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Understanding the influence of literacy on consumer memory: The role of pictorial elements☆

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Abstract

This research examines the relationship between literacy and consumer memory. The effects of a variety of stimuli at exposure (i.e., brand names, brand signatures, and products in usage) on memory (i.e., recognition, stem-completion tasks) were examined for a range of literacy. In a series of experiments, we find that the use of pictorial representations of brands (i.e., brand signatures) results in superior brand memory for individuals with lower literacy levels when compared to those at higher literacy levels. This effect is shown to occur not due to pictorial elements per se, but due to pictorial elements with a 1-to-1 correspondence with reality, i.e., which match the form in which they were originally encoded in memory. Moreover, this effect does not persist with stimulus-rich pictures of brands in usage, pointing to boundary conditions with the use of pictorial information.

Keywords: Low-literacy; Functional literacy; Memory

Introduction

This research attempts to systematically examine the relationship between literacy and consumer memory. Although consumer memory has been of central interest in consumer psychology, empirical work has mainly focused on literate consumers. From a theoretical standpoint, interactions between literacy and memory extend current theories to include a range of literacy levels, a departure from extant research and theory.

Functionally low-literate consumers display unique cognitive predilections, decision heuristics, and coping behaviors, (Viswanathan, Rosa, & Harris, 2005) and reading ability impacts memory representations and performance in memory-related tasks (Chiappe, Hasher, & Siegel, 2000). Using past research on literacy and consumer behavior, and consumer memory for pictorial versus verbal information, we conducted a series of experiments to examine consumer memory as a function of literacy. We focus on tendencies among low-literate consumers for pictographic thinking, and derive implications for their memory for brand information with pictorial elements. Because past research has shown that low-literate consumers often engage

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in processing at the perceptual level (Viswanathan et al., 2005), we focus on perceptual memory as a starting point to this research.

We use a series of studies to assess the effect of a variety of stimuli at exposure on memory tasks, studying respondents with a range of literacy levels. We varied the nature of exposure stimuli in terms of pictorial content, comparing brand names, brand signatures, and pictorial representations of brands in usage, and examined their effects on perceptual memory as a function of literacy. Our results provide insight into the relationships between literacy, pictorial content of stimuli, and consumer memory. Whereas the limited research on literacy in consumer behavior has provided big-picture understanding of low-literate consumer behavior, our research provides specific insights into the influence of literacy on consumer memory.

The paper is organized as follows. We present a review of the literature as it relates to literacy and memory followed by the development of hypotheses. Specific hypotheses are presented preceding specific experiments, reflecting the evolution of this research.

Literature review and hypotheses

Literacy is "the ability to exhibit all of the behaviors a person needs in order to respond properly to all possible reading tasks (Bormuth, 1975)." *Functional* literacy refers to the ability to function adequately as an adult (Kirsch & Guthrie, 1977). Thus, functional literacy links literacy and adequate functioning in day-to-day life, which has significant implications for consumers. Differences in definitions of literacy and functional literacy have blurred over time. We use these terms interchangeably for purposes of this paper. Following past research, we studied students enrolled at adult education centers and operationalize literacy by their grade-equivalent levels (Viswanathan et al., 2005).

Research on functionally low-literate consumers

Vulnerable consumers, such as low-income consumers (Alwitt, 1996; Andreasen, 1975; Hill, 1991), have been examined in research, however, research on functionally low-literate consumers has been very recent (e.g., Adkins & Ozanne, 2005). Viswanathan et al. (2005) report on the cognitive predilections of functionally low-literate consumers based on a qualitative study of adult education students. A striking characteristic is the difficulty in engaging in abstract thinking. Functionally low-literate consumers are able to perceive one piece of information, such as product size, but are often unable to relate that information to another piece of information, such as price. This processing of single pieces of information, without higher-level abstractions, is described as *concrete thinking* (Viswanathan et al., 2005). This is a tendency to concretize information into perceptible pieces for decision making. For example, instead of a size/price trade-off, an abstraction, functionally low-literate consumers may focus exclusively on price. Past research has also shown that low-literate people can perform concrete operations on specific units (e.g., time) and engage in concrete, context-sensitive thinking based on practical necessity, but have difficulty with trade-offs that require abstraction (Greenfield, 1972; Luria, 1976).

More relevant to the phenomena studied here is the predilection of *pictographic thinking*, which is argued to extend beyond being influenced by pictures (Viswanathan et al., 2005). Functionally low-literate consumers have a tendency to visualize amounts of products to buy by picturing them, rather than using available symbolic information, such as weight or volume in units of measurement (e.g., finding out how much sugar to buy by visualizing baking a cake and pouring sugar during the process of preparation, and buying the quantity of sugar that matches). They may visualize currency and remove bills mentally as they shop in order to keep a running total of the cost of their shopping carts. Similarly they may visualize information, such as a store sign, brand name, or price tag, as an image in a scene, rather than reading the actual text. Functionally low-literate consumers may treat store signs, brand names, and even frequently encountered numbers, as if they are objects in a scene, ignoring much of the symbolic meaning behind these bits of information. This may lead to confusion when physical features, such as the font style or color, of familiar words and brands are changed. Consumers engaging in pictographic thinking, may also make trade-offs between price and size by using physical package size, rather than using volume or unit price information available on labels.

These descriptions are consistent with findings that low literacy leads to thinking anchored in the immediate. Research conducted on low-literate adults in rural Central Asia in the early 20th century revealed a lack of abstract thinking (Luria, 1976). The author notes that "the tendency to reproduce operations used in practical life was the controlling factor among uneducated low-literate subjects" (Luria, 1976, p. 55). For example, functionally low-literate adults were shown sets of objects (e.g. hammer, saw, log, and hatchet), and asked to select the three that were most similar. They could not identify the three as tools and derive ad-hoc categories such as "tools," even when prompted that hammer–saw–hatchet were tools ("Yes, but even if we have tools, we still need wood—otherwise, we can't build anything" [Luria, 1976, p. 56]). They displayed concrete, context-dependent thinking, and grouped objects by visualizing practical situations, paralleling our discussion of low-literate consumers viewing brand names as objects in a scene or visualizing usage situations in determining quantities to purchase. In this regard, Viswanathan et al. (2005) argue that pictographic thinking reflects a primitive ability to process available information with a 1-to-1 correspondence to the physical world, rather than the symbolic world that develops with literacy (Havelock, 1963).

In general, functionally low-literate consumers primarily function in the visual, concrete realm, rather than the symbolic, abstract realm. This suggests that low-literate consumers may have better memory for information that bears a 1-to-1 correspondence with reality (i.e., where information is identical in form to how it is encountered in reality, and consequently, how it is originally encoded in memory), rather than symbolic information, and draw from sensory, rather than abstract processing. It also suggests that low-literate consumers may have better perceptual memory due to the perceptual nature of processing in which they engage.

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Literacy and memory

Prior research suggests that low literacy can negatively impact memory. Literacy influences digit retention, delayed recall of words, and logical memory tasks (Ardila, Roselli, & Rosas, 1989). A reason for lower memory performance may be the lower working memory of low-literate consumers. Working memory refers to the cognitive processes involved in the temporary storage of information while an individual is simultaneously processing information from long-term storage (Chiappe et al., 2000). Research in working memory suggests that deficient suppression mechanisms in individuals with reading disabilities negatively affect their working memory span. Literacy level has been found to be negatively correlated with short-term memory (Scribner & Cole, 1981). Thus, lower literacy levels may be associated with reduced working memory span, which may contribute to lower performance on memory tasks. Extending past findings to the consumer domain, we make the following prediction.

