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Perceptual asymmetry during free viewing of words and faces: The effect of context on recognition

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There is ample evidence supporting the dissociation between the role of the left and right cerebral hemispheres in processing words and faces, respectively. Nevertheless, research has not yet studied the effect of perceptual asymmetry in memory context effect tasks using words and faces. Thus, the present study researches the advantages of presenting information in the right versus left hemispace and the effect of context on recognition when using faces compared to words presented in the right versus left hemispace. Participants ($n = 60$) were assigned either to the group presented with pairs of words, or with pairs of faces. One stimulus in each pair was designated as the target (i.e., to be remembered) and the other served as context (i.e., to be ignored). Half of the targets were presented in the right hemispace, and half were presented in the left hemispace. As predicted, words were better recognized when presented in the right hemispace, while faces were better remembered when presented in the left hemispace. The most interesting finding is the influence of context on lateralized processing of words and pictures. That is, only when words or faces were presented in the left hemispace did contextual information affect target memory (though it yielded a different pattern of effect). Hence, the findings of the present study may be interpreted either as reflecting attentional bias to the left hemispace or structural differences between the hemispheres. Thus, cognitive processes and the content of the stimuli determine which hemisphere will be involved in processing contextual information.

1. Introduction

Humans are surrounded by multiple concurrent stimuli, some of which are of greater significance to the observers than others and are at the focus of their attention, while others exist in parallel and serve as the background, or *context*, for the primary stimulus. It has been well-documented that information is better remembered when displayed in the presence of the original learning context. The effect of consistent or changing context on the ability to recall or recognize acquired information is known as *Context Effect* (Memon & Bruce, 1985; Vakil, Raz, & Levi, 2007).

Context effect for various forms of context has been investigated in laboratory conditions, including word lists (McKenzie & Tiberghien, 2004), pictures of faces (Dalton, 1993; Winograd & Rivers-Bulkeley, 1977), pictures of objects (Levy, Rabinyan, & Vakil, 2008), and pictures of faces and hats (Vakil et al., 2007), serving both as intentionally processed items that subsequently become the targets of retrieval tasks, as well as incidentally processed contextual elements that were either present or absent at the time of target retrieval.

Vakil et al. (2007) introduced their multifactorial model of context effect. In several studies, Vakil and colleagues demonstrated that context effect is composed of at least two distinct cognitive processes; binding and additive familiarity. Binding is evident when recognition is better under the Repeat condition (i.e., original target and context pair) than the Re-pair condition (i.e., old target and context, though paired differently than in the learning stage). Additive familiarity is evident when recognition under the Re-pair condition is better than when a familiar target is paired with new context. Thus, in these paradigms, the target information that was intentionally learned requires explicit memory. Because context effect is evident without explicitly referring to this information, it is viewed as an implicit measure of memory for contextual information. Several studies have confirmed this distinction by demonstrating the independence between the two, as shown in patients with traumatic brain injury, who consistently displayed impaired memory for target information while demonstrating preserved context effect (Vakil, Golan, Grunbaum, Groswasser, & Aberbuch, 1996a; Vakil, Openheim, Falck, Aberbuch, & Groswasser, 1997). A similar pattern of results was found with elderly individuals

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(Naveh-Benjamin & Craik, 1995; Vakil, Melamed, & Even, 1996b) and with young, healthy participants (Levy et al., 2008).

The goal of the present research is to study the perceptual asymmetry that occurs during recognition of target information and the effect of context on recognition (i.e., context effect) when stimuli (faces versus words) are freely viewed in one hemispace. While presentation in the right hemispace has been shown to improve recognition when participants were instructed to remember words, presentation in the left hemispace produced better results for non-verbal stimuli such as abstract images, objects or faces (Guerin & Miller, 2009; Maillard et al., 2010). Several experiments show distinct enhanced ability to recognize verbal information (letters and words), as indicated by accuracy, speed or both, when the stimuli were displayed to the right visual field (RVF) – meaning that they were processed by the left hemisphere (Jordan, Patching, & Thomas, 2003). A similar advantage was shown, albeit not as consistent, for recognition of various types of non-verbal information that was displayed to the left visual field (LVF), meaning that it was processed by the right hemisphere (Blanchet et al., 2001).

