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Repetition-based impairment effects: when advertising repetition reduces recognition memory for competitor brands

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Abstract

Purpose – Consumers are often exposed to advertising contexts where they encounter multiple brands (e.g. print media, television and online), including where some brands might be seen multiple times and others just once. This study aims to investigate how repeated exposure to brand advertising impacts consumers' recognition memory, and subsequently their choice, for other non-repeated competitor brands present in the advertising context. It examines how brand repetition impairs recognition for non-repeated same-category competitor brands but not for different-category brands. The authors term this the repetition-based impairment effect.

Design/methodology/approach – Experiment 1 uses brand names to test repetition-based impairment effects and examines differential impacts on same-category competitor brands versus different-category brands. Experiment 2 uses real advertisements and a broader set of competing brands. Experiment 3 rules out an alternative explanation for the impairment effects. Finally, Experiment 4 explores how these effects influence subsequent brand choice.

Findings – While repeated advertisements enhance recognition memory for repeated brands, the results show they impair recognition for non-repeated competitor brands within the same product category. This impairment does not occur for brands from different product categories. In addition, repeated advertisements decrease the likelihood of consumers choosing non-repeated same-category brands compared to conditions without repetition.

Research limitations/implications – This research shows that repeated brand advertising can impair recognition memory of other non-repeated competitor brands in the advertising context within the same

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product category. It builds on research on repetition-based and competitive interference memory effects to show that in advertising, brand repetition enhances recognition of repeated brands (facilitation effect) while impairing recognition of non-repeated same-category competitors (impairment effect).

Practical implications – This research highlights that advertisers of a target brand should strategically avoid advertising vehicles in which other brands within the same category engage heavily in repeated advertising if the target brand is not repeated. Advertising in such contexts can lead to poorer recognition of the non-repeated target brand.

Originality/value – By integrating repetition-based and competitive interference effects, this research offers a boundary condition for the repetition-based impairment effect.

Keywords Memory, Recognition, Recall, Competitor brands, Advertising, Impairment, Competitive interference, Repetition

Paper type Research paper

Introduction

Repetition is one of the most common marketing communication strategies used by advertisers to make a brand more memorable. This strategy involves repeatedly exposing consumers to the same advertisement or brand message, typically within a specific advertising vehicle or context (e.g. ads in a magazine or online, a commercial slot or a television program). Yet, advertising often occurs in cluttered environments where some brands are repeated while others appear only once. This raises an important question: How does repeated exposure to one brand affect consumer memory for other, non-repeated brands shown in the same context? In this research, we examine the consequences of repeated brand advertising on recognition memory for competing brands that are not repeated – particularly those within the same product category. Specifically, the current research considers how recognition memory for the non-repeated brand might be impaired in contexts where there is repetition of other brands compared to when there is no repetition of other brands.

Although a considerable amount of research in advertising and marketing has examined whether and how repetition affects consumer memory for brands that are repeated (Burke and Srull, 1988; Janiszewski *et al.*, 2003; Jin *et al.*, 2022; Keller, 1987; Schmidt and Eisend, 2015; Singh *et al.*, 1995; Unnava and Burnkrant, 1991). Prior research has overlooked two important issues that have both theoretical and practical implications. First, much of the research on the effects of repetition on memory in advertising contexts has focused on recall-based memory, leaving a significant gap in understanding of how repetition affects recognition memory. Although both recall and recognition are used as measures of memory, they differ (Gillund and Shiffrin, 1984). Free recall involves retrieving information from memory without any aid (e.g. What brand ad did you see?), whereas recognition involves identifying previously encountered information upon re-exposure (e.g. Did you see Brand A?). From a practical perspective in consumer behavior contexts, many consumer decisions do not require recall-based memory but instead rely on recognition (Bettman, 1979). For example, although most advertising is encountered outside the purchase environment, many purchase decisions are made in-store or online, where brands are displayed and recognized as those from previously seen advertisements.

Second, prior research has primarily focused on how repeated exposure to a brand affects the memory of that repeated brand (Burke and Srull, 1988; Janiszewski *et al.*, 2003; Schmidt and Eisend, 2015). Less attention has been given to examining whether memory of repeatedly exposed brands affects the memory of other non-repeated brands. Building on the literature of strength-based interference in memory (e.g. Osth *et al.*, 2014; Ratcliff *et al.*, 1990; Shiffrin *et al.*, 1990), the current research demonstrates the critical finding that repeated exposure to brand

advertisements impairs consumers' recognition memory for other non-repeated competitor brands. This is important, particularly in the context of advertising, because impairment of memory for non-repeated brands suggests that advertising without repetition can be detrimental to the brand.

Strength-based interference in memory literature encompasses phenomena such as the part-list cuing effect (e.g. Slamecka, 1968), the retrieval practice effect (e.g. Anderson *et al.*, 1994), and the list strength effect (Ratcliff *et al.*, 1990). This interference refers to how strengthening some items in a study list through various manipulations (e.g. repetition, longer duration of exposure) reduces memory performance for other non-strengthened items in the list. Because we test repetition in our research, we refer to a *repetition-based impairment effect* rather than a strength-based impairment effect to avoid confusion and delineate from other types of strength-based interference.

The current research contributes to the literature in several ways. First, it extends the strength-based interference paradigm from the basic memory literature (Osth *et al.*, 2014; Shiffrin *et al.*, 1990) by providing an empirical demonstration of impairment effects in the applied setting of advertising using tests of recognition memory. Second, the current research identifies a boundary condition for this impairment effect. It occurs when the repeated and non-repeated brands are competitors within the same product category, but not when they belong to different product categories. That is, non-repeated different category brands appear immune to the impairment effect.

Third, in highly competitive advertising environments, the current research highlights that advertisers of a given target brand should avoid contexts in which competing brands adopt a repetition strategy within a given advertising vehicle, while the target brand is not repeated. Instead, the target brand should seek advertising spaces where competing brands do not use repetition strategies to minimize the risk of memory impairment caused by repetition-based interference.

Lastly, beyond memory, we demonstrate that the impairment effect has a consequential downstream effect on brand choice. Specifically, the current research shows that repeated brands decrease the probability of choosing non-repeated same-category brands compared to conditions where repetition is absent. Thus, the current research contributes to the literature on memory-based versus stimulus-based brand choice (Lee, 2002; Rottenstreich *et al.*, 2007), showing that memory impairment has diagnostic value in predicting consumer choice. By examining impairment effects in recognition memory, the current research provides evidence of an ecologically valid memory phenomenon that has applied value for practitioners.

Given that global advertising expenditures are projected to exceed $1tn in 2025 (WARC, 2024), understanding how advertising repetition affects memory in cluttered environments is both theoretically important and practically significant. Identifying when and how repetition-based interference occurs can help advertisers make more strategic decisions about ad placement in increasingly saturated markets.

Theoretical background

Delineating competitive interference and repetition-based interference

Two types of memory interference are important to understand and distinguish between for the purposes of the current research: competitive interference and repetition-based interference. In memory research, interference refers to the impaired ability to remember an item that was previously encountered (Anderson and Neely, 1996, p. 237). Competitive interference, which involves memory effects resulting from the presence or absence of competitor brands in the advertising environment, has received considerable attention in advertising literature (Burke and

Srull, 1988; Keller, 1987; Kent and Allen, 1994). A general finding of competitive interference suggests that memory for a target brand is impaired when the list of ads includes competitor brands, compared to when it does not. In contrast, repetition-based interference – which refers to the way repeated exposure to certain brands can impair memory for other, non-repeated brands – has not been extensively studied (cf. Jin *et al.*, 2022). The current research takes an integrated approach to examine how competitive and repetition-based interference interact to influence consumer memory. Specifically, it demonstrates that repetition-based interference is intensified when non-repeated brands belong to the same product category as the repeated brands. Table 1 summarizes these distinctions with brand-context examples.

To illustrate competitive interference in advertising contexts, we present a summary of prior research in Table 2. A comparable summary for repetition-based interference is not provided because of the limited literature explicitly addressing this phenomenon in advertising. One exception is Jin *et al.* (2022), who identified a repetition-based interference effect using a recall measure in creative, rather than general, advertising contexts. These limitations highlight the need for and value of the current research.

Repetition-based interference effects: recall versus recognition

Repetition-based interference refers to a phenomenon whereby strengthening certain items in a study list through repetition impairs the memory of other non-strengthened (non-repeated) items from that same study list (Shiffrin *et al.*, 1990). Within the memory literature, this represents a type of strength-based interference, a broader classification that considers how the strength of memory trace can also be enhanced through other manipulations, such as increased exposure duration (Ratcliff *et al.*, 1990). Prior research indicates that repeated exposure to some items impairs recall memory of non-repeated items, although it is less common to observe such impairment effects in recognition memory (Ratcliff *et al.*, 1990; Osth *et al.*, 2014). An explanation for these results relates to the different retrieval processes involved in free recall versus recognition.

