The marginal variance explained by the addition of EM was not significant, $R^2 = 0.10$, ($F_{change} = 0.46$, *ns*). In this model, engagement was again predictive of priming $\beta = 0.32$, $p < .05$. In the model, the new predictor of explicit memory was not predictive of priming $\beta = -0.09$, *ns*.

Conceptual Task Results

Means for each condition, ad-engaged and webpage-engaged, can be found in Table 1. Ad-engaged participants named the intended product given the product category when the ad was studied ($M = 7.64$, $SD = 3.54$) and when the ad was not studied ($M = 3.31$, $SD = 1.65$), yielding a priming score ($M = 4.33$, $SD = 3.70$). It might be useful to clarify that when a product was named that was not studied, that is owed to chance. Participants in the webpage-engaged condition yielded respective means of products named given the category from studied ads ($M = 4.20$, $SD = 2.31$) and from non-studied ads ($M = 2.26$, $SD = 1.62$), yielding a priming score ($M = 1.94$, $SD = 2.70$).

Mixed model ANOVA. We begin with a mixed model ANOVA with a between-participants variable of engagement level and a within-participants variable of whether the ad was studied or not. There are no covariates treated. Box's Test of Equality of Covariance Matrices was not violated, $F = (3, 880{,}158.28) = 1.96$, $p > .05$. Also, Levene's test for Equality of error variances suggested a slight inequality of variance with respect to the performance on the "studied/old score," $F(1, 69) = 6.56$, $p < .04$. With the ad-engaged ($n = 36$) and webpage-engaged conditions (n = 35) serving as levels of the between-participants independent variable, and whether or not the ad was presented serving as the within-participants independent variable, we launched a mixed-model ANOVA and found a main effect for engagement $F(1, 69) = 28.00$, $p < .001$, $r = .54$. This suggests that level of engagement affected the participant's ability to name old and new exemplars through conceptual category exemplar generation, such that those in the ad-engaged condition were able to correctly produce the exemplars more than those in the webpage-engaged condition. We also found a main effect for whether or not the ad was presented, $F(1, 69) = 66.27$, $p < .001$, $r = .70$, suggesting that participants were able to correctly produce the exemplar for product category regarding studied ads more than non-studied product categories, whose production rate again owes to chance.

We also observed a significant interaction between whether or not ad was presented and engagement, $F(1, 69) = 9.61$, $p < .05$. It appears that the level of priming did appear to rely on engagement.

RM ANCOVA with all levels of explicit contamination as covariate. In this RM ANCOVA, we test the effect of both independent variables with the covariate of explicit contamination with all levels included, 0-3. We first confirmed a homogeneity-of- variance assumption with respect to the independent variable of engagement condition and the covariate of contamination. The homogeneity-of-variance term was significant $F(1, 67) = 13.39$, $p < .001$. The assumption of parallel regression slopes in predicting priming is not met. As we have already described the model without the covariate of explicit contamination above, we would like to proceed and list results with the understanding that independent variables of ad exposure and engagement cannot explain performance on the dependent variable independent of the covariate of explicit contamination. However, listing results here in tandem with a mixed model with no covariates will present a complete picture.

The first observed effect for this analysis was from the two levels of engagement. We found an effect for engagement in the context of using explicit contamination as a covariate, $F(1, 68) = 15.18$, $p < .001$, $r = .43$. This suggests that for category exemplar generation, the participants who were ad-engaged produced more exemplars correctly compared to those who were in the webpage-engaged condition, in this context. As the violated assumptions would suggest, we also found a strong main effect for the covariate explicit contamination, $F(1, 68) = 9.35$, $p < .05$, $r = .35$, suggesting that those who had higher levels of explicit contamination correctly produced the category exemplar more than those with lower levels of contamination. Similar to the mixed model ANOVA, we also found a reduced, but still significant, effect for whether or not the ad was presented, $F(1, 68) = 4.10$, $p = .05$, $r = .24$.

Lastly, we observed interaction effects. The interaction between whether or not the ad was presented and engagement was not significant, $F(1, 68) =$

2.52, $p > .05$. Again, as the violated assumptions would imply, the interaction between whether or not the ad was presented and the covariate of explicit contamination was significant, $F(1, 68) = 14.00$, $p < .001$.

RM ANCOVA with level-3 contamination scores removed. The reader is reminded that those who had an explicit contamination score of 3 (self-described as highly contaminated) were removed from this analysis. This removed 18 participants from 72 to yield 54. The homogeneity-of-variance term was significant $F(1, 50) = 12.05$, $p < .001$, only slightly affected by removing those scoring the highest. The assumption of parallel regression slopes in predicting priming is not met. After removing all those most contaminated, we observed no effects for either independent variable, as described below. Independent and dependent variables are identical to that of the previous RM ANCOVA.

Results from this analysis reveal identical effects to the previous analysis including all contamination. We found a significant effect for engagement $F(1, 51) = 6.93$, $p < .05$, $r = .12$. Again, as the violated assumptions would suggest, we found a reduced effect, although still significant, for the covariate explicit contamination, $F(1, 51) = 4.26$, $p < .05$, $r = .08$. We also found a significant effect for whether or not the ad was presented, $F(1, 51) = 4.99$, $p < .05$, $r = .09$.

Upon removal of the highly contaminated participants, all interaction effects were deemed non-significant. The interaction between whether or not the ad was presented and engagement was not significant, $F(1, 51) = 1.42$, $p > .05$. The interaction between whether or not the ad was presented and the covariate of contamination was not significant, $F(1, 51) = 3.53$, $p > .05$.

RM ANCOVA using EM as a covariate. A third RM ANCOVA was conducted to assess the effect of EM. The homogeneity-of-variance term was significant $F(1, 67) = 9.83$, $p < 05$. Further, Box's Test of Equality of Covariance Matrices was not violated, $F = (3, 880{,}158.28) = 1.96$, $p > .05$. Thus, we proceeded. Independent and dependent variables are identical to the previous analyses, except for incorporating EM as the covariate rather than explicit contamination.

The RM ANCOVA revealed a marginally significant effect for engagement $F(1, 69) = 3.80$, $p = .055$, $r = .05$, such that those in the ad-engaged condition correctly produced product exemplars more than those in the webpage-engaged condition. There was a strong main effect for the covariate EM, $F(1, 69) = 17.04$, $p < .001$, $r = .20$, suggesting that those who scored highly on EM also correctly produced more exemplars on the category exemplar generation task. There was also a main effect for whether or not the ad was presented in this context of using EM as a covariate, $F(1, 69) = 8.92$, $p < .05$, $r = .11$.

When implementing EM as the covariate, we did not observe a significant interaction between whether or not the ad was presented and engagement, F(1,

69) = .01, $p > .05$. However, there was a significant interaction between whether or not the ad was presented and EM, $F(1, 69) = 16.32$, $p < .001$.

Hierarchical Regression. A hierarchical regression was run to analyze predictors of priming including the explicit variables of contamination and memory as well as engagement. The justification for entering EM first was that it had the strongest relation with priming, $r = 0.54$, $p < .01$. Conversely, respective Pearson r coefficients for contamination and engagement with priming were 0.50 and 0.35 respectively, $p < .01$.

As was strongly suggested in the process of our RM ANCOVAs, explicit processes apparently had a strong influence over priming. In the model, EM was predictive of priming, $\beta = 0.54$, $p < .001$ when entered alone, $R^2 = 0.29$ (F_{change} = 28.46, $p < .001$), which, of course, is the just the square of the Pearson r of 0.54. The two explicit measures were positively correlated at $r = 0.58$, $p < .01$, which does not threaten collinearity assumptions as the coefficient is well below $r = 0.9$ (Field, 2013). However, given the robust coefficient limited marginal variance explanation variance was yielded with the new predictor added to the model, R^2 = 0.34 (F_{change} = 5.13, $p < .001$), though it was significant. In the model, explicit contamination was predictive of priming $\beta = 0.27$, $p < .05$.