H1. Performance on consumer memory tasks will increase with increasing levels of literacy.

Pictorial vs. verbal information processing

An important implication of the Viswanathan et al. (2005) study is the dependence that low-literate consumers display on perceptual, rather than conceptual processes, in acquiring, retaining, and using information. This is exemplified by the viewing of brand names as objects in a scene, which relates to perceptual processing of text information as a picture. Underlying such pictographic thinking is information processing at a sensory level that attempts to parallel reality. Thus, pictorial stimuli in the marketing environment should be acquired, remembered, and used to a greater extent by low-literate consumers. Such stimuli can be placed on a continuum of being symbolic/abstract at one end, and pictorial/concrete at the other. Brand names presented as plain text would represent the symbolic/abstract end of the continuum, and scenes of brands in usage would represent the pictorial/concrete end of the continuum. Brand signatures, which include pictorial elements, would be in between.

Research in consumer behavior and cognitive psychology has examined pictorial and verbal memory. A number of studies have shown that pictures are recognized or recalled better than words, a central explanation being the role of pictures in facilitating the use of mental imagery to remember previously viewed stimuli (Childers & Houston, 1984; see Pavio, 1986 for a review). The use of vivid, image-evoking stimuli is found to improve memory (e.g., Childers & Houston, 1984), and performance in recognition tasks (Schlosser, 2006). In this regard, the use of interactive stimuli is found to be more effective than the use of pictures, which are, in turn, more effective than plain text (Schlosser, 2003). Pictures may facilitate memory by presenting a greater number of cues (Bower, 1970) and by depicting spatial and other relationships (Bower, 1970; Childers & Houston, 1984), such as between products and usage situations. Pictorial memory may also be superior to verbal memory due to the distinctiveness of pictures, which can lead to distinctive encoding (Jacoby & Craik, 1979). Pictures have been argued to serve a number of functions when presented in conjunction with text that facilitate processing: they concretize the meaning conveyed by text, help in interpreting text, help organize the content, enable elaboration, and improve learning (Levin, 1981; Macklin, 1996).

On the other hand, unrelated pictures can reduce performance in text processing. In a series of experiments with children, Macklin (1996) showed the facilitating role of pictorial information in brand name recall. The author also showed that extended visual cues reduced children's memory for brand names, as excessive visual content served as noise, and drew cognitive resources away from processing target information. Thus, pictorial information can have advantages, but only up to a point.

Given the unique characteristics of low-literate consumers' information processing styles, we expect that pictographic thinking will be facilitated by the presentation of brand signatures, rather than brand names as plain text. Brand signatures are part of brand elements (i.e., brand names, logos, etc.; Janiszewski & Meyvis, 2002; Keller, 2003; Pieters & Wedel, 2004), and visually represent brand names with associated pictorial elements (please see an example in the Appendix). Brand signatures are typically the most prominent feature on product packages, containing pictorial elements and bearing a correspondence with how brand names are seen in reality, and can facilitate distinctive encoding. Thus, the brand signature presentation will facilitate performance on memory tasks for low-literate consumers, who rely on pictographic thinking, more than for consumers with higher literacy levels. The pictorial elements of brand signatures are likely to facilitate perceptual memory for brand names. We predict that consumers at the lowest level of literacy will have higher memory for brand signatures, when compared to brand names in plain text, due to the increased tendency toward pictographic thinking, in comparison with higher levels of literacy.

H2. Consumers at the lowest level of literacy when compared to those at a relatively higher level of literacy will perform better on:

a) recognition tasks (direct test) **b)** stem-completion tasks (indirect test) when brand names are presented as signatures versus plain text, at both exposure and test.

Whereas H1 predicts better memory with higher literacy levels, H2 relates to the differential memory for brand signatures versus plain text. Moreover, the prediction holds only when the format of brand information is matched between exposure and test. We use grade-equivalent 0–4 and 9–12 literacy levels when making comparisons across low levels of literacy, and use the 5–8 literacy level as a comparison group to provide a continuum in the study of literacy as a construct.

Typical memory tests include an exposure phase, a distractor task, and a test phase (Roediger & McDermott, 1993). Different types of memory tasks have been employed to examine memory performance, such as recall and recognition tasks. Tests vary by whether they measure perceptual or conceptual aspects of memory (Jacoby, 1991; Lee, 2002). We focus on perceptual memory, due to predilection toward concrete thinking at low levels of literacy. Memory research distinguishes direct tests and indirect tests

(Johnson & Hasher 1987). Direct and indirect tests are distinguished by instructions and measurement criteria (Richardson-Klavehn & Bjork, 1988). In a direct test, subjects are referred to a particular study episode, and asked to indicate their knowledge of that episode in some way (e.g., recognition; cued recall). In an indirect test, subjects are instructed to undertake a task without referring to the previous study episode. Successful performance on the task does not depend upon clearly recalling information during the prior study episode, although the task may be influenced by that episode. Direct and indirect tests are designed to measure explicit and implicit memory, respectively (Richardson-Klavehn & Bjork, 1988). Whereas explicit memory is constrained by level of attention, exposure time, and level of information processing at exposure, implicit memory is not affected by these factors (Richardson-Klavehn & Bjork, 1988). Many indirect tests have been developed, including word stem-completion, picture fragment completion, anagram solution, word association, and category instance generation. Given our focus on brand name memory, we used stem-completion tests in our experiments.

Experiment 1

Several caveats should be noted in designing experiments with low-literate consumers. Generally, the study of low-literate individuals poses challenges at every step of the research process. Low-literate individuals are a very difficult group to recruit and administer studies with (Viswanathan, Gau, & Chaturvedi, 2008). Studies with these individuals require very careful administration procedures to avoid the possibility of anxiety arising out of participation in the study. This results in restricted sample sizes, making it necessary to begin with available participants in terms of literacy levels. A variety of elements are central here including careful personal administration by well-trained interviewers, consideration of reading and writing difficulties, use of realistic stimuli, and use of tasks that respondents can relate to from their life experiences. Our methods evolved to address these important issues (Viswanathan et al., 2008).

We study a continuum of grade-equivalent literacy levels ranging from 0 to 12, based on math and reading scores administered at entry to the adult education center, and at intervals thereafter. Students are typically placed in one of three classrooms, grouped by grade-equivalent literacy level (0–4, 5–8, and 9–12), providing us with three levels of literacy for purposes of our research. Our assumption is that grade level equivalents approximate levels of literacy. We compare the 0–4 and 9–12 levels, but use the 5–8 level as a comparison sample to provide a continuum in the study of literacy as a construct. The 5–8 level includes students in transition (e.g., those previously in the 0–4 level and students likely advancing to the 9–12 level). On the other hand, the 0–4 versus 9–12 comparison provides clear distinctions in terms of literacy.[5] Our examination of interactions between levels of literacy and experimental manipulations using a restricted range offers relatively strong tests of our hypotheses.

Method

A 3 (levels of literacy: 0–4, 5–8, and 9–12; between subjects) by 2 (exposure format: plain text vs. brand signature; within subjects) by 2 (test format: plain text versus brand signature; within subjects) by 2 (perceptual memory tests: recognition vs. stem-completion; between subjects) mixed design was used. The two within subjects factors created four conditions between exposure and test: text–text, signature–signature, text–signature, and signature–text. This allowed us to examine exposure format and test format, which were crossed (e.g., some stimuli were matched and others mismatched between exposure and test). The hypothesized advantage for pictorial elements in perceptual memory should be unique to the matched condition, as identical elements of the stimuli do not occur between exposure and test with the unmatched case.