To understand this explanation, it is important to appreciate how recall and recognition performance are assessed. In a free recall test, participants are exposed to a list of items and then asked to remember them without any external cues, where performance is typically based on a count or proportion of items correctly retrieved (Ratcliff *et al.*, 1990). In a recognition test, participants are presented with items they previously encountered during the study, along with items they did not encounter (lures), and are asked to indicate whether each item was part of the study (Ratcliff *et al.*, 1990). Unlike recall where a count/proportion of correct responses provides a good indication of memory, recognition performance is typically reported using a discriminability index known as d-prime (d'; Hirshman, 1995). This measure is based on signal detection theory (Green and Swets, 1966). Specifically, d' is calculated by subtracting the z-scores of the false alarm rate (incorrectly identifying lure items) from the z-scores of the hit rate (correctly identifying previously encountered items). That is, d' is essentially an adjustment to the hit rate by taking false alarms into account.

This adjustment to the hit rate is both necessary and important because it corrects for participant guessing and response bias in judgments about whether test items were previously seen. For example, without adjusting for false alarms, a participant who responds liberally with "yes, I recognize that item" to all test items could achieve a hit rate of 100%, even though they are not truly discriminating between previously encountered items and lures. To use an advertising example, a hit occurs when someone who has seen a Gatorade ad later sees a Gatorade product and correctly remembers it from the ad. A false alarm occurs when the person sees a Powerade product and incorrectly remembers the Gatorade ad as having been about Powerade. The magnitude of d' serves as an indicator of recognition performance

Table 1. Differences between competitive interference and repetition-based interference

Type of interference	Key question	Evidence of interference effect and research design required
Competitive interference	Is memory for target brands affected by the presence or absence of competitor brands in a set of ads?	Memory for target brands is impaired when the ad set includes competitor brands, compared to when it does not A typical experimental design uses two between-subjects conditions. In the baseline condition, the ad set includes brands from different categories (e.g. A, B, C, D, where A and B are the target brands). In the experimental condition, the same target brands are presented alongside their category competitors (e.g. A, B, A-competitor, B-competitor). Competitive interference is demonstrated when memory for A and B is worse in the experimental condition than in the baseline
Repetition-based interference	Is memory for non-repeated brands affected by the repetition of other brands in the ad set?	Memory for non-repeated brands is impaired when some brands in the set are repeated, compared to when none are repeated The design involves two conditions. In the baseline, all brands appear only once (e.g. A, B, C, D, where A and B are target brands). In the experimental condition, A and B are shown once, while C and D are repeated (e.g. A, B, 2C, 2D). Repetition-based interference is observed when memory for A and B is worse in the experimental condition than in the baseline
The current research: Integrated approach combining competitive and repetition-based interference	How do repetition and brand category (same vs different) jointly affect recognition memory for non-repeated brands?	The current research demonstrates that repeated exposure to brand advertisements impairs recognition memory for non-repeated same-category competitor brands, but not for different-category brands The experimental design combines the competitive interference and repetition-based interference paradigms, focusing on recognition memory

Source: Authors' own work

Table 2. Prior studies related to competitive interference in advertising contexts

Article	Methods and dependent measure	Findings
Keller (1987)	Experiment Dependent measure: recall	This research demonstrates a moderating effect of advertising retrieval cues on competitive interference. Recall of brand claims for the target brand was reduced in the presence of competitor ads. Yet, these interference effects were mitigated when advertising retrieval cues (e.g. ad photos and headlines) were presented, compared to when such cues were absent
Burke and Srull (1988)	Experiment Dependent measure: recall	Experiment 3 found that the recall of information about repeated brands significantly decreased as the amount of competitive advertising increased (e.g. from no competitor brands to three competitor brands). The study demonstrated that competitive advertising has a significant impairing effect on the recall of repeated brands
Kent and Allen (1993)	Experiment Dependent measure: recall and recognition	The study found that while the presence of competitor ads decreased brand recall in television ads, it had little impact on ad claim recall and brand recognition
Unnava and Sirdeshmukh (1994)	Experiment Dependent measure: recall	Experiment 1 showed that repetition increased brand name recall in the absence of competitive advertising, but this effect weakened when competitor ads were present. Notably, varying ad executions (e.g. different versions of the same ad) helped buffer against competitive interference more effectively than repeating the same execution. Similarly, Experiment 2 revealed that using different advertising modalities (e.g. visual and auditory) in repetition reduced interference compared to using a single modality
Kent and Allen (1994)	Experiment Dependent measure: recall	The study demonstrates a moderating role of brand familiarity. Competitive interference was evident for unfamiliar target brands, while ads for well-known brands were largely unaffected in terms of ad claim recall
Danaher *et al.* (2008)	Quantitative modeling using field data Dependent measure: sales	Using actual field data (e.g. real sales and advertising records), the study confirms that competitive interference significantly impacts sales, with the target brand's sales notably diminished
Guitart *et al.* (2020)	Quantitative modeling using field data Dependent measure: conversions	The research identifies competitive interference effects on online conversions and offers practical implications for advertising scheduling strategies to mitigate such effects

Source: Authors' own work

(Weeks *et al.*, 2007). Higher d' values indicate greater accuracy in discriminating between previously encountered and non-encountered test items (e.g. high hit rates and low false alarm rates). In contrast, lower d' values reflect poorer recognition accuracy, suggesting reduced ability to distinguish between previously encountered items and lures (e.g. similar hit and false alarm rates).

Prior research has demonstrated repetition-based interference effects in free recall (Jin et al., 2006; Shiffrin *et al.*, 1990), and it is important to understand the mechanisms underlying this interference. The free recall process involves a memory search in which individuals actively retrieve information from memory (Gillund and Shiffrin, 1984). During this search, they access various mental representations of previously encountered items, attempting to recall them from the study context (Shiffrin *et al.*, 1990). Importantly, items are selected and recalled based on their relative strength in memory (Murnane and Shiffrin, 1991). Because repetition strengthens memory representations, repeated items are more easily recalled. Yet, recalling a repeated item can interfere with the retrieval of non-repeated items (Shiffrin *et al.*, 1990). This occurs because, during subsequent memory searches, the stronger repeated item is more likely to be retrieved again. As a consequence, not-repeated items that have not yet been recalled – being weaker in memory – are less likely to be retrieved. This imbalance in retrieval strength gives rise to the repetition-based interference effect (Shiffrin *et al.*, 1990).

In contrast to free recall, repetition-based impairment is typically not observed in recognition studies (Shiffrin *et al.*, 1990), despite some research showing evidence for it (e.g. Norman, 2002; Osth *et al.*, 2014; Verde and Rotello, 2004). Part of the explanation for not observing repetition-based impairment in recognition may stem from research design considerations and the use of d' as a measure. Before discussing this in more detail, consider the following experimental scenario designed to test the repetition-based interference effect. There are two conditions. In the baseline condition, participants are exposed to four items once (A, B, C, D). In the experimental condition, items A and B are shown once, while items C and D are repeated (i.e. A, B, C, C, D, D). During a recognition test, participants are asked to indicate whether they recognize previously seen items (A, B, C, D) as well as lures that they had not encountered before (W, X, Y, Z). We can assess hit rates for repeated items (C and D) and non-repeated items (A and B) across the two conditions. In addition, false alarm rates to lures (W–Z) can be measured across conditions.

We contend the answer lies partly in the use of d' as a holistic measure that combines hit rates and false alarms, which may obscure important differences in the individual trends of these two components (Weeks *et al.*, 2007). In a recognition test, when an individual is asked whether they saw an item (e.g. A), they make a judgment based on the strength of the matching signal – specifically, the degree to which item A matches its mental representation in memory (Ratcliff *et al.*, 1990). When the matching signal is strong, the person is likely to respond, "Yes, I saw the item." This increases the hit rate when correct. Ratcliff *et al.* (1990) argue that when some items in a list are repeated, the matching signal for repeated items becomes stronger, while the signal for the non-repeated items within the same list becomes weaker. Therefore, hit rates should increase for the repeated items (C and D) and decrease for the non-repeated items (A and B) in the experimental condition compared to the baseline condition. If we only consider the hit rate component of the non-repeated items, it appears that repetition-based interference occurs similarly to what is observed in free recall, as the hit rate for the same non-repeated items (A and B) is lower in the experimental condition than in the baseline condition. However, d' also includes another component – false alarm rates – that must be considered.