The marginal variance explained by the additional predictor of engagement was at trace values, with SPSS reporting the same value of R^2 =

0.34 (F_{change} ≈ 0.00, *ns*), with only adjusted R^2 suggesting the scant difference. In the model, engagement was not predictive of priming β = -0.002, *ns*.

Discussion

General Findings

The current studies investigated the attentional requirements for both perceptual and conceptual implicit memory tasks. Please note that the effect of engagement across the two halves cannot be compared statistically. However, informal comparison of the results was used to obtain an understanding of how attentional requirements affect participant ability to perform on implicit memory task. In general, across both studies (not accounting for covariates) participants significantly answered more studied items correctly than unstudied. This result holds true regardless of the level of engagement to the embedded advertisements. For the perceptual task, results showed that levels of engagement to embedded ads did not significantly influence participants' implicit memory. In fact, scores showed that those in the webpage-engaged condition correctly identified more studied ads than unstudied. This is in line with TAP framework suggesting that perceptual implicit memory is not influenced by the level of attention an individual gives to a stimulus. For the conceptual task, results showed that those who were engaged with the advertisement were able to produce the correct category exemplar for the given category heading. This too is in line with TAP framework, suggesting that conceptual implicit memory works similar to that of EM, such that more attention and deeper levels of encoding are necessary for stimuli to be remembered.

Improved Methods

Improvements in perceptual and conceptual tasks. The current study offered an improved methodology to test perceptual and conceptual priming of online advertisements. For the perceptual study, we used a highly recommended test for participant recognition, picture identification (McDermott & Roediger, 1994). In regard to conceptual implicit memory, Northup and Mulligan's (2014) methodology compelled improvements for testing. Using Inquisit, we were able to avoid participants being forced in and out of various applications, tabs, and/or webpages. The current study rendered the webpages and their embedded ads as black-and-white to increase internal validity, whereas the previous researchers did not. Researchers also implemented a test condition of *webpage-engaged* as a manipulation of attention. This condition corresponds to a more ecologically valid method of encoding webpage material and was not used by Northup and Mulligan (2014). However, we back Northup and Mulligan in the use of real webpage captures to further externally/ecologically validate the current study.

Improvements in gauging explicit contamination and EM. The current study purposefully highlighted the importance of explicit contamination in several ways. Researchers attempted to mask the implicit memory task by informing participants they would be engaging in a “distractor task” (the IM task) before being given their test of memory (EM task). Additionally, a speeded task was used for both studies (perceptual and conceptual). Researchers went to extreme lengths to measure and gauge the participants’ levels of explicit contamination. All participants engaged in an explicit contamination questionnaire as advocated by previous researchers (MacLeod, 2008; Roediger & McDermott, 1993). Within this explicit contamination questionnaire, participants were also given an additional four EM questions pertaining to the control webpages all participants saw at the beginning of their task. The explicit contamination questionnaire along with participants’ EM, were both used as covariates of general explicit contamination. Using both of these measures as covariates is something that previous researchers have not done. Additionally, we will highlight the effects that both of these covariates had on each task.

Participant commitment as suggested through explicit measures. Researchers want to highlight the overall coherence of the current studies. While recognition memory is known to be powerful, participants showed EM scores of roughly 80% across all EM trials. As well, they showed 94% correct rejections for wholly-new ads. Both results should be taken as endorsements of participant commitment and a suggestion of ideal length of the task. If the task was longer and more taxing and the participants less vigilant, we might have less confidence in the data. Looking at Table 1, we can see that the basic pattern of old/new held up, also suggesting some task vigilance on the part of the participant. While we cannot fully endorse that the tasks tapped implicit memory, in a sense both tasks worked. Whether the participants employed explicit or implicit memory, experience (studied trials) predicted the proportion named in each task in the form of speeded naming of the black-and-white ad or product naming in the category of the ad presented. In each experiment, a greater degree of priming was observed as a function of engagement. The magnitude of the priming was more enhanced in the conceptual experiment as predicted in H_2A. As well, it was shown that perceptual tasks rely less on engagement as was predicted in H_1B.

Using EM as a covariate. As was described in the Method section, EM was collected by asking a series of 60 questions and totaling the number of correct responses. A correct response was tallied in one of three ways: 1.) correctly identifying a studied advertisement, 2.) correctly rejecting an advertisement that was never seen at study but appeared in the task, and 3.) correctly rejecting a completely new advertisement. A higher score would indicate a better use of EM. Across both experiments, participants averaged nearly 80% correct on the EM measure. There was no precedent on the best way to measure EM. The current researchers decided that asking yes/no questions would yield a more precise EM score; however, the yes/no questions can cause the scores to reach ceiling, resulting in the high (80%) correct scores. If the researchers had gone with open-ended questions, data would have revealed a floor effect, potentially resulting in scores close to 0% correct, which is demonstrated in the four additional questions attached to the explicit contamination measure.

Using explicit contamination as a covariate. Similar to the EM measure, previous research has not developed an accurate or standard method to determine participant levels of contamination. Blum and Yonelinas (2001) excluded approximately half of their entire participant pool without providing any reason or rationale. They took their participants' responses to the contamination question at face value. If a participant said he/she were explicitly contaminated, the researchers removed them from the study. This action did not allow much room for an interpretation of the level of participant contamination. Because there is no standard methodology for contamination determination, the current study went to extra lengths to not remove people based on the face-value response.

A less conservative, but reasonable, suggestion of contamination. Explicit contamination was determined using an after-task questionnaire. The questionnaire included five questions pertaining to explicit contamination and four EM questions related to the control webpages every participant was presented at the beginning of the "study phase." The five questions were scored on a three-point scale ranging from minimal contamination (score of 1) to highly contaminated (score of 3). Based on the articles reviewed, no previous research has attempted to stratify participant contamination into separate gradations as we did here. This gradation allowed the current project to retain more participants rather than losing over half like Blum and Yonelinas (2001). Based on our grading of the questionnaire responses, a total of 36 participants (18 from each study) were removed because they were determined to be highly contaminated. The inclusion of the four EM questions pertaining to the control webpages was to further test a participant's contamination level. The researchers want to emphasize that out of 548 potential chances (137 participants each answering four questions) not a single one was answered correctly.

A further suggestion of face-value reporting of explicit contamination. This result brings in to question the participant's ability to be explicitly contaminated during the test phase on a speeded task. If participants could not remember seeing the control ad or the specific control webpage the ad was on when not under a time constraint, how is it plausible that they could recall the study ads and webpages, and then use that information to complete the speeded task (in either study)? Evaluating and analyzing explicit contamination is an area within this field of research that needs to be further investigated.

Task vigilance across both studies. Researchers want to highlight the overall task vigilance that was displayed throughout the entire project. The timing and spacing of each individual section within the studies showed to evince and maintain participant attention. Had the individual tasks or the overall study (either perceptual or conceptual) been longer there may have not been as much participant commitment. With a longer study, or questionnaire, this would invite the participant to begin to lose focus and begin absentmindedly completing the study, rather than being attentive and doing their best to answer any and all questions/tasks given to them. This can be seen from the overall results of the individual studies. Had the participants been absentmindedly completing the study, the results would have reflected lower overall scores in all columns. However, as Table 1 depicts, the scores fluctuate between each variable and across both studies. This implies a dedication to the implicit memory task. As well, results from the EM measure have similar implications. Across both studies participants on average scored 80% on the EM measure. Readers are reminded that this score is calculated by answering 60 yes/no questions. A higher score indicates that the participant was able to correctly identify ads that were embedded and correctly reject ads that were not embedded/never seen. With participants averaging 80% across both studies, this suggests immense task vigilance. Had they mindlessly been clicking through the questions results would reflect scores well below 80%. This is another indication of task vigilance among participants.