Studies tested the effect of presenting stimuli to the LVF versus the RVF using very brief presentation durations (less than 180 ms) in order to ensure that stimuli reached one hemisphere only. However, quite a few studies have demonstrated perceptual asymmetry under the free viewing condition. In memory and context effect research, stimuli are generally presented for several seconds in order to enable sufficient processing time for the contextual information to allow the context effect to emerge. Therefore in the present study, stimuli were presented under the free viewing condition.

Several studies using various paradigms have demonstrated that normal participants show left-side attentional bias (Luh, 1995; Luh, Rueckert, & Levy, 1991) under free-viewing conditions. This relative neglect of the right side is referred to in the literature as pseudoneglect (Bowers & Heilman, 1980). Perceptual asymmetry was found for free viewing of chimeric stimuli, primarily faces (Chiang, Ballantyne, & Trauner, 2000; Gilbert & Bakan, 1973; Levine & Levy, 1986; Levy, Heller, Banich, & Burton, 1983; for review see Voyer, Voyer, & Tramonte, 2012). Similarly, bias for the left hemispace was demonstrated during free viewing of line bisections (Krupp, Robinson, & Elias, 2010; for review see, Jewell & McCourt, 2000), luminance judgments (Nicholls, Bradshaw, & Mattingley, 1999; Nicholls & Roberts, 2002), and size and numerosity (Nicholls et al., 1999). Similarly to the present study, Dundas, Plaut, and Behrmann (2013) showed an advantage for word processing in adults when stimuli were presented in the right hemispace, and an advantage for face processing when presented to the left hemispace. Based on a literature review, Chiang et al. (2000) concluded that "Most of the studies have had remarkably consistent results, whether tachistoscopic or free-viewing techniques were used, suggesting that free-viewing tasks may be able to provide inferences about hemispheric asymmetries in humans" (p. 417). Voyer et al. (2012) reached a similar conclusion based on their meta-analysis. "Nevertheless, converging evidence presented here supports the interpretation that free viewing tasks are a valid measure of hemispheric asymmetries, although attention might have some modulating influence." (p. 563).

In this context it is important to note that the neuroimaging studies that demonstrated cerebral asymmetry in various tasks were generally conducted using free viewing techniques. Neuroimaging studies have shown that the left hemisphere primarily processes verbal information, while the right hemisphere typically processes non-verbal information, perceptual details and spatial relativity (Coleshill et al., 2004; Kennepohl, Sziklas, Garver, Wagner, & Jones-Gotman, 2007; Laeng, Overoll, & Ole Steinsvik, 2007; Thomason et al., 2009). Similarly, memory for verbal and non-verbal stimuli was found to be impaired in patients with damage to the right or the left hemisphere, respectively (for review see Gainotti, 2014). In their literature review, Li et al. (2013) point out the similarities and differences between word and face processing, as reported in both fMRI and ERP studies. Numerous fMRI studies have demonstrated the role of the ventral occipito-temporal cortex in the left hemisphere in word processing (McCandliss, Cohen, & Dehaene, 2003) and the role of the same area in the right hemisphere for face processing (Tarkiainen, Cornelissen, & Salmelin, 2002). ERP studies reached a very similar conclusion. While N170 was recorded from posterior electrodes on the left side of the scalp when visually presenting words (Mercure, Dick, Halit, Kaufman, & Johnson, 2008), N170 was recorded from similar electrodes on the right side of the scalp when faces were presented (Bentin, Allison, Puce, Perez, & McCarthy, 1996). Several studies made direct comparisons between words and faces using ERP (i.e., N170) with adults, and confirmed the differential role of the left and right hemispheres, respectively (Dundas, Plaut, & Behrmann, 2014; Mercure et al., 2008).

An alternative approach to understanding the distinct role of each cerebral hemisphere asserts that the underlying *cognitive process* rather than the *content* (i.e., verbal vs. non-verbal) of the stimuli determines which hemisphere will be more active. Accordingly, when analytic, serial or sequential processes are required, the left hemisphere will play the primary role. When synthetic, holistic, parallel or gestalt processing is required, the right hemisphere is primarily engaged (Garoff, Slotnick, & Schacter, 2005). According to this approach, the analytic/serial processing subserved by the left hemisphere is perfectly suited to the continuous nature of verbal information, while parallel processing conducted by the right hemisphere corresponds with the simultaneous analysis that occurs while studying intricate facial features (see review by Dien, 2009).