Research suggests that repeated items in a list may influence false alarm rates. Specifically, repetition enhances the memory strength of repeated items, making them more distinct from

items that were not previously seen (i.e. lures). Consequently, the perceived match strength for lures decreases because they stand in greater contrast to the strongly encoded repeated items. This phenomenon, known as *differentiation*, refers to the increasing disparity between the robust memory traces of repeated items and the weaker traces of non-target lures (McClelland and Chappell, 1998; Shiffrin *et al.*, 1990; Shiffrin and Steyvers, 1997). Consequently, lures are less likely to be mistakenly recognized as previously seen. Using a brand example of how differentiation can lead to reduced false alarms, consider when Energizer introduced the Energizer Bunny advertisement. Initially, many consumers associated it with Duracell, indicating a higher false alarm rate despite Energizer's substantial investment in advertising that year. According to an Energizer spokesman, this confusion decreased with greater exposure through repetition across time (Liesse, 1990). This example demonstrates how strengthening memory for the focal brand, Energizer, through heavy advertising enhances differentiation – it leads to an increase in the correct identification of the target brand (Energizer) and a decrease in the incorrect identification of the lure brand (Duracell). Returning to the experimental scenario, evidence of differentiation can be observed when the false alarm rates for items W to Z in the experimental condition – where items C and D are repeated – are lower than those in the baseline condition.

In summary, strengthening some items in a list through repetition has two opposing effects on non-repeated items in recognition tasks. First, repetition lowers the hit rate for non-repeated items (e.g. items A and B), reducing recognition accuracy in the experimental condition compared to the baseline condition. Second, it also lowers the false alarm rate for lures (e.g. W to Z) through differentiation, which increases recognition accuracy in the experimental condition. These opposing effects can cancel each other out, thereby masking the repetition-based impairment effect when recognition is measured using d'. Building on these ideas, the following section explores when and how repetition-based impairment can be observed in recognition.

Evidence of impairment effects for recognition memory

Most studies that report no strength-based impairment effects in recognition memory use word lists where words are randomly selected from a word pool or database (e.g. the Toronto Word Pool), which is common in basic memory research (Ratcliff *et al.*, 1990). In the few cases where impairment effects are observed, the studies involve more complex stimuli, where repeated items share characteristics or "overlap" with non-repeated items or other test items (e.g. Norman, 2002; Osth *et al.*, 2014; Verde and Rotello, 2004).

For example, in associative recognition research, where participants must remember two associated items, usually in the form of word pairs (as opposed to item recognition, where participants must remember single items or single words), Verde and Rotello (2004) found a strength-based impairment effect in recognition. Participants were presented with "overlapping" word pairs, in which one word appeared in multiple pairs (e.g. lake–monkey, lake–chest, bread–monkey). Some of these pairs were repeated, while others were not. The study found that repetition enhanced recognition for repeated pairs but impaired recognition performance for non-repeated pairs. In contrast, Osth and Dennis (2014) found no impairment effect in a similar study that used non-overlapping word pairs. In another study, Norman (2002) observed an impairment effect in recognition using a plurality discrimination task. Participants studied lists of singular and plural words (e.g. apple, oranges), with some words repeated and others not. During the test phrase, participants made recognition judgments for words that were either the same plurality as the studied words (e.g. apple, oranges) or different plurality lures (e.g. apples and orange). The results showed that

recognition was enhanced for repeated words but impaired for non-repeated words, indicating an impairment effect.

One explanation for the impairment effect observed in these recognition tasks is that a high level of similarity or overlap between items presented during the study phase and those encountered during the test phase makes the recognition task more difficult. This increased difficulty may prompt participants to engage in a recall-like process, relying on memory retrieval strategies similar to those used in free recall. Hence, an impairment effect may emerge, resembling what is typically observed in free recall tasks (Norman, 2002; Verde & Rotello, 2004). Yet, not all researchers agree that this impairment effect stems from a recall-like process. Osth et al. (2014), using non-word stimuli (i.e. fractal-like forms), suggested that overlap among stimuli may introduce additional interference within the study list, as items with shared features compete with one another. This interference could mean that when some items are reinforced through repetition, confusion among similar items increases, preventing differentiation from occurring. Thus, hit rates may decline while false alarm rates remain unchanged, making the recognition task more difficult. In such cases, recognition for non-repeated items may be impaired, as reflected in a lower d' – with reduced hit rates but no corresponding decrease in false alarms.

In summary, when stimuli overlap or are conceptually similar to other items in the study and test phases, strength-based impairment effects in recognition can emerge – including repetition-based impairment effects. This is an important observation, as brands in advertising contexts often share considerable similarity with competitor brands in consumers' minds (e.g. Gatorade and Powerade), particularly when they belong to the same product category. These insights form the basis of our proposed hypotheses, discussed in the following section.

Proposed hypotheses

As the literature suggests, a critical factor in determining the conditions in which repetition-based impairment effects occur in recognition memory is the degree of similarity or relatedness among list and test items (Osth *et al.*, 2014). When tested items are dissimilar or unrelated, studies are less likely to observe impairment effects in recognition memory (Osth and Dennis, 2014). Conversely, significant impairment effects are often found when similar or related items are involved (Norman, 2002; Verde and Rotello, 2004). This phenomenon is particularly relevant to advertising contexts, where brands within the same product category frequently share conceptual similarities in consumers' minds, leading to representational overlap in memory. Such overlap arises because these brands offer similar products or services and are often encountered in comparable contexts (e.g. Energizer and Duracell; Crest and Colgate; and MasterCard and Visa).

Given these considerations, we hypothesize that repetition-based impairment effects in recognition memory will be especially likely for brands within the same product category featured in an advertising context. As discussed earlier, repeated exposure to one brand strengthens its memory representation, which can interfere with the recognition of similar, non-repeated competitor brands because of conceptual similarity or representational overlap. In this setting, we expect that repetition enhances recognition accuracy for repeated brands while impairing recognition for non-repeated competitor brands within the same category. This targeted impairment effect aligns with prior research showing that similarity or overlap among items can lead to recognition difficulties, particularly in studies where such overlap has triggered impairment effects (Norman, 2002; Osth *et al.*, 2014; Verde and Rotello, 2004). Furthermore, the literature consistently demonstrates that repetition strengthens memory representations, resulting in higher recognition accuracy for repeated items (Hirshman, 1995; Ratcliff *et al.*, 1990). This hypothesis (*H1*) is foundational, as it establishes the expected

facilitation effect of repetition – an essential condition for any subsequent impairment effects involving non-repeated items. Accordingly, the following hypotheses are proposed:

H1. Brand repetition will lead to increased recognition (d') for the repeated brands compared to when there is no brand repetition (facilitation effect).

H2. Brand repetition will lead to decreased recognition (d') for non-repeated brands compared to when there is no brand repetition, but this effect will be restricted to same-category brands only.

To bolster our argument that same-category competitor brands will exhibit an impairment effect because of representational overlap in memory, we draw on previous research demonstrating impairment effects in recognition tasks (Norman, 2002; Osth *et al.*, 2014; Verde and Rotello, 2004). Specifically, to further examine our *H1* and *H2* predictions, the current research dissects the components of d' to determine whether a greater decline in d' for non-repeated same-category brands, compared to non-repeated different-category brands, is driven by changes in hit rates and/or false alarms. Conceptual overlap theories suggest that such a decline in d' is primarily because of reduced hit rates, as the memory representations of same-category brands become less distinct (Osth and Dennis, 2014). In contrast, false alarm rates are expected to remain relatively stable, owing to the lack of differentiation among these overlapping memory traces (Osth *et al.*, 2014). Furthermore, if conceptual overlap is the source of the impairment, we would expect lower hit rates for non-repeated same-category brands compared to different-category brands. This is because the increased difficulty of the recognition task – caused by the overlap – either prompts a shift toward recall-like processes (Norman, 2002; Verde and Rotello, 2004) or introduces additional interference within the study list, thereby reducing differentiation (Osth *et al.*, 2014). Based on this reasoning, the following hypothesis is proposed:

H3. Brand repetition will lead to decreased recognition hit rates for non-repeated brands compared to when there is no brand repetition, with this effect being (a) stronger for same-category brands and (b) weaker for different-category brands.

Correspondingly, if the increased difficulty of the recognition task caused by overlap reduces differentiation (Osth *et al.*, 2014), we would expect to see a smaller (or no) reduction in false alarms when items are similar. In other words, it is expected that brand repetition will reduce false alarm rates for non-repeated different-category brands (where there is little or no overlap), but not for non-repeated same-category brands (where overlap exists). Therefore, the following hypothesis is proposed:

H4. Brand repetition will lead to decreased recognition false alarm rates for non-repeated brands compared to when there is no brand repetition, with this effect being (a) stronger for different-category brands and (b) weaker (or absent) for same-category brands.

To demonstrate the practical significance of understanding the repetition-based impairment effect and its implications beyond the domain of memory, we seek to explore how memory impairment induced by competitive advertising repetition extends its impact to a downstream consequence, namely, *brand choice*. This expectation is grounded in well-established research demonstrating the critical role of memory in influencing brand choice (Lee, 2002). Specifically, brands that engage in more frequent advertising than their competitors often benefit from heightened consumer awareness, increased brand preference,

and ultimately, greater brand choice (D'Souza and Rao, 1995). Our focus, however, is on the flip side of the effect – that is, we predict that choice will be diminished for brands where recognition is impaired because of the repetition of competitor advertising. When brands within the same category share similar attributes, the repetition of one brand's advertisements is likely to strengthen its memory representation, thereby impairing the recognition and subsequent choice of competing, non-repeated brands.