Two Orthogonal Tests of the Role of Attention on Implicit Memory

Readers are reminded that, although both of the studies in the current experiment are measuring implicit memory, the results from these experiments cannot be crossed examined for statistical purposes. However, researchers would like to highlight that comparing the results between the two studies (as is shown in Table 1) is beneficial when understanding the role of attention in different implicit memory facets. Participants in the perceptual study were less affected by the attention manipulation compared to those in the conceptual study, as Transfer-Appropriate Processing (TAP) would suggest. This effect is emphasized when looking specifically at the “studied correct total of 20.” For the perceptual study, those in the webpage-engaged condition were able to correctly identify (on average) more “studied” advertisements than participants in the ad-engaged condition (10.67 vs. 9.97). Again, suggesting fewer direct attentional requirements for encoding to occur. For the conceptual study, results reflect the complete opposite. Looking at the same column – “studied correct of 20” - those in the webpage-engaged condition were able to produce the correct category exemplar (on average) at about half the rate of participants in the ad-engaged condition (4.20 vs. 7.64). Suggesting a strong need for a direct attentional requirement to encode the stimuli in a conceptual manner.

An Address of the Perceptual Implicit Memory Task

Reliable priming in both between-participants conditions. Results showed that regardless of the participant’s level of engagement they were able to identify more studied ads than unstudied. This is exactly as H_1A predicted; webpage-engaged participants will recognize previously embedded ads significantly more than ads never presented. This would suggest that participants were able to strongly encode the perceptual features of the embedded advertisement. By neutralizing the embedded ad and the webpage (black and white), these results highlight how strong perceptual implicit priming is. Without the aid of color-specific logos, participants were still able to recognize the perceptual overlap between the embedded ads and the pictures flashed at them during study.

Non-significant effect for engagement. The main finding for this study showed that the level of engagement did not have any effect on the participant's ability to identify studied and unstudied advertisements when presented in a perceptual picture identification task. This is exactly what H_1B predicted; the ad-engaged condition will show greater, but not significant, levels of perceptual priming. This finding falls directly in line with TAP framework, suggesting that there are fewer direct attentional requirements for a person to access implicit memory when prompted in a perceptual manner.

The webpage-engaged condition: No need for direct attention to stimuli. Results further expressed that participants in the webpage-engaged perceptual task were able to identify more studied ads correctly than those in the ad-engaged condition. Finding that the webpage-engaged group identified more studied items correctly strengthens this paper's argument on the position that attention is not required for activation of someone's perceptual implicit memory (Bentin, et al., 1995; Mulligan & Hartman, 1996; Mulligan & Peterson, 2008;

Smith & Oscar-Berman, 1990; Spataro, Mulligan, & Rossi-Arnaud, 2010; Spataro, Mulligan, & Rossi- Arnaud, 2011). As well, it further validates the TAP framework that perceptual tasks do not require the same deep cognitive encoding that conceptual or EM measures need (Roediger, 1990).

Examining explicit contamination as a covariate. When implementing participant contamination as a covariate the results showed similar findings to the previously mentioned analyses. Readers are reminded that explicit contamination was tested as a covariate in two iterations. One analysis maintained all participants with all levels of contamination, and the other analysis removed all participants that were deemed to be “highly contaminated” (3s removed). The analyses will be reviewed in tandem. Regardless of the participant’s level of contamination, the results showed that the effects of engagement remained non-significant, as was hypothesized. This continues to uphold the TAP framework perspective that was addressed above.

A significant covariate in perceptual priming. Further, both analyses revealed that explicit contamination had a significant effect on the participants’ overall performance. These results express that if participants scored high on the explicit contamination measure then they also tended to show a higher implicit memory score. This implies that the participants were cognitively aware of the connection between the study phase (viewing websites) and the test phase (perceptual picture identification task). This further implies that the participants used this awareness to help them complete/answer the prompts on the perceptual picture identification. This could have been due not giving the participants enough of a time lapse between the study and the test phase, however researchers do not believe this to be the culprit. While a future researcher may allow more time between study and test, we question the true diagnostic nature of an explicit-contamination task.

An overly conservative face-validity assumption of claimed contamination? Researchers want to bring in to question the authenticity of explicit contamination measures/surveys, especially in the context of perceptual picture identification. There are two major flaws in these surveys that go hand-in-hand. The first is that we as researchers have no way to confirm the participants are contaminated. If they say they were contaminated then we accept that *prima facie*. This contamination flaw is what caused Blum and Yonelinas (2001) to lose over 60% of their participants. Further, there is no way clear way of trying to further break down the level of contamination. Researchers attempted to do this in the current experiment by scoring responses to the contamination survey and attempting to get a better understanding of the participant’s overall contamination, a rather homespun but necessary step. For instance, if a participant were aware of the connection between the ads and the perceptual picture identification images are they as contaminated as someone who was aware of the connection and used this awareness to help them answer the task prompts?

Implausibility of real contamination in the current study. This observational question brings in another component of contamination flaw that specifically pertains to perceptual picture identification and generally to any speeded task. When examining the current project, participants were flashed an image at 33ms. They also only had 7.5 seconds to record an answer before being automatically taken to the next question, which they did for 40 questions. It does not seem cognitively possible for someone to process an image flashed at 33ms, reflect on the 20 webpages they were just presented, correspond the flashed image to one of the 20 pages they examined, and the input the correct answer in less than 7.5 seconds. This pattern would had to have persisted for 40 trials, 20 of which they have to be able to realize that that image was not on one of the previously shown webpages. This issue will be further addressed in the following section.

Examining EM as a covariate. Along with explicit contamination, researchers examined the effect that a participant's EM had on their ability to perform during the perceptual picture identification task. When implementing EM as a covariate, results showed similar results to the previously mentioned analyses; the participant's level of engagement did not affect their ability to correctly identify the images on the perceptual picture identification task. Again, this continues to support TAP framework and the idea that attention is not a requirement for information to be stored in someone's implicit memory. However, unlike explicit contamination, EM did not reduce the priming effect. As TAP would suggest, EM should not be correlated to participant performance within the perceptual implicit memory task. This is because perceptual implicit memory does not require the stimuli to be deeply encoded, as is needed with EM and conceptual implicit memory (discussed later).

Perceptual Test Implications

An apparent priming effect in the absence of direct attention*.* Along with methodology improvements, the results from Study 1 have strong implications for future research. Researchers supported both hypotheses relevant to the perceptual task. Though attention appeared to enhance priming, it did not enhance it to a significant degree. These results add to the debate of whether perceptual priming is affected by manipulations of attention at encoding, advocating for the argument that attention is not required. These results are also intriguing for marketing reasons because they show that even if deliberate attention is not attributed to an online advertisement, consumers are still encoding it at a shallow level.

A modest proposal for recalibration of contamination. As well, due to improved methodology, this test yielded vastly fewer contaminated participants to that of Northup and Mulligan's (2014) over 50%. Although explicit contamination had a significant effect, researchers want to emphasize the need for a more internally valid method for determining the level of contamination. If research continues to simply believe the participants and remove them based on this criterion, it will result in mass participant elimination as we saw in Blum and Yonelinas (2001). However, if this field of research adopts a scaling method – as we attempted to implement here – it will allow the researchers to see more of a full picture of the effect that contamination had on the results. It will also reduce the amount of participants that have to be completely eliminated from the study due to saying "I was contaminated." By scaling contamination, it should allow for a significantly higher level of participant retention, a better understanding on the level of a participant's contamination ("I noticed a connection" vs. "I used the connection to my advantage"), and clearer results on the effect of contamination on perceptual implicit memory.