Sixty students enrolled at adult education centers in a Midwestern city participated in the experiment and were paid $10 for their participation. Participants ranged in age from 18 to 81 and were divided into three literacy groups (0–4 level, 5–8 level, and 9–12 level).[6] As a cover story, participants were told that they were participating in a study on how consumers use product information. This was done to avoid the potential anxiety that could be generated by presenting the task as a memory test. Participants were randomly presented with 12 brand names in plain text and 12 brand names in brand signatures. All plain text brand names were shown using 36 pt. Arial font, and brand signatures were of an approximately similar size. Popular brand names were chosen to be relevant to the target population (see Appendix). Applying a procedure used in prior memory research (e.g., Goldinger et al., 2003), the brand names were shown one per page (i.e., the brand name either as a signature or a word). After each brand exposure, participants were asked whether they knew the brand and whether they have bought the brand. After a 15 minute distractor task,[7] respondents completed a recognition task (e.g., a direct perceptual memory task indicating which brands were presented earlier) or a stem-completion task (e.g., an indirect perceptual memory task which requires participants to complete the brand name or the brand signature akin to a picture fragmentation task, given a partial cue without mentioning the previous exposure) in the test phase. Ten participants from each of the three literacy levels participated in each of the two tasks involved in this experiment. We asked the participants to say the brand names aloud, rather than writing them down, in consideration of their writing skills. For the stem-completion task, the first three letters of each brand were shown, for both the plain text and brand signature conditions. Half of the brand names presented at

[5] In addition, we also compared these groups to undergraduate students, a more literate group based on higher education. However, given the differences across undergraduate students and students at adult education centers, we excluded the data from undergraduates from the analyses, but presented means for purposes of providing a comparison, and linked our findings to the large body of research based on this population.

[6] Purely for comparison purposes, although not included in the analyses, 47 undergraduate students enrolled in introductory business courses at a Midwestern University participated in the experiment for course credit. The average age of undergraduate students was 20.5 years.

[7] Distractor tasks in all studies involved unrelated tasks that did not involve the brands used in the study (e.g., word pairings, retail experiences, health and nutrition).

study were presented at test in the same "matched" format (e.g., brand name–brand name or brand signature–brand signature) and the other half in the other "unmatched" format (e.g., brand name–brand signature and brand signature–brand name). Following two practice trials using filler brands, 24 brands previously exposed were presented interspersed among 24 filler brands. The fillers used were relatively familiar brands, primarily in different product categories. No filler brand outperformed any focal brand in the recognition task, and overall, the stem-completion of focal brands was greater than that of filler brands. Finally, participants were asked to rate their familiarity and preference for each brand on 7 point scales.[8]

Results

The dependent variable was the number of target brands in exposure correctly recognized or completed in the memory test, with a total of 24 correct responses possible. A repeated measures ANOVA was performed on the number of brands correctly recognized or reported in the stem-completion task using the type of task (recognition vs. stem-completion) and literacy level (0–4, 5–8, 9–12) as between subjects factors, and exposure format (text vs. signature) and test format (text vs. signature) as within subjects factors, with a maximum of 6 correct responses in each condition created by crossing exposure format with test format. In support for H1, a main effect of literacy level ($F(2,54)=20.56$, $p<.0001$) was found. Across both the recognition and stem-completion tasks, 0–4 level individuals displayed lower memory performance ($M=2.71$) than 9–12 level individuals ($M=4.68$, $t(38)=5.20$, $p<.0001$), and 5–8 individuals ($M=4.20$, $t(38)=3.54$, $p<.001$). The difference in performance was not significant between 5–8 and 9–12 levels. Similar results were found in separate analyses of recognition and stem-completion.

For the repeated measures ANOVA on the number of brands correctly recognized or reported, significant main effects for test format ($F(1,54)=37.6$, $p<.001$) and type of task ($F(1,54)=23.30$, $p<.001$) were also found. Overall performance on the stem-completion task ($M=4.49$) was greater than performance on the recognition task ($M=3.23$). Significant two-way interactions were found for exposure format × test format ($F(1,54)=85.37$, $p<.001$), and test format × type of task ($F(1,54)=21.93$, $p<.001$).

Separate ANOVAs were run on recognition and stem-completion tasks to test H2a and H2b. For recognition, we found significant main effects of literacy ($F(2,27)=13.9$, $p<.001$) and test format ($F(1,27)=38.79$, $p<.001$), a significant literacy × exposure format interaction ($F(2,27)=9.43$, $p<.01$), and a significant exposure format × test format interaction ($F(1,27)=37.44$, $p<.01$). To test H2a, we focused on the means of the "matched" conditions, where the stimuli format (i.e., brand signature or plain text) was identical at both exposure and test. The difference in memory for brand signatures versus plain text

Table 1
Means for Experiment 1.

Literacy level	Exposure	Test	Memory test			
			Stem-completion		Recognition	
			Signature	Text	Signature	Text
0–4	Signature		4.20_a	3.30_a	3.30_a	1.30_b
	Text		3.10_a	3.70_a	1.80_b	1.00_b
5–8	Signature		5.30_a	3.90_b	4.60_a	2.10_c
	Text		4.40_a	5.40_c	4.40_b	3.50_b
9–12	Signature		5.50_a	4.80_b	5.00_a	3.30_c
	Text		$5.00_{a,b}$	5.30_a	4.40_b	4.10_b

Cell means, within the same memory test and literacy level group, in a row or column not sharing the same subscript differ significantly ($p<.05$). The means from the undergraduate sample were 5.35_a, 3.22_b, 5.88_a, and 5.08_b, respectively, across the four corresponding cells for signature and 4.52_c, 4.74_c, 5.00_b, and 5.96_a, respectively, across the four corresponding cells for text.

in the matched conditions was significantly higher ($t(18)=2.25$, $p<.05$) for the 0–4 ($M=3.30$ versus 1.0, respectively) when compared to the 9–12 level ($M=5.00$ versus 4.10, respectively), providing support for H2a. Moreover, a similar pattern was not found with unmatched conditions (Table 1 and Fig. 1), consistent with our rationale which rests on match between exposure and test.

For the stem-completion task, we found a significant main effect of literacy ($F(2,27)=7.02$, $p<.001$), but did not find a significant effect of test format ($F(1,27)=2.14$, $p>.15$). The exposure format × literacy interaction was not significant ($F(2,27)=1.62$, $p>.22$). Focusing again on matched conditions between exposure and test, the difference in memory for brand signatures versus plain text was directionally higher for the 0–4 ($M=4.20$ versus 3.70, respectively) compared to the 9–12 level ($M=5.50$ versus 5.30, respectively) but was not statistically significant ($t(18)=.64$). These results are only directionally consistent with H2b (Table 1 and Fig. 1). A similar test on unmatched conditions was also not significant.

To assess the role of degree of familiarity in influencing our results, we used the average familiarity ratings across the target brands as the familiarity measure and repeated the two ANOVA analysis adding brand familiarity as a covariate.[9] Results showed that the effect of familiarity was significant in the stem-completion test ($F(1,26)=13.85$, $p<.001$) but not in the recognition test ($F(1,26)=1.94$, $p>.1$). In both tests, the main effect of match disappeared but the main effect of literacy level and two-way interactions presented above remain significant.