As Lee (2002) demonstrated, memory plays a significant role in both memory-based and stimulus-based brand choices. Impairing a brand's recognition, therefore, can significantly reduce its likelihood of being chosen by consumers, particularly in a cluttered advertising environment where competing messages vie for attention. Furthermore, prior research highlights how competitive advertising interference diminishes the effectiveness of advertising by diluting the effectiveness of individual brand messages, resulting in lower sales (Danaher *et al.*, 2008) and online conversions (Guitart *et al.*, 2020). This reduction in advertising effectiveness directly correlates with a decrease in brand choice, providing empirical support for the idea that impaired recognition – driven by competitive advertising repetition – will lead to reduced consumer choice for non-repeated brands. In light of these considerations, we formalize our prediction in the following hypothesis:

H5. Brand repetition will lead to decreased choice for non-repeated same-category brands, compared to when there is no brand repetition.

Overview of experiments

To test our hypotheses, we conducted four experiments designed to progressively build evidence for the repetition-based impairment effect and its downstream consequences. Because the current research examines how repetition affects memory impairment and brand choice among competing versus non-competing brands, brand memory – rather than ad memory – serves as a direct and theoretically relevant measure of the hypothesized effects across all experiments.

Experiment 1 established the basic repetition-based impairment effect using familiar brand names, showing that memory impairment for non-repeated brands occurs only when they belong to the same product category as the repeated brand. To enhance ecological validity, Experiment 2 used real advertisements and a broader set of competing brands, replicating the impairment effect in a more realistic, cluttered advertising environment. However, a potential confound in Experiments 1 and 2 is that the total number of ad exposures varied across conditions, with the repeated-brand condition involving longer exposure lists. Experiment 3 addressed this limitation by equating the total number of ad exposures across conditions, thereby isolating the effect of list length. Finally, Experiment 4 tested whether repetition-based memory impairment extends to downstream behavior by examining its impact on brand choice for non-repeated same-category competitors. Together, these four experiments provide a coherent and cumulative test of how advertising repetition influences memory and choice in competitive brand environments.

Experiment 1

In Experiment 1, we expected to observe a repetition-based impairment effect that would be restricted to non-repeated same-category competitor brands.

Participants and design

A total of 291 undergraduate students from a Midwestern university participated in the experiment for course credit (45.2% male, 54.8% female). The study used a 2 (brand repetition:

present, absent) × 2 (test lure type: same-category, different-category) between-group design. Participants viewed two sets of brands (Set A and Set B). In the repetition-present condition, Set A brands were seen once and Set B brands were seen three times. In the repetition-absent condition, both sets were seen only once. For the same-category (different-category) test lure condition, all test lures were from the same product (different product) categories as the studied brands. For dependent measures, we assessed hit rates and false alarm rates, which we used to calculate recognition accuracy in the form of d'.

Procedure

The experiment was conducted in a computer lab, with participants randomly assigned to one of four conditions. They were told they would evaluate brand information, but the actual purpose (a memory test) was not disclosed until after. The experiment had three phases: brand exposure, a filler task and a memory test.

Participants viewed 26 brand names in a slideshow, each displayed for one second in the center of a black screen in white font. The set included 10 brands from Set A, 10 from Set B, and six filler brands. In the repetition-absent condition, all brands were shown once, while in the repetition-present condition, Set A brands were shown once and Set B brands three times. Brand order was randomized, and repeated brands were never shown consecutively. Three filler brands were placed at the start and end to minimize primacy and recency effects.

After the slideshow, participants completed a five-minute arithmetic filler task, followed by a yes/no recognition test. The test included 42 brands: 2 filler brands, 10 from Set A, 10 from Set B and 20 lure brands. Participants in the same-category lure condition saw 20 same-category brands, while those in the different-category condition saw 20 different-category brands. The test order was randomized, and two filler test brands were shown first to guide responses. Participants answered "yes" or "no" for each brand and could not change their responses. The experiment lasted about 25 minutes.

Stimuli

A pretest with 38 college students (who did not participate in the main experiments) was conducted to select brands for the study. Participants rated their familiarity with 156 brands from 43 product categories on a 5-point scale (1 = unfamiliar, 5 = very familiar). Based on the results, 20 pairs of competing brands (one pair per category) with similar familiarity levels (e.g. Coke/Pepsi, Visa/Mastercard) were selected. Set A and Set B each contained 10 predetermined brands, while the same-category lure set had 20 competing brands (one per brand in Set A and Set B). For the different-category lure set, 20 brands from unrelated categories were selected. The mean familiarity scores were as follows: Set A (M = 4.17, SD = 0.67), Set B (M = 4.15, SD = 0.66), same-category lure set (M = 4.17, SD = 0.71) and different-category lure set (M = 4.16, SD = 0.69). Six filler brands were chosen from categories unrelated to any of the study or test brands. Figure 1 shows the study design.

Dependent measures

The dependent measures were hit rate, false alarm rate, and *d'* (recognition accuracy), each calculated separately for Sets A and Set B. These measures were calculated individually for each participant. The hit rate was assessed based on each participant's proportion of correct responses to presented items. The false alarm rate was measured by each participant's proportion of incorrect responses to lure items. Recognition accuracy (*d'*) was calculated as *d'* = z (hit rate) – z (false alarm rate), where z (x) represents a z-transformation (Green and Swets, 1966). Because *d'* cannot be calculated when the hit rate or false alarm rate is 1 or 0, perfect rates were converted to 0.99 and 0.01, respectively (Hirshman, 1995).

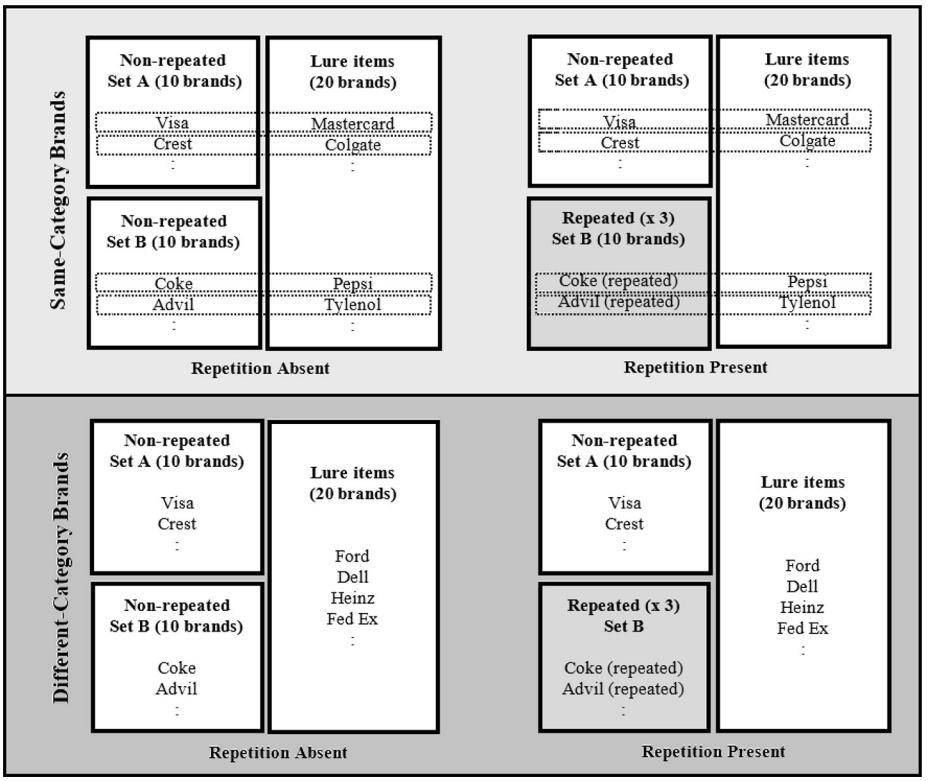

Figure 1. Study design for Experiment 1

Note(s): The design above represents the repetition-present condition of Experiment 2 (in the repetition-absent condition, brands in all sets are shown only once). Each product category has eight brands: four study brands, P*i*B*j*, and four lure brands, P*i*L*j* (where P*i* denotes product category *i*; B*j* denotes brand *j*; L*j* denotes lure *j*). Same-category brands are in dashed boxes

Source: Authors' own work

Results

To test *H1*, which predicted a facilitation effect for repeated brands, we compared performance for Set B brands across the brand repetition-present and -absent conditions. We ran a 2 (brand repetition) × 2 (test lure type) analysis of variance (ANOVA) with *d'* for Set B brands as the dependent measure. In support of *H1*, this showed a significant main effect of repetition ($F(1, 287) = 80.27$, $p < 0.001$), such that *d'* for the repetition-present condition was significantly higher than *d'* for the repetition-absent condition, ($d'_{\text{RepPres}} = 2.46$, $d'_{\text{RepAbs}} = 1.61$). There was a marginally significant interaction between repetition and lure type ($F(1, 287) = 3.69$, $p = 0.056$). Adding further support to *H1*, planned comparisons via simple effects analysis showed that the facilitation effect was robust across lure types. Repetition significantly improved *d'* scores when lures were from different product categories than the studied brands ($d'_{\text{Diff\_RepPres}} = 2.74$, $d'_{\text{Diff\_RepAbs}} = 1.70$, $t(143) = 6.92$, $p < 0.001$), and also when lures were from the same product categories as the studied brands ($d'_{\text{Same\_RepPres}} = 2.18$, $d'_{\text{Same\_RepAbs}} = 1.51$, $t(144) = 5.69$, $p < 0.001$). *H1* was supported.