An Address of the Conceptual Implicit Memory Task

Reliable priming in both between-participants conditions. The typical implicit memory paradigm held, in which studied items were identified as exemplars of products more than unstudied items. Results revealed that participants in either condition were able to correctly produce significantly more old items (previously exposed to) on the category exemplar generation task relative to new items. This result is exactly as H_2A predicted; participants in a webpage-engaged condition will name a brand as an exemplar at a higher rate for ads to which they have been exposed versus ads to which they have not been exposed.

TAP supports the effect for direct attention in conceptual implicit memory. Before accounting for either of the covariates, the results show that those in the engaged condition performed better on the category exemplar generation task than those in the passive condition. This would suggest that, unlike *perceptual* implicit memory priming, a participant's level of engagement is crucial for being able to measure implicit memory when testing conceptually. This is exactly what H_2B predicted; participants in an ad-engaged condition (to be defined below) will name a brand as an exemplar at a higher rate for ads to which they have been exposed versus ads to which they have not been exposed, with a greater difference between ad-engaged and webpage-engaged conditions due to the depth of the engagement.

Further, the results not only support the researcher's hypotheses but also add support to the TAP framework. TAP framework claims that conceptual implicit memory works similar to EM, such that for priming to take effect there needs to be an emphasis on processing the conceptual and semantic features of the stimuli rather than just observing the superficial features. They need to be forced to engage with the stimuli on a deeper cognitive level. Because of this need for a deeper level of encoding, TAP framework claims that *conceptual* implicit memory has an attentional requirement. This is shown in the results of the current study where the ad-engaged condition significantly outperformed the webpage-engaged condition. Participants in the ad-engaged condition were advised to only focus on the embedded advertisement allowing deeper processing of the advertisement, rather than trying to encode the entire website as the webpage-engaged condition was advised to do. Those in the ad-engaged condition not only had the advantage of being directly engaged with the advertisement, but they were also asked to rate their familiarity with the shown ad. Rating their familiarity with the ad forced them to encode the advertisement on a deeper level than those in the webpage-engaged condition, resulting in higher implicit memory score for those in the ad-engaged condition (Northup & Mulligan, 2013).

Examining explicit contamination as a covariate. As was done with the perceptual study, explicit contamination was used as covariate for the conceptual task. When accounting for explicit contamination (all contamination; those highly contaminated removed) the results were the same as previously mentioned. The engaged participants produced the correct exemplar on the category exemplar generation task significantly more than the passive participants. These findings align with the researchers' hypotheses, as well as continue to validate the TAP framework. When testing implicit memory with a conceptual task direct attention to the target stimuli is required for an individual to be able to properly encode the information.

A significant covariate in conceptual priming. Additional results revealed effects identical to the perceptual task. When accounting for explicit contamination in the model, results showed that a participant's explicit contamination significantly affected their implicit memory score. If the participants scored higher on the explicit contamination measure, then they also performed better on the category exemplar generation task. According to these results, it would imply that the participants were aware of the connection between the embedded advertisements and the category headings that were being presented to them during their task. It also implies that once they became aware of the connection between them, they used this to their advantage to produce the correct category exemplar on the task.

More plausible contamination in the conceptual study. As was advocated for in the perceptual section above, the researchers again would like to bring in to question the validity of these explicit contamination measures. Are these accurate measures of their true contamination? The current study implemented a speeded task for both the perceptual and the conceptual task. This was done by forcing the participants to produce their answer to the task in less the 7.5 seconds. Similar to the perceptual task, researchers are still reluctant to believe that participants were able to read the category heading presented on the screen, filter through the 20 webpages they had just been exposed to (keep in mind, they also have to be able to confidently remember which 20 they were exposed to and realize that the other 20 headings were never mentioned in the webpages), correlate the ad on the webpage with the presented heading, and then type the answer in to the textbox. Participants would have to repeat this process for all 40 trials. However, due to the conceptual priming of the stimuli and the deeper levels of encoding, researchers are willing to concede that the participants may have been able to make a connection between embedded ads and the category headings after the fact. In other words, they did not become aware of the connection between the embedded ad and the category heading until after they had already produced their answer. But, because they were aware of the connection in general and because this awareness occurred before being given the explicit contamination survey, they believe that they had been highly contaminated. Their answer was produced implicitly due to the time constraint, but because they had conceptually encoded the advertisement so heavily, they believed this aided them during the conceptual implicit memory task. Researching ways to improve measuring and monitoring explicit contamination are highly compelled for, as it would further validate implicit and EM research as a field within cognitive psychology.

Examining EM as a covariate. An additional analysis was conducted to examine the effects of engagement on the category exemplar generation task when accounting for explicit memory (EM) as a covariate. The effects of engagement were identical to all previous analysis; participants who were directly engaged with the embedded advertisement performed better on the category exemplar generation task compared to those who were webpage-engaged. These results continue to reinforce the support for the suggested experiment hypotheses and further provide evidence for TAP framework. Like explicit contamination, EM was shown to significantly affect the statistical model. Participants that produced higher EM results also produced higher implicit memory score results. EM being correlated with participants' scores on the implicit memory task is more plausible than explicit contamination being correlated. This is due to the encoding similarities between conceptual implicit memory and EM. As stated previously, conceptual implicit memory requires a deeper level of encoding to occur at study. Because of this deep encoding, it allowed for participants to excel on the EM measure (M = .81, SD = .12).

Conceptual Task Implications

An apparent priming effect significantly enhanced by direct attention. Study 2 offered many methodology improvements to previous studies. Along with these improvements, results revealed robust priming effects that are directly in line with TAP framework. The participants in the engaged condition, regardless of the covariates examined, always outperformed the participants in the passive condition. These findings add to the implicit memory research and allow for a better understanding of conceptual priming.

A concession to, but difficulty describing, the role of explicit contamination/memory. Explicit contamination was shown to significantly affect the participant's ability to perform on the category exemplar generation task. Researchers want to stress the need for extensive research on explicit contamination and how to better measure it. Whether that is implementing the measurement of purported contamination, as researchers attempted to do here, or a completely different method that somehow allows for researchers to have a better understanding of contamination.

General Implications and Future Directions

The current experiment offers a magnitude of implications and is almost limitless on how future studies could adopt and improve upon theoretical framework and/or methodology. The major implication(s) was that the current experiment found robust priming effects in both the perceptual and conceptual studies. The perceptual task results revealed that when assessing implicit memory via a perceptual model, there is not a direct attentional requirement for the stimuli to be encoded. Whereas for the conceptual model, our results revealed that direct attention to the stimuli is crucial for proper encoding to occur. Both sets of results further validate and provide support for Transfer Appropriate Processing (TAP) as a theoretical framework for implicit memory research.

Although the covariate of explicit contamination was shown to significantly affect both studies, researchers are reluctant to claim that explicit contamination truly influenced the participants' answers in the manner that the statistical analysis would imply. As mention previously, researchers will concede that participants may have become aware of the connection between the embedded ads and the implicit memory task (perceptual picture identification or category exemplar generation). But the researchers will not concede that the participants became aware of this connection during the implicit memory task and used this to their advantage when answering the prompts. Researchers strongly advocated that their participants' answers were produced implicitly, and the connection awareness took place after the face. This is why future research needs to exclusively focus on explicit contamination and better methods for measuring and monitoring the participants' level. As stated previously, by improving the way explicit contamination is measured, it will further validate and strengthen any experiment within the implicit memory domain.