Overall, results showed that performance on memory tests improve with increasing literacy levels, supporting H1. For recognition, the difference in memory for brand signatures versus plain text in the matched conditions was significantly higher for the 0–4 when compared to the 9–12 level, providing support for H2a. For stem-completion, the differences were not statistically significant, and H2b was only directionally

[8] Forty-seven undergraduate students were used as a comparison group. These participants followed the same procedure, but completed the experiment in small groups (15–20 per session) by writing down brand names after seeing the stimuli projected on a screen using a PowerPoint presentation.

[9] Mean familiarity ratings were generally comparable and moderately high or higher across the three levels of literacy in all experiments (overall means of 5.45 or greater on a 7 point scale).

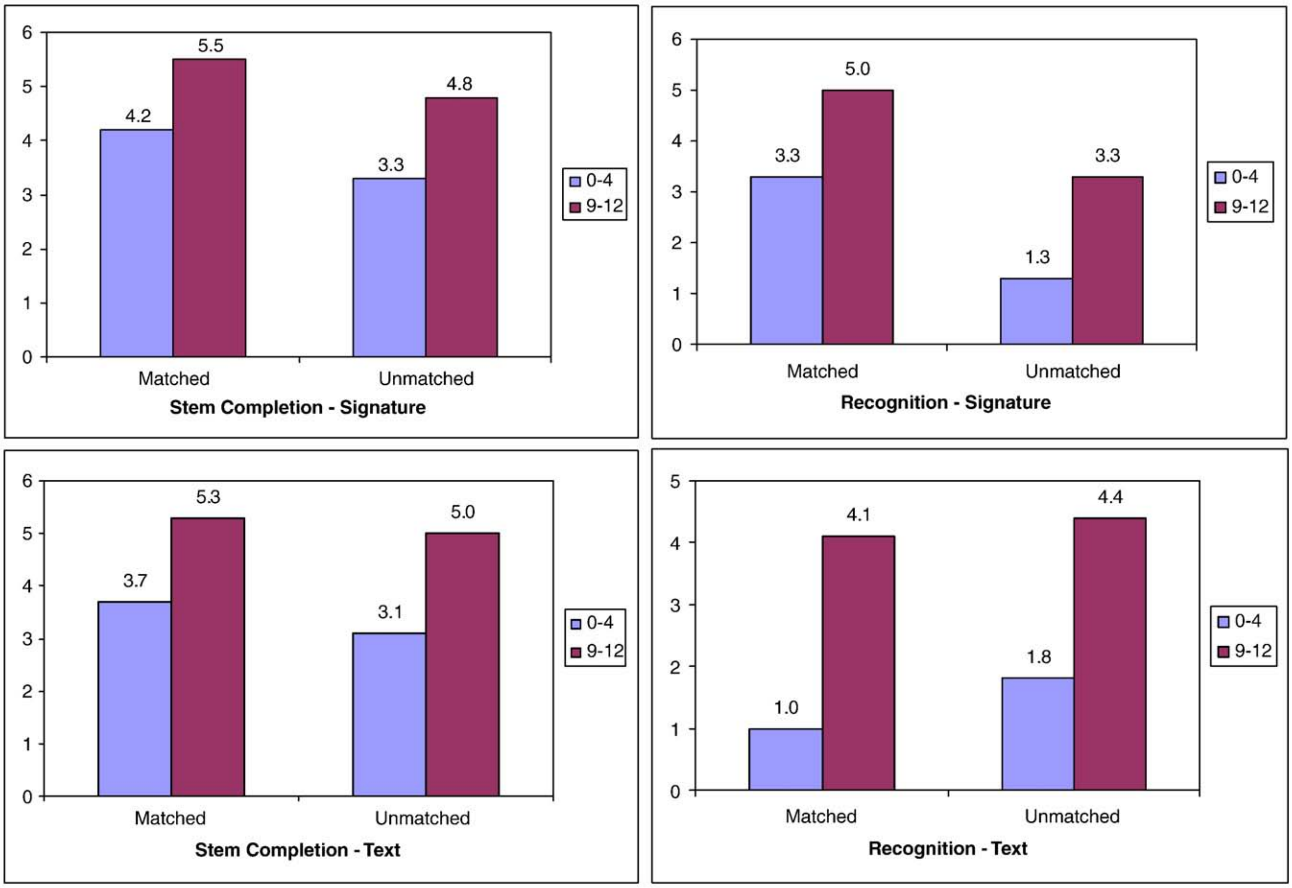

Fig. 1. Results for Experiment 1.

supported (see Table 1). A noteworthy finding relates to the differences in the unmatched conditions based on stimuli at exposure versus test being signatures or plain text. In two of three cases each for recognition and one out of three for stem-completion, plain text at exposure and brand signature at test had significantly higher means when compared to brand signature at exposure and plain text at test (see Table 1). Presumably, this occurs due to the advantage of pictorial elements that brand signatures provide at test.

Discussion

The results of Experiment 1 provide support for the prediction that consumers at the lowest level of literacy benefit to a greater degree from pictorial elements represented in brand signatures, when compared to higher levels of literacy. The advantage of pictorial elements over verbal elements is more accentuated in the 0–4 group, presumably because of a greater reliance on pictographic thinking. We found statistically significant effects for recognition, the direct perceptual memory test, but not for stem-completion, the indirect perceptual memory test. One explanation relates to the degree of match between stimuli at exposure and test, with the recognition task using a perfect match, and the stem-completion task using only a partial match (Appendix). Additionally, the use of stem-completion tasks with pictorial stimuli may parallel recent findings that suggest that consumer evaluation of small fragments of the whole are biased (Zhao & Meyer, 2007). However, there was significantly higher performance on the stem-completion task, across all conditions. For 0–4 level participants, the higher performance on stem-completion for plain text may have led to less room for improvement in the brand signature condition.

The results of Experiment 1 point to the facilitating role played by pictorial elements in brand signatures on memory at lower levels of literacy. The question that arises is whether the effect is due to pictorial elements per se (i.e., the additional visual cues offered by pictorial elements that facilitate distinctive encoding and subsequent memory when exposure and test are matched), or due to pictorial elements that have a 1-to-1 correspondence with reality (i.e., when the stimuli at exposure and test match the form in which they were originally encoded by participants when encountered in reality). Of particular relevance to this explanation is that degree of familiarity (i.e., how well respondents knew the brand), did not appear to be an explanatory variable. Degree of familiarity should be distinguished from our description of 1-to-1 correspondence with reality, which relates to match between the form of a stimulus as encountered in reality and subsequently encoded and represented in memory and its form during our study. Our explanation is related to the stimulus being in a "familiar" form, but should be distinguished from

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degree of familiarity with different brands. In Experiment 2, we further explore the role of 1-to-1 correspondence with reality of pictorial elements in leading to the memory advantage found in Experiment 1.

Experiment 2

Experiment 2 further explores whether the pictorial advantage for lower levels of literacy occurs due to 1-to-1 correspondence between pictorial elements and reality by using real and altered brand signatures as stimuli. The altered brand signatures were real brands, for which the signature was digitally altered (Appendix). If consumers at the lowest level of literacy benefit strictly from processing pictorial information, we should expect equal performance for real and altered brand signatures, compared to consumers at relatively higher levels of literacy. However, if consumers at the lowest literacy level rely more on pictorial elements that bear a 1-to-1 correspondence with reality (i.e., the form in which they were originally encoded in memory) than those with relatively higher literacy levels, then their performance on real, versus altered, brand signatures should be higher, compared to those with relatively higher literacy levels. Stated differently, if consumers with relatively higher literacy process brand signatures in terms of the words they represent to a greater degree than those at the lowest level, then the difference between real and altered brand signatures should be higher for consumers with lower literacy.