H2 suggested non-repeated brands would show an impairment effect in the presence of repetition, but that this would be restricted to same-category brands. To test this hypothesis, a comparison of Set A brands across the repetition and lure type conditions is necessary. We conducted a 2 × 2 ANOVA similar to the above, but with *d'* for Set A as the dependent variable. The main effect of repetition was not significant ($d'_{RepPres}$ = 1.42 vs d'_{RepAbs} = 1.52, $F(1, 287) = 1.63$, $p = 0.20$), but the main effect of lure type was significant ($F(1, 287) = 18.96$, $p < 0.001$), with same-category lures leading to lower memory performance than different-category lures (d'_{Same} = 1.29 vs d'_{Diff} = 1.65). The interaction between repetition and lure type was marginally significant ($F(1, 287) = 3.18$, $p = 0.076$). Importantly, in line with *H2*, planned comparisons via follow-up simple effects analysis revealed a significant impairment effect in the same-category lure condition ($d'_{Same\_RepPres}$ = 1.17, d'_{Same_RepAbs} = 1.42, $F(1, 287) = 4.70$, $p = 0.03$), but no impairment effect in the different-category lure condition ($d'_{Diff\_RepPres}$ = 1.67 vs d'_{Diff_RepAbs} = 1.63, $F(1, 287) = 0.13$, $p = 0.72$). Thus, *H2* was supported.

We ran a 2 × 2 ANOVA with hit rate for Set A brands as the dependent variable. The main effect of repetition was significant ($F(1, 287) = 19.11$, $p < 0.001$), with poorer hit rates observed for non-repeated brands in the repetition-present condition than repetition-absent condition ($HR_{RepPres}$ = 0.65 vs HR_{RepAbs} = 0.74). The main effect of lure type was not significant (HR_{Same} = 0.68 vs HR_{Diff} = 0.71, $F(1, 287) = 1.64$, $p = 0.20$), but importantly, we found a significant interaction effect between repetition and lure type ($F(1, 287) = 6.90$, $p = 0.009$). Follow-up planned comparisons via simple effects analysis revealed that, as expected, hit rates were significantly poorer for non-repeated same-category brands in the repetition-present condition compared to the repetition-absent condition ($HR_{Same\_RepPres}$ = 0.61 vs HR_{Same_RepAbs} = 0.75, $F(1, 287) = 24.57$, $p < 0.001$), but there was no difference in hit rates for non-repeated different-category brands across the repetition conditions ($HR_{Diff\_RepPres}$ = 0.69 vs HR_{Diff_RepAbs} = 0.73, $F(1, 287) = 1.52$, $p = 0.22$). Thus, the results showed that repeated brands had a more harmful effect on the hit rate of non-repeated brands when lures were from the same product category. The results support *H3a* and *H3b*.

To test *H4*, we ran a 2 × 2 ANOVA with false alarm rates for Set A brands as the dependent variable. The main effect of repetition was significant ($F(1, 287) = 8.95$, $p = 0.003$), indicating that false alarm rates were lower in the repetition-present condition than in repetition-absent condition ($FAR_{RepPres}$ = 0.21 vs FAR_{RepAbs} = 0.27). There was also a significant main effect of lure type ($F(1, 287) = 15.33$, $p < 0.001$), with false alarm rates higher for same-category lure items compared to different-category lure items (FAR_{Same} = 0.27 vs FAR_{Diff} = 0.20). The interaction between repetition and lure type was not significant ($F(1, 287) = 0.11$, $p = 0.75$). Planned comparisons revealed that repetition led to a significant decline in false alarms for non-repeated different-category brands ($FAR_{Diff\_RepPres}$ = 0.17 vs FAR_{Diff_RepAbs} = 0.23, $t(143) = 2.30$, $p = 0.023$) but only a marginally significant decline in false alarms for non-repeated same-category brands ($FAR_{Same\_RepPres}$ = 0.25 vs FAR_{Same_RepAbs} = 0.29, $t(144) = 1.92$, $p = 0.057$). The results suggest false alarms declined to a greater extent with different-category lures than same-category lures, evidencing reduced differentiation with same-category brands. *H4a* and *H4b* were supported. Table 3 summarizes the results.

Discussion

In Experiment 1, we found evidence that repetition led to a facilitation effect for repeated brands and an impairment effect for non-repeated brands when lures were from the same product category. This aligns with research suggesting that conceptual "overlap" among stimuli and test items can lead to impairment effects in recognition memory (Norman, 2002; Osth *et al.*, 2014; Verde and Rotello, 2004). In line with past work showing no impairment

Table 3. Results of Experiment 1 for Non-Repeated Brand Ads (Set A)

	Same-category lure condition			Different-category lure condition		
	d'	Hit rate	False alarm rate	*d'*	Hit rate	False alarm rate
Repetition						
Absent	1.42 (0.65)*	0.75 (0.16)***	0.30 (0.15)**	1.63 (0.84)	0.73 (0.18)	0.23 (0.16)*
Repetition						
Present	1.17 (0.64)*	0.61 (0.17)***	0.22 (0.12)**	1.67 (0.63)	0.69 (0.16)	0.17 (0.13)*

Note(s): Values are means (standard deviations) in each condition. An asterisk(s) represents a significant difference between the two repetition conditions. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$
Source(s): Authors' own work

effect for unrelated items, we found an absence of impairment when lure items were from different product categories (Jin *et al.*, 2008; Ratcliff *et al.*, 1990). Our results suggest that a repetition-based impairment effect in recognition accuracy for non-repeated same-category brands (reduced *d'*) is derived from reduced hit rates with only a marginal decline in false alarms, whereas the lack of impairment effect for non-repeated different-category brands is derived from reduced hit rates and correspondingly reduced false alarm rates (stable *d'*). In terms of explanations about the lack of impairment effect in recognition being because of a differentiation function (Shiffrin *et al.*, 1990), our research accords with the idea that overlapping stimuli may involve lesser differentiation (Norman, 2002). In the next experiment we test for these effects with more ecologically valid stimuli (real brand ads as opposed to just brand names) and a design that creates a competitive advertising context.

Experiment 2

Experiment 2 differed from Experiment 1 in three ways. First, to enhance external validity, Experiment 2 used real brand advertisements as stimuli rather than just brand names.

Although brand names are often used in sports, they usually appear in specific visual formats (e.g. logos or distinct fonts). In Experiment 1, they were presented abstractly, using only uniform white text, limiting external validity. Second, we created a more competitive advertising context by presenting participants with multiple competing brands during the study, as well as multiple competing brands as test lures. This design allowed us to assess whether a repeated brand (e.g. Advil presented three times) will impair recognition of a non-repeated same-category competing brand (e.g. Tylenol) more than a non-repeated different-category brand (e.g. Sprite), when all were presented in the same advertising environment. Third, in Experiment 1, the brand sets (repeated vs non-repeated) were predetermined. In Experiment 2, the allocation of brand ads (repeated, non-repeated, and lure) was randomized across participants to minimize item bias.