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FIGURES

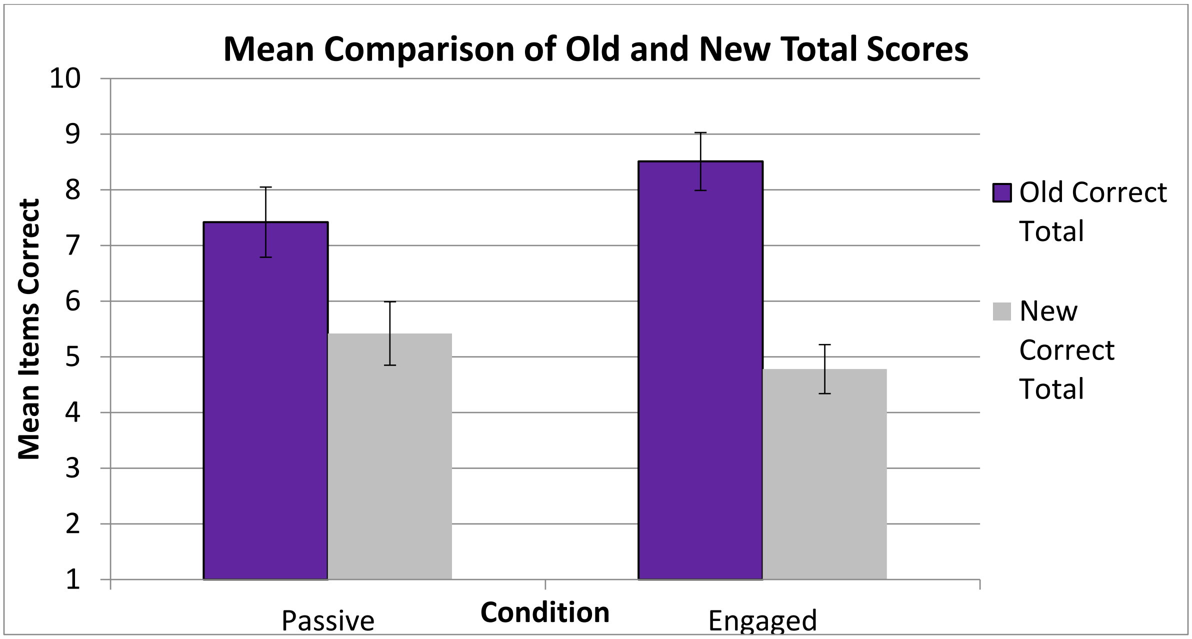


Figure 1. *Comparison of Old and New Total Scores*

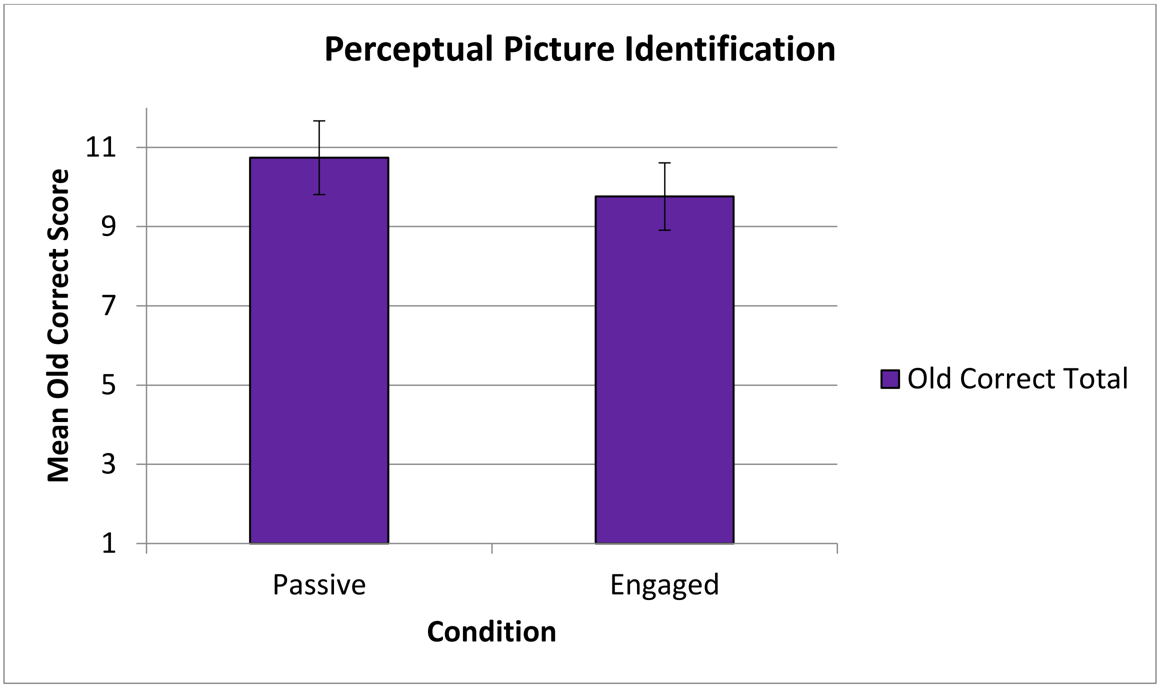


Figure 2. *Perceptual task results – Old Correct Total*

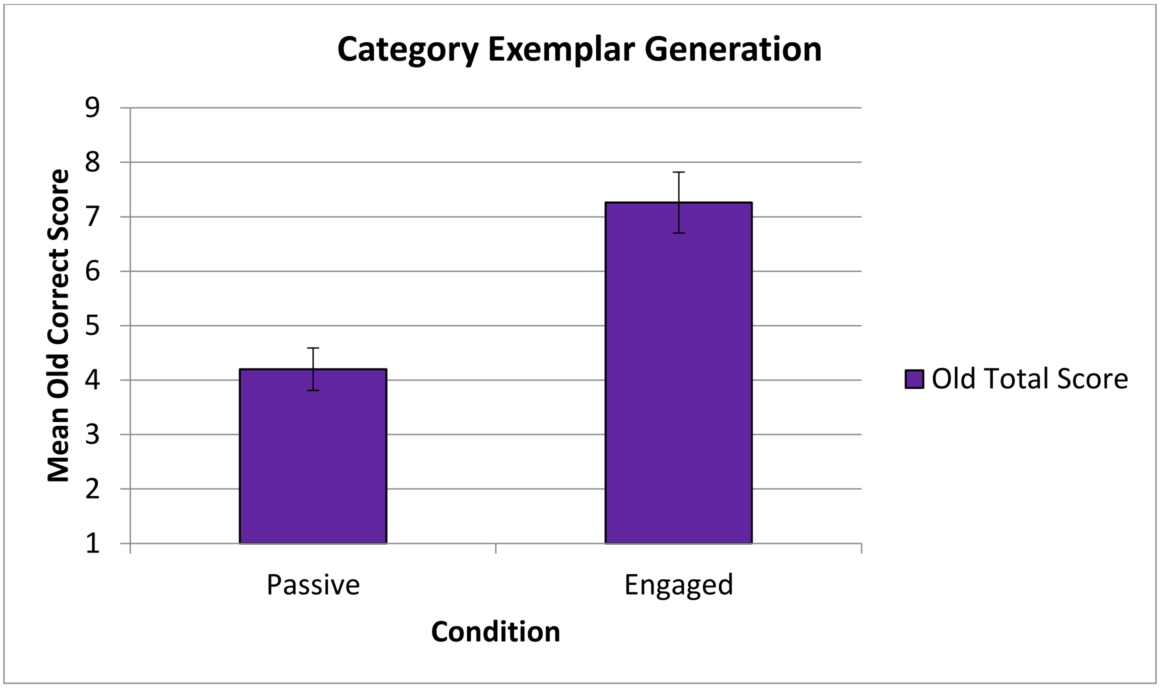


Figure 3. *Conceptual task results – Old Total Score*

TABLES

Table 1

Proportion of speeded items named and proportion of category exemplars named for respective studies by engagement condition.