H3. Consumers at the lowest level of literacy when compared to those at a relatively higher level, will perform better on:

a) recognition tasks **b)** stem-completion tasks for real, when compared to altered brand signatures.

The prediction for H3 is about differential memory for real versus altered brand signatures, with this difference being higher for 0–4 when compared to 9–12 level consumers. As predicted in H1, 9–12 level consumers are expected to have better overall performance in memory.

Method

A 3 (levels of literacy: 0–4, 5–8, and 9–12; between subjects) by 2 (exposure format: real versus altered brand signature; within subjects) by 2 (perceptual memory tests: recognition vs. stem-completion; between subjects) mixed design was used in Experiment 2. Seventy-two students enrolled at adult education centers in a Midwestern city participated in the experiment. Students from adult education centers were paid $10 per hour for their participation. Students from adult education centers ranged in age from 18 to 67.[10]

[10] Purely for comparison purposes, 48 undergraduate students enrolled in an introductory business course at a Midwestern University completed the experiment in exchange for extra credit. The average age of undergraduate students was 20.8 years.

Procedures were similar to Experiment 1. Following two practice trials with brand signatures, participants were presented with 8 real brand signatures (a subset of those used in Experiment 1) and 8 brand signatures representing alterations from real brands. All altered brand signatures contained two to four colors (similar to real brand signatures), but the colors used differed from the colors of the real signature, with unique color schemes for each altered brand signature. None of the real versions of the altered brand signatures contained any icons, thus no icons were included. The size of the text in the altered brand signature was roughly proportional in size to the text in the real version. The fonts for all altered brand signatures differed from the real version, and no fonts were used for multiple brand signatures.

After a 15 minute distractor task, respondents completed a recognition task or stem-completion task in the test phase. Participants were presented with 16 brand signatures, half of which were real, and half altered. The brands previously exposed were presented, interspersed, among 16 filler brands (Appendix). The fillers used were brands in different product categories with similar levels of familiarity. For the stem-completion task, participants were shown the first three letters of the brand, for both real and altered brand signatures. For both tasks, all of the brands shown at exposure were matched in format with the brands used in the memory test. Similar to Experiment 1, no filler brand outperformed any focal brand in the recognition task, and overall, the stem-completion of focal brands was greater than that of filler brands.

Results

A repeated measures ANOVA was performed on the number of brands correctly recognized, or reported in the stem-completion task, using type of task (recognition vs. stem-completion) and literacy level (0–4, 5–8, 9–12) as between subjects factors, and exposure format (real vs. altered signature) as a within subjects factor. Eight correct responses were possible in real versus altered signature conditions. In support for H1, a main effect of literacy level ($F(2,66)=6.52$, $p<.01$) was found. Across both recognition and stem-completion memory tests, 0–4 level participants displayed lower performance ($M=5.94$) than 9–12 level participants ($M=7.36$, $t(46)=4.23$, $p<.001$), and 5–8 level participants ($M=6.82$, $t(46)=1.97$, $p=.056$). The difference in performance between the 5–8 and 9–12 levels was not significant. The difference in performance between recognition and stem-completion test was not significant ($F<1$).

Next, we conducted separate analyses for recognition versus stem-completion memory tests. For the recognition test, the main effect of format was not significant ($F(1,33)=2.24$, $p>.1$) but a significant literacy level × format interaction was found ($F(1,33)=7.06$, $p<.01$). The difference in memory for real versus altered brand signatures was significantly higher ($t(22)=2.57$, $p<.05$) for the 0–4 ($M=6.83$ and 5.33, respectively) when compared to the 9–12 level ($M=7.33$ and 7.42, respectively), providing support for H3a (Table 2 and Fig. 2). Results of the stem-completion test showed a main effect of format of brand signature ($F(1,33)=58.68$, $p<.001$) and a literacy level × format

Table 2
Means for Experiment 2.

Literacy level	Memory test			
	Stem-completion		Recognition	
	Real signatures	Altered signatures	Real signatures	Altered signatures
0–4	7.58_a	4.00_b	6.83_a	5.33_b
5–8	7.25_a	6.25_a	6.67_a	7.08_a
9–12	7.75_a	6.92_b	7.33_a	7.42_a

Cell means, within the same memory test, in a row not sharing the same subscript differ significantly ($p<.05$). The means from the undergraduate sample were 7.87_a, 7.52_b, 7.88_a, and 7.84_a, respectively, across the four corresponding cells in the rows.

interaction ($F(1,33)=7.32$, $p<.01$). Although participants from all levels recognized real brand signatures to a greater degree than they did altered ones, this advantage was significantly higher ($t(22)=4.29$, $p<.01$) for the 0–4 level ($M=7.58$ and 4.00, respectively), when compared to the 9–12 level ($M=7.75$ and 6.92, respectively), providing support for H3b. As shown in Table 2 and Fig. 2, only participants from the 0–4 level recognized real brand signatures to a significantly greater degree than they did altered brand signatures ($t(11)=4.89$, $p<.001$). There were no significant differences for the other groups.

For recognition, memory for the 9–12 level was not significantly higher than for the 0–4 level for real brand signatures (7.33 versus 6.83), but was significantly higher for the altered brand signatures (7.42 versus 5.33). Thus, pictorial elements with a 1-to-1 correspondence with reality elevate recognition memory for the lowest level of literacy to that of a relatively higher level of literacy, and the lack of such pictorial elements leads to a decline in recognition for the lowest level. A similar effect is also found in the stem-completion test (real brand signatures—0–4 (7.58) vs. 9–12 (7.75) and altered brand signatures—0–4 (4.00) vs. 9–12 (6.92)).

To examine the effect of degree of familiarity, we repeated the above analysis after adding familiarity as a covariate. We used the average of responses on 7 point scales as in Experiment 1. For the recognition test, familiarity had no significant main effect or interaction effect. For the stem-completion test, familiarity had a significant main effect ($F(1,32)=10.39$, $p<.03$) as well as an interaction effect with format ($F(1,32)=22.45$, $p<.001$) but did not alter either the significance of the main effect of format ($F(1,32)=9.87$, $p<.001$) or the literacy level × format interaction ($F(1,32)=9.22$, $p<.001$).

Discussion

Findings from Experiment 2 extend the findings of Experiment 1, and further support the advantage in the memory for brand signatures with a 1-to-1 correspondence to the real world among low-literate consumers. In both the recognition and stem-completion, participants at lower levels of literacy, when compared to those at higher levels, show significantly better performance in tasks using real brand signatures, when compared to tasks using altered brand signatures. In other words, consumers at the lowest level of literacy are more sensitive to deviation from 1-to-1 correspondence with the real world than consumers at higher levels of literacy. Consumer at the lowest levels of literacy appear to benefit from pictorial elements with 1-to-1 correspondence with reality (and therefore, with a 1-to-1 correspondence with the form in which it was originally encoded in memory), consistent with the notion of pictographic thinking and viewing brand names as objects in a scene discussed in past research (Viswanathan et al., 2005).

It is noteworthy that these differential effects across levels of literacy are found for both the direct recognition test, and the indirect stem-completion test. Thus, the 1-to-1 correspondence of pictorial elements with reality leads to differential memory when recognizing a stimulus as previously presented, and also when completing a word stem. This is different from the findings in the first experiment where differences for the indirect stem-completion test were directional, but did not reach significance. A key difference was the use of real versus artificial pictorial elements in Experiment 2, when compared to the use of real versus no pictorial elements in Experiment 1. Our findings suggest that the effects from the 1-to-1 correspondence of pictorial elements with reality may be stronger when only brand signatures are used as stimuli.