Participants and design

A total of 75 undergraduates (41.3% male, 58.7% female) from an introductory marketing course at a Midwestern university participated for extra credit. The experiment used a one-factor between-group design, varying brand repetition (present, absent). Figure 2 shows the design, which included eight brands per product category: four presented brands and four lure brands, across six product categories. In the repetition-present condition, Set B brands were repeated three times (e.g. candy-Twix), Set A brands (same-category) were shown once

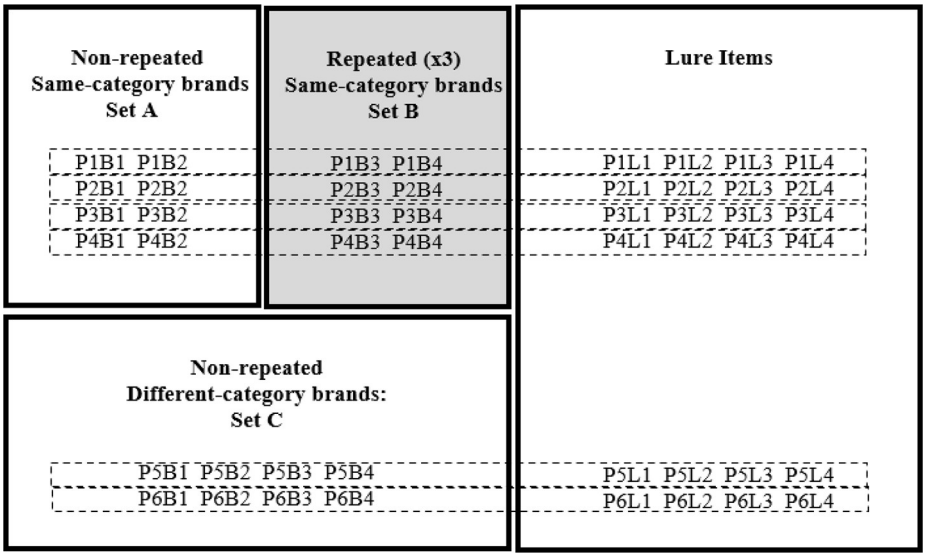

Figure 2. Study design for Experiment 2
Note(s): The total number of exposures in the repetition-present condition is 32 (8 + [8 × 3]), which is the total number of exposures in the repetition-absent condition, 32 (8 + 8 + 16)
Source: Authors' own work

(e.g. candy-KitKat), and Set C brands (different-category) were shown once (e.g. bottled water-Fiji). In the repetition-absent condition, all brands in Sets A, B, and C were shown once.

Stimuli

As a pretest, we selected nine product categories with multiple recognizable brands and pre-selected about 12 competing brands per category. A total of 117 undergraduates from the same university rated their familiarity and attitudes toward each brand. Based on these ratings, we finalized six product categories with eight brands each, excluding those with the highest and lowest familiarity or attitude scores to avoid bias. Familiarity means ranged between 3.9 and 4.1 (SD ≈ 0.70) on a five-point scale. The final categories were bottled water, candy, cereal, chewing gum, detergent and toothpaste, with 48 total brands plus four filler brands.

Six research assistants collected magazine-style ads of the chosen brands from the Internet. Ads were real and varied somewhat but were selected based on the following criteria to minimize execution differences: full package illustration, high visibility of the brand name, no lengthy body text and high resolution.

Procedure

Experiment 2 was conducted in a lab with participants randomly assigned to conditions. Ads were presented on a computer screen, each exposed for three seconds. The allocation of repeated versus non-repeated ads and the assignment of study versus test lure brands within each category were randomized across participants. After the ad presentation, participants

completed a five-minute filler task, similar to Experiment 1. Before the recognition test, participants were given a shopping scenario, imagining they needed to buy the brands they saw, and were instructed to identify those brands in the upcoming task. In the yes/no recognition test, brands were shown one at a time, and participants selected "yes" or "no" to indicate if they saw the brand, even if uncertain. The experiment lasted about 30 minutes.

Results

Repeated brand ads (Set B) in the repetition-present condition led to significantly higher recognition accuracy than the same brand ads presented only once in the repetition-absent condition ($d'_{RepPres}$ = 2.70, d'_{RepAbs} = 1.77, $t(73)$ =5.28, $p < 0.001$). In line with predictions, this represents a facilitation effect for repeated brands, and supports *H1*. For non-repeated same-category brands ads (Set A), results showed an impairment effect for recognition accuracy, in that *d'* was poorer in the repetition-present condition than repetition-absent condition ($d'_{RepPres}$ = 1.43, d'_{RepAbs} = 1.77, $t(73) = -2.17$, $p = 0.03$). In contrast, for non-repeated different-category brand ads (Set C) there was no impairment effect on recognition accuracy, with no significant difference in *d'* across the repetition-present and -absent conditions ($d'_{RepPres}$ = 1.65 vs d'_{RepAbs} = 1.77, $t(73) = -0.48$, $p = 0.48$). Together these results support *H2*.

Similar to the finding in the previous experiment, in Experiment 2 the hit rate for non-repeated same-category brands (Set A) was significantly lower in the repetition-present condition than the repetition-absent condition ($HR_{Same\_RepPres}$ = 0.57 vs HR_{Same_RepAbs} = 0.69, $t(73) = -2.85$, $p = 0.006$). This was in contrast to the hit rate for non-repeated different-category brands (Set C) where there was no significant difference across the repetition-present and -absent conditions ($HR_{Diff\_RepPres}$ = 0.63 vs HR_{Diff_RepAbs} = 0.69, $t(73) = -1.64$, $p = 0.11$). These results support *H3a* and *H3b*. In terms of false alarm rates, because non-repeated same-category brands (Set A) and non-repeated different-category brands (Set C) were presented in the same list, there are not separate false alarm rates for each set (only one false alarm rate for the entire list). There was no significant difference in false alarms rates across the repetition-present and -absent conditions ($FAR_{RepPres}$ = 0.14 vs FAR_{RepAbs} = 0.13, $t(73)$ = 0.369, p = 0.714), thus *H4* was supported in general, but differences in the strength of effect across different- and same-category non-repeated brands could not be tested. A summary of results is presented in Table 4.

Discussion

As in Experiment 1, repetition in Experiment 2 led to facilitation effects in recognition for repeated brands, despite the inclusion of multiple same-category and different-category brands as study and test brands. Repetition also caused impairment in recognition for non-

Table 4. Results of Experiment 2 for non-repeated brand ads

	d'	Hit rate	False alarm rate
Repetition absent (non-repeated brands)	1.77 (0.70)*	0.69 (0.15)*	0.13 (0.09)
Repetition present: Set A (non-repeated same-category brands)	1.43 (0.63)*	0.57 (0.20)*	0.14 (0.11)
Repetition present: Set C (non-repeated different-category brands)	1.65 (0.65)	0.63 (0.17)	0.14 (0.11)

Note(s): Values are means (standard deviations). The target comparisons are repetition absent vs repetition present (Set A), and repetition absent vs repetition present (Set C). *$p < 0.05$
Source: Authors' own work

repeated same-category brands, but not for different-category brands. This impairment effect was driven by a reduction in hit rates, with no evidence of reduced false alarms or differentiation (cf. Shiffrin *et al.*, 1990). These results indicate that recognition impairment can occur in competitive advertising environments with same-category competitors.

While Experiments 1 and 2 show impairment effects in recognition, a potential confound – list length – must be ruled out. In the repetition-present condition, participants saw more brand presentations than in the repetition-absent condition. Because longer lists can impair memory performance (List Length Effect; Gillund and Shiffrin, 1984), Experiment 3 addressed this issue.

Experiment 3

Experiment 3 served as a partial replication of Experiment 2, using Set A and Set B brand ads from Experiment 2 only (not Set C) to restrict focus to non-repeated same-category comparisons. The design also differed in that the number of brand ad presentations was the same across the repetition-present versus absent conditions to rule out differences in list length as an explanation for findings in our earlier experiments. This was achieved by adding extra filler brands to the repetition-absent condition. Figure 3 presents the study design.

Participants and design

A total of 70 undergraduate students (44.3% male, 55.7% female) participated for extra credit. This experiment used a one-factor between-group design, varying brand repetition (present, absent), similar to Experiment 2. Set A and Set B brands from Experiment 2 were used, with non-repeated and repeated brands from the same category. In the repetition-present condition, Set A brands (8 ads) were shown once, and Set B brands (8 ads) were repeated three times, totaling 32 presentations. In the repetition-absent condition, Set A, Set B, and filler brands (16 ads) were each shown once, also totaling 32 presentations. Filler brands were from different categories than Set A and Set B. Lures were same-category brands matched to Set A and Set B, as in Experiment 2. The key comparison was memory performance for non-repeated Set A brands across conditions. The procedure followed that of Experiment 2, including a five-minute filler task, with the experiment lasting about 30 minutes.

Results

Results showed that recognition performance for repeated brands (Set B) in the repetition-present condition did not significantly differ from the same brands (Set B) seen only once in the repetition-absent condition ($d'_{\text{RepPres}} = 2.02$ vs $d'_{\text{RepAbs}} = 1.84$, $t(68) = 0.78$, $p = 0.440$).