	Perceptual Task (n=66)		
	Old Correct of 20	New Correct of 20	Priming Score
Engaged	9.97 (4.88)	6.27(4.48)	3.70(2.38)
Passive	10.67(5.51)	8.64(4.78)	2.03(3.20)
	Conceptual Task (n=71)		
	Old Correct of 20	New Correct of 20	Priming Score
Engaged	7.64 (3.54)	3.31 (1.65)	4.33 (3.70)
Passive	4.20 (2.31)	2.26 (1.62)	1.94 (2.70)

Table 2

Perceptual Picture Identification Regression Model

	Variable	β	p	R^2
Model				
	Engagement	.29	>.05	.08
	Explicit Contaminatior	.07	<.05	.09
	Explicit Memory	-0.09	<.05	.10

Table 3

Category Exemplar Generation Regression Model

	Variable	β	p	R^2
Model				
	Explicit Memory	.54	>.001	.29
	Explicit Contaminatior	.27	>.05	.34
	Engagement	-0.002	<.05	.34

APPENDIX A

List of 40 news websites

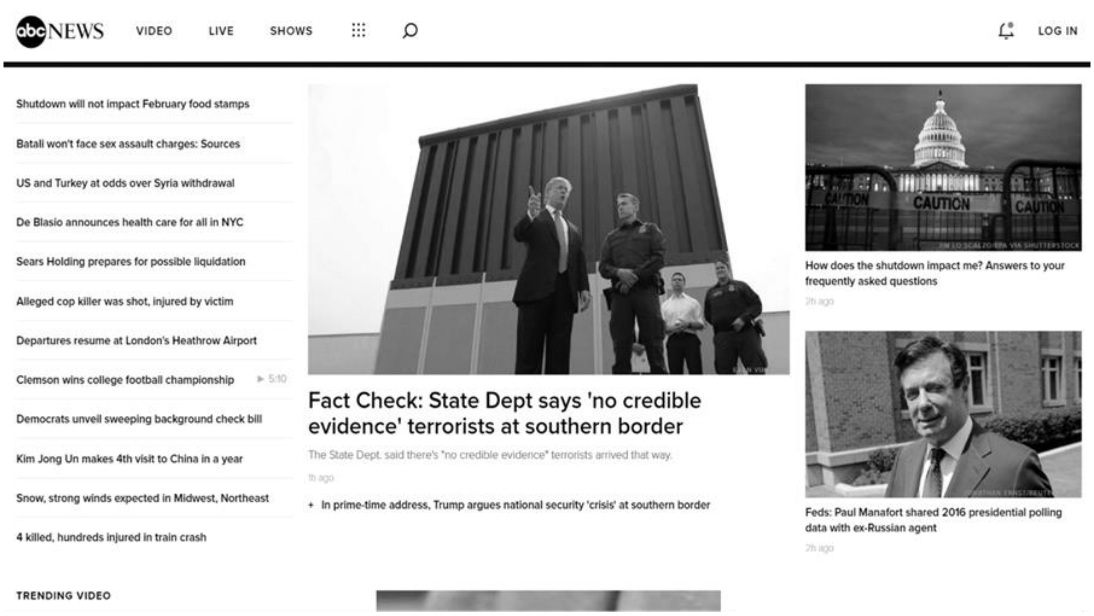
Title of page	URL
CNN	https://us.cnn.com/
New York Times	https://www.nytimes.com/
FOX	https://www.foxnews.com/
USA Today	https://www.usatoday.com/news/
Reuter	https://www.reuters.com/news/us
Politico	https://www.politico.com/
Yahoo	https://www.yahoo.com/news/
LA Times	https://www.latimes.com/local/
NBC	https://www.nbcnews.com/
CBS	https://www.cbsnews.com/
New York Post	https://nypost.com/news/
New York Daily	https://www.nydailynews.com/
Newsweek	https://www.newsweek.com/
Denver Post	https://www.denverpost.com/
Washington Times	https://www.washingtontimes.com/
Mercury	https://www.mercurynews.com/
Philly	http://www2.philly.com/

Saint Louis Post	https://www.stltoday.com/
Chicago Sun	https://chicago.suntimes.com/
Wall Street Journal	https://www.wsj.com/
San Francisco Chronicle	https://www.sfchronicle.com/
TIME	http://time.com/
Florida Sentinel	https://www.sun-sentinel.com/news/florida/
Charlotte Observer	https://www.charlotteobserver.com/news/state/north-carolina/
Kansas City Star	https://www.kansascity.com/news/
Providence Journal	http://www.providencejournal.com/news
WTOP	https://wtop.com/local/dc/
Orlando Sentinel	https://www.orlandosentinel.com/news/
CBS – San Francisco	https://sanfrancisco.cbslocal.com/
CBS – New York	https://newyork.cbslocal.com/
CBS - Minnesota	https://minnesota.cbslocal.com/
FOX 2 Now – Saint Louis	https://fox2now.com/
Daily Herald	https://www.dailyherald.com/
ABC – Washington D.C.	https://wjla.com/
Boston Herald	https://www.bostonherald.com/

Seattle Post-Intelligencer	https://www.seattlepi.com/
ABC	https://abcnews.go.com/
The Onion	https://www.theonion.com/
Wichita Eagle	https://www.kansas.com/
Huffington Post	https://www.huffingtonpost.com/

APPENDIX B

Screenshots of original Websites (2 examples)



abc NEWS VIDEO LIVE SHOWS LOG IN

Shutdown will not impact February food stamps

Batali won't face sex assault charges: Sources

US and Turkey at odds over Syria withdrawal

De Blasio announces health care for all in NYC

Sears Holding prepares for possible liquidation

Alleged cop killer was shot, injured by victim

Departures resume at London's Heathrow Airport

Clemson wins college football championship 5:10

Democrats unveil sweeping background check bill

Kim Jong Un makes 4th visit to China in a year

Snow, strong winds expected in Midwest, Northeast

4 killed, hundreds injured in train crash

TRENDING VIDEO

Fact Check: State Dept says 'no credible evidence' terrorists at southern border

The State Dept. said there's "no credible evidence" terrorists arrived that way.

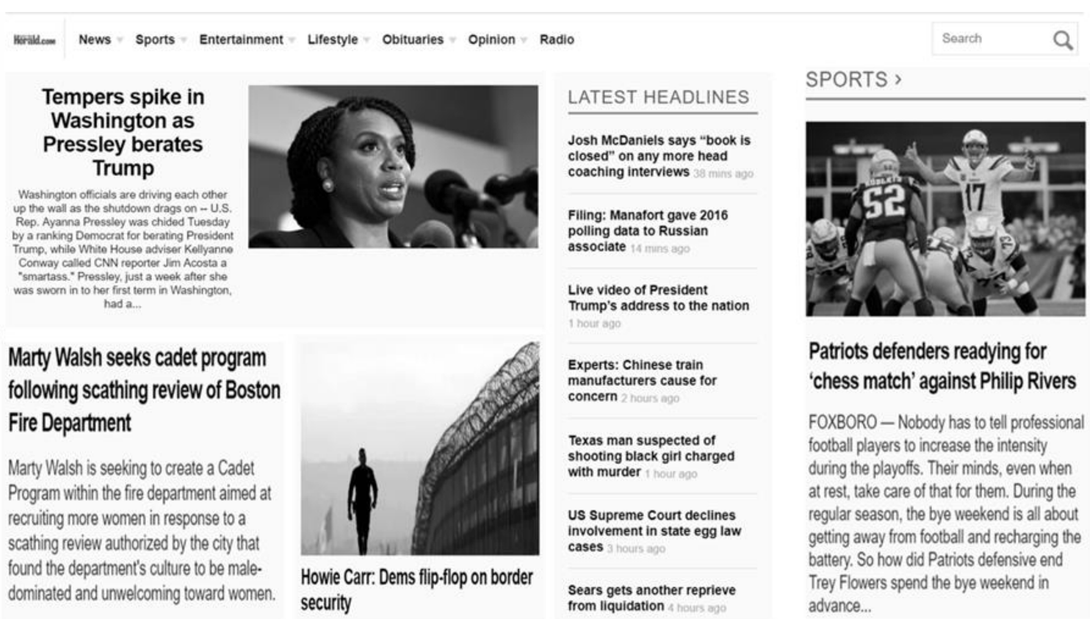
+ In prime-time address, Trump argues national security 'crisis' at southern border