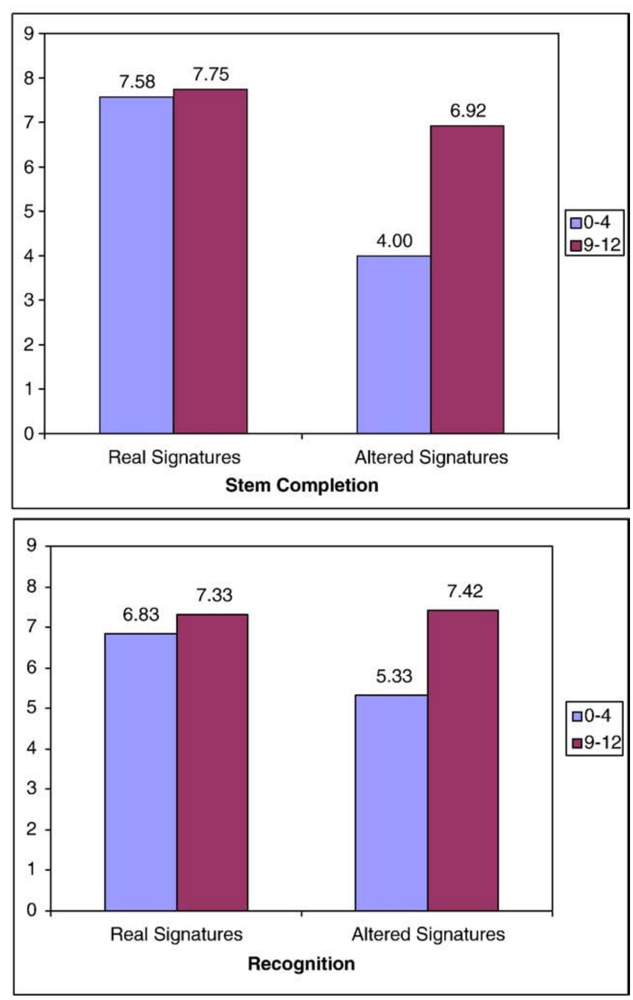

Fig. 2. Results for Experiment 2.

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The general effects we find at higher levels of literacy are also noteworthy. For those with higher levels of literacy, differences in performance for real versus altered brand signatures were not significant for either recognition or stem-completion. This points to the focus on brand names, without benefits or disadvantages accruing from pictorial elements of brand signatures.

The findings of Experiment 2 further demonstrate the subtle differences in perceptual memory among consumers with different levels of literacy. Results for H2 from Experiment 1 suggest that consumers at the lowest level of literacy (0–4) exhibited better performance on perceptual memory tasks when the stimuli are pictorial in nature (i.e., brand signature) rather than plain text when compared to higher levels of literacy (9–12). Results for H3 from Experiment 2 showed that this advantage appears to stem, not from pictorial elements per se, but from the 1-to-1 correspondence with reality of brand signatures. Moreover, general measures of degree of familiarity do not affect the findings. Thus, the advantage appears to stem from a more specific 1-to-1 correspondence between real brand signatures and their occurrence in reality, which in turn corresponds to how consumers originally encoded the brand information when they encountered it in reality, as opposed to the degree to which they know about a brand. When stimuli at exposure and test match the form in which they were originally encoded in reality, i.e., bear a 1-to-1 correspondence with the form in which the stimuli occur in reality, and when such a form has pictorial elements, it leads to enhanced memory for the lowest level of literacy.

Experiment 3

In a third experiment, we further examined whether presenting brands in usage in pictorial form adds to the advantage for low levels of literacy or detracts from it. On the one hand, showing brands in usage represents stimuli that are rich in pictorial elements, creating linkages between elements in a scene. On the other hand, such pictorially stimulus-rich information, may interfere with perceptual processing for low-literate individuals. The potential for brand name and pictorial elements of advertisements to create positive or negative effects on attention has been noted in past research (Pieters & Wedel, 2004). Macklin (1996) presented a similar finding for children due to limited processing capacity, as pictorially stimulus-rich information may create noise and divert processing away from target information. In this regard, although visual memory for scenes has been found to be very robust (Hollingworth, 2005), stimuli rich in pictorial representation, such as a usage situation, might partially inhibit the perceptual memory, which in turn, may hinder performance on a perceptual memory task, such as stem-completion. Such an effect may be pronounced for consumers at the lowest level of literacy due to their limited processing capacity when compared to those at relatively higher levels.

H4. Consumers at the lowest level of literacy, when compared to those at relatively higher levels of literacy, will have lower performance on a perceptual memory task for brands in usage when compared to brand signatures.

Table 3
Means for Experiment 3.

Literacy level	Memory test	
	Stem-completion	
	Usage	Signature
0–4	4.33	7.17
5–8	7.17	6.67
9–12	8.00	8.00

The means from the undergraduate sample were 7.81 and 7.23, respectively, across the two corresponding cells.

As largely similar results were found for H1, H2, and H3 across two studies, H4 focused on stem-completion, chosen to provide a stronger test, in light of the lack of statistically significant support for one hypothesis in Experiment 1 when compared to the recognition task.

Method

The method for Experiment 3 was similar to previous experiments, except that we used brand signatures versus brands in usage situations (please see the Appendix). Thus, Experiment 3 is a literacy level (3 levels, between subjects) × exposure format (brand signature vs. brands in usage situations, between subjects) factorial design. Participants were presented with 12 brand signatures or 12 brands in usage situations. The stimuli for the brands in usage format included a picture of the product in usage, with the brand signature shown in the bottom-right corner. We used the stem-completion as the memory test with one practice trial and 16 trials, of which 8 consisted of the brands presented at exposure. Thirty-six students enrolled at adult education centers in a Midwestern city participated, and were paid $10 each. Participants ranged in age from 18 to 68 years. Procedures were similar to those of Experiments 1 and 2.[11] For this experiment, the brand signatures were used in the stem-completion test.

Results

An ANOVA with exposure format (brands in usage vs. brand signature) and literacy level (0–4, 5–8, and 9–12) as between subject factors was conducted. The dependent variable was the number of targets correctly completed, with 8 correct responses possible. In support of Hypothesis 1, a main effect of literacy level ($F(2,30)=6.87$, $p<.01$) was found. 0–4 level individuals performed worse ($M=5.75$) than 5–8 level individuals ($M=6.92$) and 9–12 level individuals ($M=8.00$, $t(22)=3.18$, $p<.01$) (Table 3 and Fig. 3).

[11] Purely for comparison purposes, 43 undergraduate students enrolled in an introductory business course at a Midwestern University completed the experiment in exchange for extra credit. These participants followed the same procedures, but completed the experiment in small groups (15-20 per session) by writing down brand names after seeing the stimuli projected on a screen using a PowerPoint presentation.

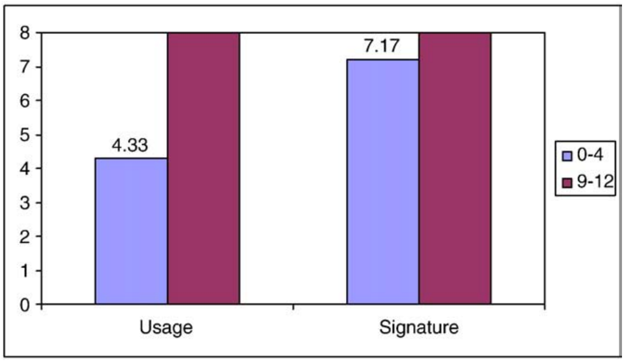

Fig. 3. Results for Experiment 3.