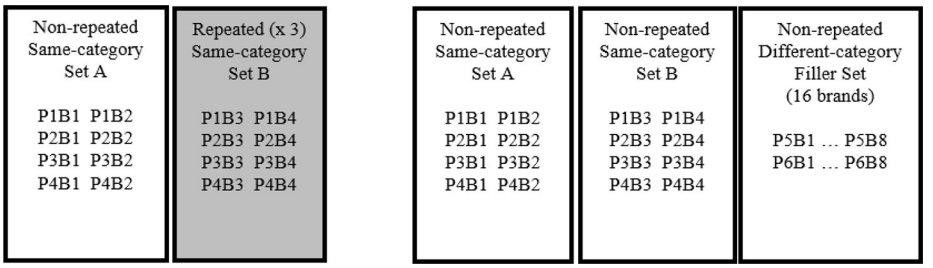

Figure 3. Study design for Experiment 3
Source: Authors' own work

Despite this, hit rates were significantly higher for Set B brands in the repetition-present condition compared to the repetition-absent condition ($HR_{RepPres}$ = 0.83 vs HR_{RepAbs} = 0.73, $t(68) = 2.39$, $p = 0.020$). This rise in hit rates tends to suggest repetition did strengthen memory for these brands, but that it was not reflected in overall *d'* performance. Thus, *H1* is partially supported, but through hit rates only. Recognition performance for non-repeated same-category brands (Set A) was significantly poorer in the repetition-present condition compared to the repetition-absent condition ($d'_{RepPres}$ = 1.13, d'_{RepAbs} = 1.55, $t(68) = -2.41$, $p = 0.019$), indicating an impairment effect was evident. *H2* was supported. The hit rate for non-repeated brands (Set A) was significantly lower in the repetition present versus absent condition ($HR_{RepPres}$ = 0.57 vs HR_{RepAbs} = 0.68, $t(68) = -2.82$, $p = 0.006$), offering support for *H3a* (note that *H3b* was not tested in this experiment because focus was restricted to same-category brands only). The false alarm rates did not differ between the two conditions ($FAR_{RepPres}$ = 0.21 vs FAR_{RepAbs} = 0.18, $t(68) = 1.26$, $p = 0.21$), supporting *H4b* (as above, *H4a* was not tested in this experiment). Table 5 presents the results.

Discussion

Experiment 3 showed an impairment effect for non-repeated same-category brands when list length was identical across the repetition-present and repetition-absent conditions. The results replicated previous impairment effects, indicating that this effect is not because of list length. The impairment was driven by a reduced hit rate, with no difference in false alarms between conditions. This consistent finding suggests that overlapping memory representations for same-category competing brands may explain the impairment. In the next experiment, we examined whether these effects influence downstream behavior, specifically brand choice.

Experiment 4

In Experiment 4, our goal was to examine whether the impairment effect for same-category brands extends beyond recognition memory to brand choice. As predicted in *H5*, we expected that brand repetition would decrease the choice of non-repeated same-category brands compared to when there is no brand repetition.

Participants and design

We used an Amazon Mechanical Turk (MTurk) online panel for this experiment, with 243 adult US participants (54.7% male, 45.3% female) receiving $2.00 compensation. Age ranged from 18 to 23 years to 60+, with a median age of 30–35 years. The one-factor between-group design varied brand repetition (present, absent). Set A and Set B brands from Experiment 2 were used, focusing on non-repeated same-category brands. To adapt for the online setting, participants studied fewer ads. In each product category, two brands were selected as non-repeated (Set A), two as repeated (Set B), and two as lures. In the repetition-present condition, Set A brands were shown once, and Set B brands were repeated three times. In the repetition-absent condition, all

Table 5. Results of Experiment 3 for non-repeated brand ads (Set A)

	d'	Hit rate	False alarm rate
Repetition absent	1.55 (0.62)*	0.68 (0.15)**	0.18 (0.12)
Repetition present	1.13 (0.83)*	0.57 (0.16)**	0.21 (0.13)

Note(s): Values are means (standard deviations) in each condition. *$p < 0.05$, **$p < 0.01$
Source(s): Authors' own work

brands were shown once. We measured hit rate, false alarm rate, d', and the probability of choosing non-repeated brands over lure brands. Figure 4 shows the design.

Procedure

The experiment was conducted online. The overall procedure was similar to Experiment 2, except the filler task lasted only three minutes. After exposure to the ads, participants completed the filler task, a yes/no brand recognition test, and a stated brand choice task. The experiment took about 10 minutes.

Measures

To prevent participants' memory task responses from influencing the brand choice task, we used different product categories for each. Two of the six categories were used for the recognition test, while the other four were used for the brand choice task. Recognition was tested with a yes/no format, as in previous experiments. In the brand choice task, participants were given a shopping scenario where they had to choose between two brands: one non-repeated same-category brand (Set A) and one non-presented same-category lure brand. Repeated brands were excluded from the choice task to avoid signaling the experiment's purpose (and because repetition facilitation effects were not our main focus). Participants completed eight brand choice scenarios with randomized presentation order.

Immediately after the choice task, we asked a set of post-experimental questions to gauge how participants made their decisions (Janiszewski *et al.*, 2013). Five statements were posed:

(1) "I selected brands that were more familiar";

(2) "I selected brands that I have used";

(3) "I selected brands according to my preference";

(4) "I selected brands randomly"; and

(5) "I selected brands that I just saw during the ad presentation."

Two response options (yes or no) were given. The five statements were presented in random order. We included post-experimental questions to identify any potential demand or confounding effects. Any significant differences in responses between the repetition-absent and repetition-

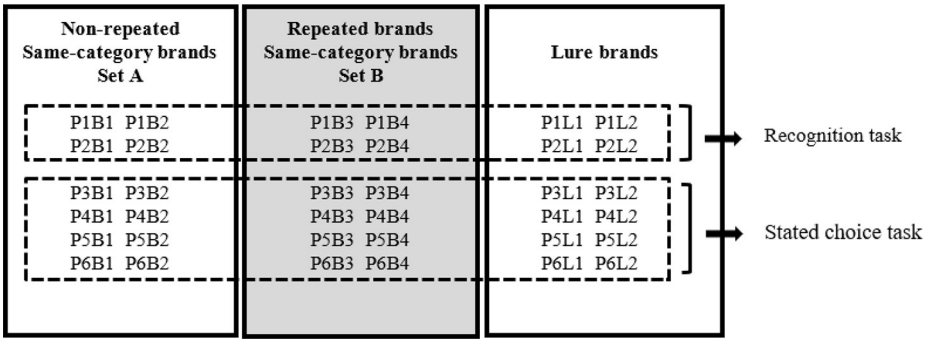

Figure 4. Study design for Experiment 4
Source: Authors' own work

present groups could indicate such effects. If significant differences were found, we planned to use them as covariates; however, none were found.

Results: recognition

In support of *H1*, recognition accuracy for repeated brands (Set B) was significantly higher in the repetition-present condition than the repetition-absent condition ($d'_{RepPres} = 2.11$, $d'_{RepAbs} = 1.43$, $t(241) = -4.25$, $p < 0.001$). This represents a facilitation effect, as observed in the previous experiments. An impairment effect was also found, with recognition accuracy for non-repeated same-category brands (Set A) significantly lower in the repetition-present condition than the repetition-absent condition ($d'_{RepPres} = 0.84$, $d'_{RepAbs} = 1.17$, $t(241) = -2.07$, $p = 0.040$). This supports *H2*. In line with previous experiments, the hit rate for non-repeated same-category brands (Set A) in the repetition-present condition was significantly lower than in the repetition-absent condition ($HR_{RepPres} = 0.62$, $HR_{RepAbs} = 0.76$, $t(241) = -3.12$, $p = 0.002$), thus supporting *H3a*. In contrast to previous experiments, *H4b* was not supported. The false alarm rate in the repetition-present condition was lower than in the repetition-absent condition ($FAR_{RepPres} = 0.30$ vs $FAR_{RepAbs} = 0.38$, $t(241) = -2.35$, $p = 0.02$). This lower false alarm rate was not sufficient to limit *d'* from declining, in that the impairment effect was still observed, as noted above. Table 6 presents the results.

Results: stated brand choice

A total of eight choice scenarios were presented. As shown in Figure 4, each choice scenario included two brand options: one non-repeated brand (Set A) and one non-presented lure brand (Set L). The brands for the choice task were from product categories 3–6. The complete set of choice pairs included the following: P3B1–P3L1, P3B2–P3L2, P4B1–P4L1, P4B2–P4L2, P5B1–P5L1, P5B2–P5L2, P6B1–P6L1 and P6B2–P6L2. The choice probability for non-repeated brands (Set A) was calculated by dividing the number of Set A selections by eight. Thus, a higher probability indicates that a participant was more likely to choose non-repeated study brands over non-presented lure brands. Consistent with predictions that the impairment effect would generalize to stated brand choice, results showed participants were less likely to choose non-repeated same-category brands over non-presented same-category lure brands in the repetition-present condition compared to the repetition-absent condition ($M_{RepPres} = 0.49$ vs $M_{RepAbs} = 0.53$, $t(241) = 2.11$, $p = 0.036$). Thus, *H5* was supported. Furthermore, the choice pattern remained consistent when gender ($t = 1.94$, $p = 0.053$) and age ($t = 2.75$, $p = 0.006$) were controlled. The results suggest the impairment effect we observed in recognition for same-category brands does indeed generalize to stated brand choice.