How does the shutdown impact me? Answers to your frequently asked questions

2h ago

Feds: Paul Manafort shared 2016 presidential polling data with ex-Russian agent

2h ago



News Sports Entertainment Lifestyle Obituaries Opinion Radio Search

Tempers spike in Washington as Pressley berates Trump

Washington officials are driving each other up the wall as the shutdown drags on -- U.S. Rep. Ayanna Pressley was chided Tuesday by a ranking Democrat for berating President Trump, while White House adviser Kellyanne Conway called CNN reporter Jim Acosta a "smartass." Pressley, just a week after she was sworn in to her first term in Washington, had a...

Marty Walsh seeks cadet program following scathing review of Boston Fire Department

Marty Walsh is seeking to create a Cadet Program within the fire department aimed at recruiting more women in response to a scathing review authorized by the city that found the department's culture to be male-dominated and unwelcoming toward women.

Howie Carr: Dems flip-flop on border security

LATEST HEADLINES

Josh McDaniels says "book is closed" on any more head coaching interviews 38 mins ago

Filing: Manafort gave 2016 polling data to Russian associate 14 mins ago

Live video of President Trump's address to the nation 1 hour ago

Experts: Chinese train manufacturers cause for concern 2 hours ago

Texas man suspected of shooting black girl charged with murder 1 hour ago

US Supreme Court declines involvement in state egg law cases 3 hours ago

Sears gets another reprieve from liquidation 4 hours ago

SPORTS ›

Patriots defenders readying for 'chess match' against Philip Rivers

FOXBORO — Nobody has to tell professional football players to increase the intensity during the playoffs. Their minds, even when at rest, take care of that for them. During the regular season, the bye weekend is all about getting away from football and recharging the battery. So how did Patriots defensive end Trey Flowers spend the bye weekend in advance...

APPENDIX C

List of Critical Brands (and Categories)

Universal (movie studio)	Advil (pain relief medicine)
Jared Jewelers (jewelry story)	Nikon (camera)
Camel (cigarettes)	Maybelline (makeup)
Ace (hardware store)	Shell (gasoline station)
Dominos (pizza delivery)	Orbit (gum)
Nyquil (flu medicine)	Snickers (candy)
Enterprise (rental car)	Wendy's (fast-food restaurant)
Levis (jeans)	Southwest (airline)
Ashley (furniture store)	Colgate (toothpaste)
Tombstone (microwave pizza)	Payless (shoe store)
Stouffers (frozen dinner)	Samsung (cell phone maker)
Playstation (video game console)	Kibbles and Bit (dog food)
Chase (credit card)	Nordstrom (department store)
Doritos (snack chips)	Smirnoff (alcohol)
Swatch (watch)	Holiday Inn (hotel chain)
Pepsi (soft drink)	Clorox (household cleaner)
Pantene (shampoo)	Budweiser (beer)
Toyota (car)	Steve Madden (shoe company)
Seventeen (magazine)	Häagen-Dazs (ice cream)
Borders (bookstore)	Special K (cereal)

APPENDIX D

40 Embedded ads

CHASE

seventeen

ACE Hardware

UNIVERSAL

CAMEL

Advil

Budweiser

swatch

CLOROX

enterprise

Doritos

TOMBSTONE PIZZA

Colgate

Ashley HOMESTORE

Special K

TOYOTA

Domino's Pizza

BORDERS

Wendy's

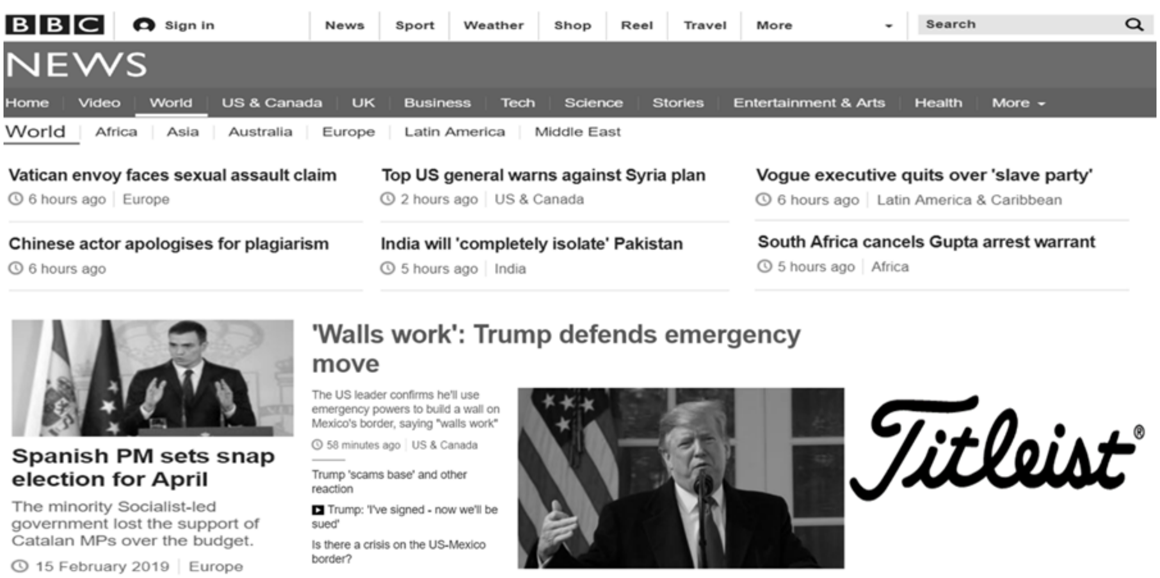
SNICKERS

APPENDIX E

Webpage with Embedded Ad

Left:

Right:



APPENDIX F

Informed Consent Document

Study title: Looking at Websites

Introduction to the study: The current study is within the department of Psychology of Stephen F. Austin State University conducted by graduate student Matthew Custard under the supervision of Dr. Scott Drury. You will be asked to view and study news websites, complete a series of questions, partake in a memory test, and fill-out a quick 5-item questionnaire. The information you are able to remember from the viewed webpages will be utilized in the memory test.

Duration: Participation in this study will take approximately 30 minutes.

Whom to approach with questions: If you have any questions or concerns about being in this study you should contact Matthew Custard at custardml@jacks.sfasu.edu. If you have further questions you may contact the SFASU Office of Research and Sponsored Programs at osrp@sfasu.edu or 936-468-6606 if you would like more information regarding your rights as a research participant.

Participant privacy: An individual's results will be pooled with the results of all other participants and stored without names on the server of the company that runs the software. These results will not include any identifying information, like name or student ID number. That information is kept separately and not able to be reconciled with the sign-up information you at the SONA site.