The main effect of exposure format was not significant ($F(1,30)=2.46$). However, we found a significant exposure × literacy interaction ($F(2,30)=4.38$, $p<.05$). In support of H4, the difference in performance of the 0–4 level for brands in usage versus brand signatures ($M=4.33$ and 7.17 respectively) was significantly higher than the difference for the 9–12 level ($M=8.00$ and 8.00 respectively) ($t(10)=2.37$, $p<.05$). Given the ceiling effect for the 9–12 level, we also find support for H4 when comparing the 0–4 level to the 5–8 level ($t(10)=3.15$, $p<.05$). Finally, we examined familiarity with the target brands as a covariate in the analysis using data based on ratings on a 7 point scale. Similar to Experiments 1 and 2, we found a slight main effect of familiarity ($F(1,29)=3.87$, $p=.06$). Neither the significance of the effect of literacy ($F(1,29)=6.44$, $p<.05$) nor the literacy by exposure interaction ($F(1,29)=4.45$, $p<.05$) was altered.

Discussion

Several key findings emerged in Experiment 3. Pictorial depiction of brands in usage situations led to poorer memory for low-literate consumers, when compared to brand signatures, providing support for H4. Our results provide tentative support for the conclusion that interference due to stimulus-rich pictures in the brand usage condition inhibits perceptual memory for the 0–4 level, congruent with similar findings with children, who lack fully-developed literacy skills (Macklin, 1996). The stem-completion task following exposure to brand signatures represents a partial match between stimuli at exposure and test. This is not the case for the brand usage condition, thus advantages in absolute terms should not be overemphasized. However, in relative terms, exposure to brand signatures offers an advantage for 0–4, compared to 9–12, level participants. With regard to higher levels of literacy, differences in performance for brand signatures versus brands in usage were not significant. This points to the focus on brand names, without benefits or disadvantages accruing from pictorial elements of signatures versus brands in usage. Finally, similar to Experiments 1 and 2, introducing a measure of general degree of familiarity with the brand as a covariate did not alter the significance of the effects.

General discussion

Our research builds on recent research on low-literate consumer behavior and the sizable literature on consumer memory by examining the relationship between literacy and consumer memory. Consistent with past research, we found decreased performance on memory tasks with lower levels of literacy. Unique to this work, we empirically demonstrate the consequences of pictographic thinking identified in recent research (e.g., Viswanathan et al, 2005) on consumer memory. The use of pictorial representations of brands (i.e., brand signatures) results in superior brand memory, for individuals with lower literacy levels, when compared to those at higher levels. This effect is shown to occur, not due to pictorial elements per se, but due to pictorial elements with a 1-to-1 correspondence with reality, and does not persist with stimulus-rich pictures of brands in usage, pointing to boundary conditions with the use of pictorial information.

Our research has implications for research on consumer memory in general, and literacy and memory in particular. Our research identifies conditions when the low memory performance of low-literate consumers can be reversed to be on par with that of consumers with higher levels of literacy, as suggested by results with real signatures in Experiments 2 and 3. Such conditions relate to the use of pictorial elements that bear a 1-to-1 correspondence with reality and therefore, a 1-to-1 correspondence with the form in which the brand was encoded when originally encountered in reality, which leads to increased perceptual memory for brand names. Thus, these findings provide a boundary condition for the findings from past research, which suggest that low literacy is associated with low memory performance. Our approach is distinct in not just showing potential vulnerabilities due to low literacy, but in identifying strengths in using pictographic thinking to enhance memory. Our research builds on past research on literacy and consumer behavior (Viswanathan et al., 2005) by developing in-depth insights about consumer memory.

In terms of literacy, our findings suggest that hypothesized differences hold even when comparing 0–4 and 5–8 levels, whereas 5–8 and 9–12 levels appear to show similar performance in memory tests. Thus, for perceptual memory issues, it appears that the lowest level of literacy leads to fundamental differences, compared to relatively higher levels. We collected data from undergraduate students purely for comparison purposes with a conventional sample. We used somewhat different procedures and did not include this data in the formal analyses, but a comparison of means provides preliminary evidence of similar levels of perceptual memory for undergraduate students as 5–8 and 9–12 literacy level participants (Tables 1 to 3) and provides another baseline to compare the disadvantages or improvements in perceptual memory for 0–4 level respondents. Our findings provide preliminary evidence that perceptual memory for the lowest (i.e., 0–4) level of literacy can be comparable to that of undergraduate students with pictorial elements that bear a 1-to-1 correspondence with reality.

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We used both direct (i.e., recognition) and indirect (i.e., stem-completion or picture-fragment completion) tests in examining memory performance. As reported in Experiment 1, which compared plain text to brand signatures, performance on the stem-completion test was higher than performance on the recognition test, and a significant two-way interaction was found between test format and type of memory test. Noteworthy here is the low level of recognition for stimuli in plain text form at test (Table 1) for the 0–4 level. In Experiment 2 comparing real versus altered brand signatures, i.e., both stimuli that contained pictorial elements, differences in performance between the direct recognition test and the indirect stem-completion test were not significant. In contrast to Experiment 1, the stem-completion task led to a larger difference than the recognition between real and altered brand signatures for 0–4 when compared to 9–12 literacy levels. In Experiment 1, this predicted contrast was directional for the stem-completion task and statistically significant for the recognition task. Thus, for the 0–4 level, altered brand signatures in Experiment 2 have a more detrimental effect on stem-completion, an indirect memory task, when compared to plain text in Experiment 1 (Table 2). For the 0–4 level, plain text appeared to have a detrimental effect on recognition in Experiment 1 (Table 1). These findings point to the differential role of pictorial elements in direct versus indirect perceptual memory tests.

In this regard, a number of findings about implicit and explicit memory in past research are noteworthy. For instance, divided attention and the amount of conscious processing resources affect explicit memory (e.g., Parkin, Reid, & Russo, 1990). Using literacy levels as a proxy for amount of conscious processing resources for purposes of speculative discussion, dissociation between recognition and stem-completion tests would be expected for the lowest level of literacy. We find some evidence of such dissociation for brand names as plain text (i.e., without pictorial elements) in Experiment 1. Interestingly, we find the opposite effect and a greater attenuation for implicit memory in Experiment 2 with altered signatures, i.e., with stimuli with pictorial elements that do not bear a 1-to-1 correspondence with reality. Another possibility for the inconsistencies between implicit and explicit tests may relate to the effect of mismatches between study and test on implicit memory (e.g., auditory study and visual test phase; Rajaram & Roediger, 1993). In this regard, changes in perceptual form often do not affect recognition accuracy, whereas conceptual encoding enhances it (Wagner & Gabrieli, 1998). Our results relating to changes in perceptual form can be interpreted in the context of past research. In a broad sense, our explanation in terms of 1-to-1 correspondence with reality is based on changes in perceptual form, such as in Experiment 2 with real versus artificial brand signatures and Experiment 1 with plain text. Contrary to past research, we do not find the differential effects between explicit and implicit memory in terms of changes in perceptual form affecting implicit memory more than explicit memory, with the following exception. For the 0–4 level in Experiment 2, the difference between real and artificial brand signatures was larger for the stem-completion task, when compared to the recognition task. Overall, we did not find clear evidence of dissociation between explicit and implicit memory for any level of literacy. Our explanation based on 1-to-1 correspondence with reality holds true for both explicit and implicit memory. Future research should examine such factors as divided attention and processing resources, conceptual encoding, different processing goals such as incidental and intentional learning, and exposure formats, and their effect on implicit and explicit memory for different literacy levels as well as the underlying processing mechanisms involved. Our research suggests that 1-to-1 correspondence with reality is an important driver when studying such issues for different literacy levels.