Our analysis of post-experimental questions indicated the results were not because of potential demand effects. The majority of participants in both repetition conditions reported their choice decisions were based on their brand preference (repetition present = 91%,

Table 6. Results of Experiment 4 for non-repeated brand ads (Set A)

	d'	Hit rate	False alarm rate	Choice
Repetition absent	1.17 (1.16)*	0.76 (0.33)**	0.38 (0.32)*	0.53 (0.17)*
Repetition present	0.84 (1.35)*	0.62 (0.36)**	0.30 (0.27)*	0.49 (0.16)*

Note(s): Values are means (standard deviations) in each condition. *$p < 0.05$, **$p < 0.001$
Source(s): Authors' own work

repetition absent = 95%, $\chi^2(1) = 1.54$, $p = 0.22$), current brand use (repetition present = 85%, repetition absent = 90%, $\chi^2(1) = 1.31$, $p = 0.26$), and brand familiarity (repetition present = 78%, repetition absent = 85%, $\chi^2(1) = 2.11$, $p = 0.19$). There was also no difference across conditions in participants indicating they responded randomly (repetition present =5.7%, repetition absent = 6.6%, $\chi^2(1) = 0.08$, $p = 0.71$). In addition, approximately equal proportions of participants indicated they selected brands that they saw during the ad presentation (repetition present = 27.9%, repetition absent = 19.8%, $\chi^2(1) = 2.16$, $p = 0.18$). Thus, in general, the impairment effect we observed with brand choice does not appear to be based on demand effects.

Discussion

Results from Experiment 4 indicate the impairment effect in recognition has downstream consequences on stated brand choice. When some brands are repeated, the probability of selecting a non-repeated same-category brand over a non-presented same-category lure is lower. This is an important finding because it shows the impairment effect on memory can influence which brands are ultimately chosen by consumers.

General discussion

While past advertising research has primarily focused on how repetition enhances memory for the repeated brand (Schmidt & Eisend, 2015) and how the presence of competitors affects memory for that brand (Burke and Srull, 1988; Keller, 1987; Kent and Allen, 1994), our study advances understanding of advertising-related memory processes by building on research on repetition-based and competitive interference to examine how repeated brand advertising can impair recognition of other, non-repeated competitor brands within the same product category. Across studies, brand repetition consistently enhanced recognition of repeated brands (facilitation effect) while impairing recognition of non-repeated same-category competitors (impairment effect). This impairment was generally driven by reduced hit rates for non-repeated brands, while false alarm rates remained relatively stable across conditions. Furthermore, repeated brand exposure was found to decrease the likelihood of choosing non-repeated competitor brands.

By examining these non-repeated brands, the current research highlights the importance of considering broader indirect and inadvertent effects in advertising – effects that extend beyond those directly associated with repeated brands. Furthermore, by testing recognition rather than recall, we contribute to understanding how different types of memory retrieval processes are influenced by competitive dynamics in advertising environments (Burke and Srull, 1988; Keller, 1987; Kent and Allen, 1994).

Our findings also extend the strength-based interference literature in memory research (Ratcliff et al., 1990). Specifically, the current research demonstrates that advertising provides another case or context where strength-based interference effects – driven by repetition – can be observed in recognition memory because of conceptual overlap among stimuli in brand advertising (Osth et al., 2014). This is a notable contribution, given the limited number of prior examples in the literature (e.g. Verde and Rotello, 2004). While earlier work suggested that strength-based interference has a lesser effect on recognition (Shiffrin et al., 1990), our findings add to the growing body of evidence indicating that such effects can emerge in recognition tasks when stimuli are conceptually similar.

In addition to memory outcomes, our results contribute to the broader literature on brand choice by showing that repetition-based memory impairment extends to downstream behavioral consequences. Specifically, reduced recognition accuracy for non-repeated brands leads to lower stated brand choice, reinforcing the view that memory processes play a central role in shaping consumer decisions (Lee, 2002; Rottenstreich et al., 2007).

Practical implications

This research offers several important insights for advertising practice. First, advertisers should be aware of the dual effects of advertising repetition. While repetition strengthens memory for the advertised brand (facilitation effect), it simultaneously weakens memory for non-repeated same-category competitor brands within the same advertising context (impairment effect). This dynamic may represent a double advantage for brands that engage in repeated advertising but also underscores the vulnerability of brands with limited exposure in competitive environments.

Although repetition is generally associated with improved memory, it exhibits diminishing returns – typically following a logarithmic curve (Ray and Sawyer, 1971). Once the marginal benefit of repetition plateaus, additional exposures may offer little to no further improvement in memory for the repeated brand. However, impairment for competing brands may persist even at this point. Notably, our data show that the magnitude of this impairment effect was substantial after just three exposures: recognition performance dropped by 17.6% in Experiment 1 and by 19% and 27% in Experiments 2 and 3, respectively.

Importantly, we also demonstrated that this impairment effect extended beyond memory to influence brand choice – a downstream outcome of particular interest to brand managers concerned with consumer decision-making and sales performance.

Second, when considering the combined effects of competitive and repetition-based interference, the most detrimental advertising context for a non-repeated target brand is one in which competitor brands engage in repeated advertising. For instance, Budweiser – a regular Super Bowl sponsor – often airs multiple advertisements during a single game. In such a context, competing beer brands with limited exposure may suffer substantial memory impairment, diminishing the effectiveness of their own advertising efforts, even when other variables such as creativity, duration, and message complexity are held constant.

More broadly, advancements in programmatic television advertising offer strategic tools for mitigating such risks. Technologies that track when, where, and how frequently competitor ads are aired (Guitart et al., 2020) can enable advertisers to make real-time adjustments to ad placements. By monitoring competitor activity, brands can optimize their campaign timing and positioning to avoid highly competitive environments and minimize potential interference effects.

Third, it is possible that similar impairment effects may arise when memory is strengthened through mechanisms other than repetition. In memory research, strengthening is typically achieved through repeated exposure or extended encoding time (Ratcliff et al., 1990). In advertising, however, other factors – such as creative execution – can also enhance memory for a brand. For instance, Jin et al. (2019) found that highly creative advertisements not only improve memory for the target brand but can also impair memory for competing brands. This finding also suggests a potential strategic opportunity: non-repeated brands may be able to counter the dominance of repeated brands by using creative advertising. In other words, creativity may serve as a compensatory mechanism, helping less frequently advertised brands compete more effectively in memory-based consumer decisions.

There may also be other contexts in which similar impairment effects occur. For example, when a brand is prominently featured in a television program through product placement (Pervan and Martin, 2002) or gains high visibility through event sponsorship (Weeks et al., 2017), it can become more memorable, potentially interfering with memory for competing brands. These forms of brand integration may strengthen the focal brand's memory trace and, in turn, reduce the accessibility of other brands in the same category.

Accordingly, marketers should carefully consider how various types of brand exposure – whether through repetition, creativity, or content integration – can be strategically leveraged

to enhance brand memory. At the same time, they must remain aware of the inadvertent consequences such strategies may have on competitor recognition.

Limitations and future research

A number of issues should be addressed in future research. First, the use of real advertisements as stimuli in our experiments raises the possibility that participants had prior exposure to some of the brands or ads, which may have influenced memory strength and/or brand choice decisions. Future studies could address this limitation by using more controlled or unfamiliar ad stimuli to eliminate potential confounds related to prior brand familiarity or exposure.

Second, we measured memory shortly after ad exposure, and therefore did not determine how long the impairment effects might persist. Future research is warranted to examine the durability of these effects over longer time intervals (e.g. hours or days). Additionally, researchers may find value in exploring other forms of repeated stimuli – such as television advertisements, brand claims, or copycat brands that use similar visual elements – and how cumulative cross-media repetition might influence memory and brand choice over extended durations.

Third, our study relied on a stated brand choice task. While this approach is appropriate for initial investigation, future research should examine whether similar impairment effects extend to real brand choices and actual purchase behavior in naturalistic settings. Fourth, we manipulated repetition using only two levels (a single exposure vs three repetitions). Future studies should investigate a wider range of repetition levels to better understand the magnitude and trajectory of the impairment effect. The pattern may be non-linear, with impairment effects intensifying once repetition exceeds a certain threshold. Moreover, factors known to moderate facilitative effects of repetition – such as spacing or variation in ad executions – should be examined for their influence on the strength of impairment.

Fifth, although our research clearly distinguished between competing (e.g. Coke/Pepsi) and non-competing brands (e.g. Coke/Mastercard), it did not account for differences in the intensity of competition among brands within the same category. For instance, Bud Light and Miller Lite may be perceived as more direct competitors than Bud Light and Guinness. Future work could explore how the degree of perceived competition moderates the impairment effect.

Lastly, while student samples are appropriate for theory testing, they may limit external validity. This is especially relevant given the smaller sample sizes used in some studies (e.g. Experiments 2 and 3). Future research should replicate these findings using broader adult samples and larger participant pools to enhance generalizability.

In conclusion, repeated advertising not only enhances memory for the advertised brand but also impairs recognition and choice of competing non-repeated brands. Accordingly, brands should either adopt repetition strategies themselves or avoid advertising contexts where competitors are likely to do so. A clear understanding of the dual effects of repetition can help advertisers optimize their strategies in highly competitive environments.

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