Risks and discomforts: Minor discomfort due to frustration or fatigue may occur in some individuals. Therefore, be aware that if at any point during the experiment, you are uncomfortable completing a task or answering a survey question, you are free to skip that task or withdraw your participation by merely stopping. You will receive credit anyway.

Compensation: If participating for credit, you will receive 1 research credit1 for 30 minutes of participation. If you should decide you no longer wish to participate in the study; you will not be penalized and may still receive credit depending on the instructor in the course in which you are enrolled.

If you have read and understand all that is stated above and wish to continue please indicate so below.

I have read and understand all that is stated above and wish to continue

____(signature)

I do not wish to continue. (Hand back to researcher)

APPENDIX G

Debrief Statement

Thank you for participating in the study entitled, “Looking at Websites,” conducted by Matthew Custard, and Dr. Scott Drury. This study was designed to assess your memory for web embedded advertisements.

After consenting to participate in this study, you were asked to analyze a series of webpages. These webpages had target advertisements embedded within them. Following the webpages, we tested your implicit memory with either picture identification or category exemplar generation. You were then asked to fill-out three surveys. One was a test of your explicit memory, the next one was to see if you participated in explicit contamination during the study, and the final one was a simple demographics survey. This study is designed to determine whether or not a person’s full attention must be given to an online advertisement in order for it to be remembered.

As a reminder, your participation in this study is confidential, and your name is not attached to any answers you provided. If you experienced negative affect as a result of participating in this study, you may contact SFASU Counseling

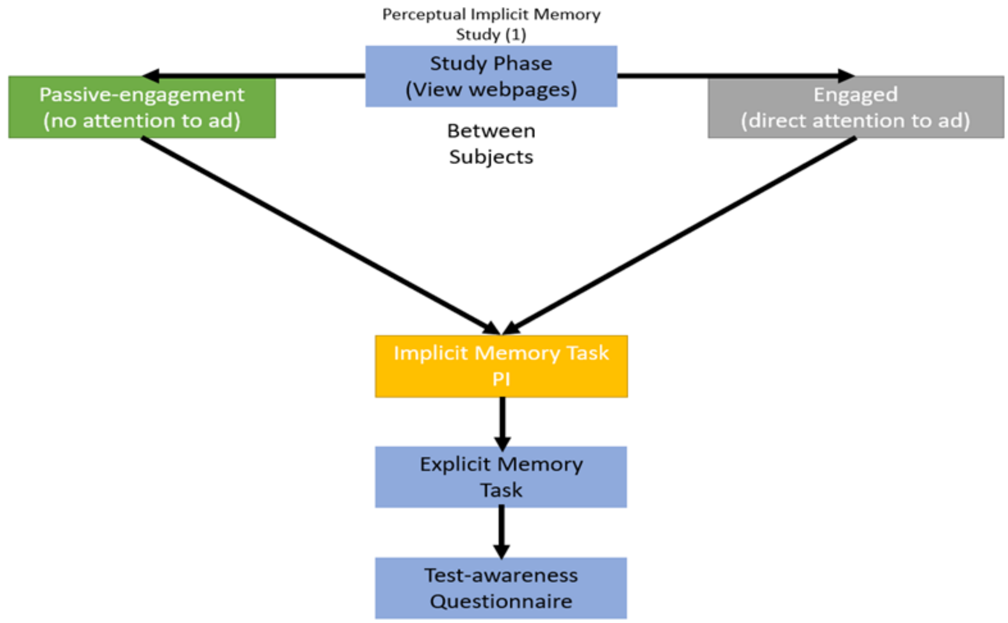
Services, located on the 3rd floor of the Rusk Building, or contact their office at (936) 468-2401 or counseling@sfasu.edu.

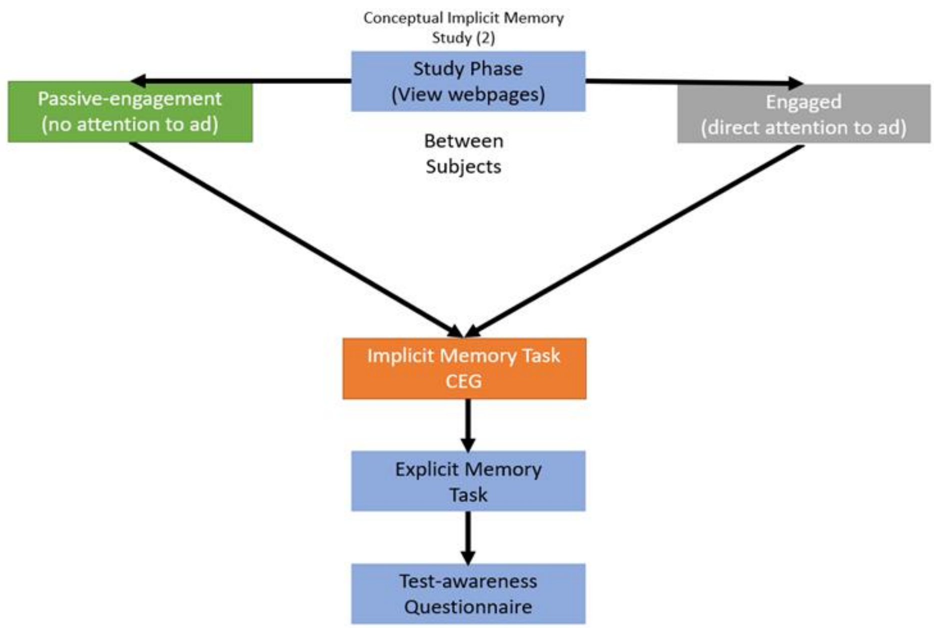
We respectfully ask that you not communicate to other students about the nature of this study or the predicted results until the completion of the project. If you have any additional questions or wish to be informed of the results of the study, you may contact Matthew Custard at custardml@jacks.sfasu.edu.

Thank you for your participation. You may reach The Office of Research and Sponsored Programs at (936) 468-6606.

APPENDIX H

Flow Chart of Methodology





APPENDIX I

Perceptual “test-awareness” Questionnaire

1. What do you think was the purpose of the study you just completed?

2. When you were identifying and rating brand logos, did you think there was anything unusual about brands that you produced?

3. Did you notice any connection between the brand ads embedded in the previously presented webpages and the brand identification activity you performed? If so, what did you notice?

4. If you were aware of a connection between the brand ads embedded in the previously presented webpages and the brand identification activity you performed, were you aware of this connection when you were producing the brands, or did you only become aware of it after I began to ask you these questions?

5. If you noticed that some of the logos corresponded to the brand ads embedded in the webpages, did you intentionally try to use brand ads from the earlier part of the experiment as examples for the presented logos?

Conceptual “test-awareness” Questionnaire

1. What do you think was the purpose of the study you just completed?

2. When you were producing brand names to the categories, did you think there was anything unusual about the categories or the brands that you produced?

3. Did you notice any connection between the brand ads embedded in the previously presented webpages and the brand identification activity you performed? If so, what did you notice?

4. If you were aware of a connection between the brand ads embedded in the previously presented webpages and the brand identification activity you performed, were you aware of this connection when you were producing the brands, or did you only become aware of it after I began to ask you these questions?

5. If you noticed that some of the categories corresponded to the brand ads presented earlier, did you intentionally try to use brands from the earlier part of the experiment as examples for the presented categories?

APPENDIX J

Explicit Memory Questionnaire

Do you remember seeing an advertisement for (insert brand from table)?

VITA

After graduating from Putnam City North High School, Oklahoma City, OK, in 2013, Matthew Custard attended Southwestern College. During his time at Southwestern College, he earned his Bachelor of Arts in Psychology in 2017. Following graduation, Matthew attended Stephen F. Austin State University as a graduate student. In 2019 he graduated with a Master of Arts in Psychology.

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