Research on familiarity and perceptual fluency in cognitive psychology also warrant discussion here. The notion of familiarity has been employed in cognitive psychology to refer to the degree to which stimuli match representations in memory (Clark & Gronlund, 1996). Our reasoning based on 1-to-1 correspondence with reality essentially rests on memory representations of brand information that are likely to reflect their occurrence in reality. In this regard, it should be noted that differences in a general measure of brand familiarity did not significantly alter the basic findings across three studies. Thus, our explanation is related to the stimulus being in a familiar form, i.e., matching a pictorial representation in memory, but should be distinguished from a degree of general familiarity with or knowledge about the brand. A related notion of relevance here is perceptual fluency, the ease and speed of perception, which can lead to a feeling of familiarity and recognition judgments (Jacoby & Dallas, 1981). If a stimulus is easily or fluently perceived, it can lead to a feeling of familiarity and, in turn, be judged as "old" in recognition. The relationship between perceptual fluency and different types of memory has been studied in past research (Wagner & Gabrieli, 1998). The role of perceptual fluency in consumer memory for different levels of literacy is an important direction for future research. Experiments that manipulate perceptual fluency for different levels of literacy and study the effects on memory would provide insights into the underlying processes.

Our research also adds to the large body of research on consumer memory for pictures and words. Earlier in the paper, we discussed past research on consumer memory for pictures, which has shown that pictures are recognized or recalled better than words. Pictures facilitate memory by increasing the number of cues, or by depicting spatial and other relationships, such as between products and usage situations, but also serve to create noise and take cognitive resources away from processing target information (Bower, 1970; Childers & Houston, 1984). The current research, while extending memory advantages for pictorial elements to lower levels of literacy, identifies 1-to-1 correspondence with reality, rather than pictorial elements per se, as a key element that drives our findings. Pictorial cues that bear a 1-to-1 correspondence with reality or the form in which brand signatures have been previously encoded lead to advantages for the lowest level of literacy. In this regard, across multiple experiments, the degree of familiarity of participants with brands did not alter the fundamental findings. However, even such pictorial cues cannot sustain enhanced memory for the lowest level of literacy when presented in a stimulus-rich context, where additional pictorial information serves as noise and takes limited cognitive resources away from target information. Thus, our research reinforces the picture advantage found in past research while providing a nuanced understanding of drivers of such an advantage, such as through elements of pictorial information that bear a 1-to-1 correspondence with reality, and important individual differences, such as literacy levels.

Past research has focused on different brand elements, pictorial information and text information in marketing communications, such as advertisements (Pieters & Wedel, 2004). Our comparison of memory for plain text versus brand signatures versus brands in usage provides unique insights about consumer memory across different levels of literacy. For both recognition and stem-completion tests representing direct and indirect perceptual memory tests, respectively, memory for brand names at higher levels of literacy was comparable for plain text versus brand signatures, for real versus altered brand signatures, and for brand signatures versus brands in usage. This represents robust perceptual memory for brand names across a variety of conditions representing different potentially distracting or facilitating information and provides interesting findings that can be explored further in future research on consumer memory. At higher levels of literacy, it appears that the impact of potentially distracting pictorial cues, such as of usage situations, or potentially facilitating characteristics, such as 1-to-1 correspondence with reality, does not have a significant influence on perceptual memory for brands. The role of such factors in conceptual memory for information across levels of literacy is a promising direction for future research. Similarly, recent examination of construal level theory (cf., Trope, Liberman, & Wakslak, 2007; with commentary from Dhar and Kim, 2007; Fiedler, 2007; and Lynch and Zauberman, 2007) suggest that understanding of how information is construed by low-literate consumers is worthy of further study. Other relevant research issues include the role of congruent or incongruent text in enhancing or decreasing memory performance for different pictorial representations. In terms of broader implications, our research speaks to the influence of literacy levels on marketplace phenomena in terms of learning and memory as related to a variety of types of information including price. By extension, the effects of literacy on information processing and consequent decision making is another area of research with theoretical implications for consumer psychology and practical implications for marketing and public policy.

Limitations of our research stem from factors such as limited access to low-literate consumers, and consequently small sample sizes. Related to access and our use of students at adult education centers is the need for future research to delve into more fine-grained differences, such as a study of socio-economic factors, and their implications for memory and other consumer behavior phenomena. In this regard, our samples consisted largely of individuals from lower socio-economic strata. Given the challenges in research on low literacy, we believe that examining different literacy levels using students at adult education centers is a good starting point. Over time, we also need to develop further fine-grained understanding of literacy and numeracy, and their relationships with related variables. However, our experience suggests considerable practical difficulties in finding suitable participants. Future research should also address other limitations of our study such as an examination of different processing goals (e.g., incidental versus intentional learning, choice versus judgment). In conclusion, this research on literacy and consumer memory has important theoretical and practical implications and provides a basis for future work on consumer memory.

Appendix A. Stimuli used in experiments

Experiment 1

Target brands: Clorox, Bounty, Folgers, Aveeno, Skittles, Windex, French's, Altoids, Fritos, Sprite, Crisco, Hershey's, Tylenol, Gatorade, Hormel, Cheerios, Palmolive, Alessi, Snickers, Campbell's, Smucker's, Libby's, Nalley, and Skippy.

Filler brands: Drano, Alpo, Snuggle, Secret, Keebler, Annie's, Welch's, Lipton, Cascade, Charmin, Hellman's, Pamper's, Arnold, Clairol, Combat, Roland, Barilla, Colgate, Breyer's, Kleenex, Softsoap, Thomas, Pringles, Febreze, Durkee, and Listerine.

Sample brand signatures

Sample stem-completion brand signature

Experiment 2

Target brands: Hershey, Tylenol, Gatorade, Folgers, Skittles, Sprite, Cheerios, Clorox, Campbell's, Windex, Doritos, Crisco, Bounty, Skippy, Snickers, and Tabasco.

Filler brands: Alpo, Dell, Google, Keebler, KitKat, Panasonic, Welch's, Cascade, Pringles, Pampers, French's, Tostitos, Kleenex, Softsoap, Febreze, and Listerine.

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Sample altered brand signature

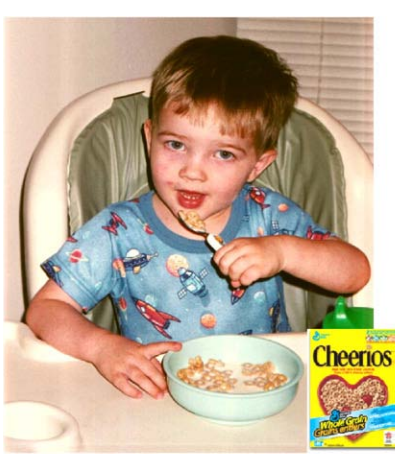
Sample stem-completion stimuli

Experiment 3

Target brands: Folgers, Snickers, Bounty, Cheerios, Tylenol, Crisco, Windex, and Skippy.

Filler brands: Alpo, Colgate, Febreze, Durkee, Softsoap, Listerine, Roland, and Pampers.

Sample brands in usage



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