In paradigms using stimuli in which the large-global target (e.g., the letter 'H') is formed of small-local letters (e.g., the letter 'e'), it has been shown that response time for global targets is faster than for local targets when the stimulus is displayed to the left hemispace. However, response time for local targets is faster when displayed to the right hemispace, leading researchers to conclude that global data is processed primarily in the right hemisphere while local data is processed primarily in the left hemisphere (Kimchi & Merhav, 1991; Langerak, La Mantia, & Brown, 2013; Lux et al., 2004; Yoshida, Yoshino, Takahashi, & Nomura, 2007).

Thus, the question to be considered is which hemisphere will be more involved while implicitly processing contextual information? One possibility is that it depends on the content of the stimuli. That is, context effect will be evident for words when presented to the left hemisphere, and for faces when presented to the right hemisphere. This hypothesis is supported by a study by Morimoto et al. (2008) who examined how the hemispheres differ in their ability to suppress intervention, that is, to filter out irrelevant background information. The researchers conducted their study using a task in which a target stimulus was displayed along with a context stimulus that outflanked it. They found that the inferior frontal gyrus in the left hemisphere was activated when the context word accompanied a target in the form of a color blot, while the same area was activated in the right hemisphere when the color blot served as the context for a target word. This indicates that context stimuli accompany target stimuli for cognitive control processes such as intervention suppression. That is, the left hemisphere was primarily involved while processing contextual verbal stimuli while the right hemisphere was primarily involved while processing contextual non-verbal stimuli.

An alternative possibility is that regardless of the content of the stimuli, the right hemisphere will be most sensitive to contextual information. This alternative option is based on several studies described above that showed an advantage for the right hemisphere while processing global and background information. Recent meta-analysis research has shown that global and context-related thought and formative processes are significantly more dominant in the right hemisphere than in the left (Mihov, Denzler, & Förster, 2010). Thus, our overall prediction is that words will be better recognized when presented in the right hemispace while faces will be better recognized when presented in the left hemispace. With regard to contextual information, two alternatives are proposed. The first is that like target information, the content of the stimulus (words or faces) will determine which visual field presentation will produce better recognition (right or left, respectively). The second alternative is that regardless of the content of the contextual stimuli, context effect will be more pronounced when contextual stimuli are presented in the left than in the right hemispace.

As summarized above, ample evidence supports the dissociation between the role of the left and right cerebral hemispheres in processing words and faces, respectively. To the best of our knowledge, there is no documented research on the effect of perceptual asymmetry in memory context effect tasks that incorporate recognition of words and faces serving as target versus contextual information. Although there are studies that tested the laterality of context effect, these studies did not focus on memory. For example, Van Petten and Rheinfelder (1995) and Coulson, Federmeier, Van Petten, and Kutas (2005) used ERP to assess laterality in context effect with verbal lexical decision or priming tasks.

2. Method

2.1. Participants

Sixty undergraduate students at Bar-Ilan University participated in the present study. All participants received either monetary compensation or class credits (as part of the requirements for first-year psychology students) for participating in the study. Based on self-reports, the participants were all right-handed, and had normal or corrected vision (glasses or contact lenses). Participants were assigned either to the words or faces group. There were 30 students in each group, with an equal number of male and female participants. The average age of participants in the words and faces groups was 22.93 ($SD = 2.55$) and 23.43 ($SD = 2.36$), respectively. The groups did not differ significantly by age, $t(58) = 0.79$, $p = 0.43$.

The study was conducted in accordance with the requirements defined by the university ethics committee and all participants signed informed consent forms. Each participant filled out a demographic questionnaire to provide information such as name (stored separately from the results file), age, gender, faculty, years of education and dominant hand.

2.2. Task and procedure

The structure of the experiment was identical for both groups, with the only difference being that faces were used as stimuli in one, while words were used in the other. The experiment was designed using SuperLab (Cedrus, Inc.) software. At the learning phase, the words group and the faces group were presented with 48 pairs of words and 48 pairs of faces (24 pairs of male faces and 24 pairs of female ones), respectively (see Appendix A). The word list consisted of 96 (48 pairs) concrete, two-syllable common Hebrew nouns, which were selected based on a study by Vakil and Sigal (1997). The 96 faces (forming 48 pairs) used in the study consisted of 48 male and 48 female faces presented in same-gender pairs. All faces were photographed from the front with neutral expressions and under uniform lighting conditions. The faces were taken from the AR Face Database with consent from its authors (Martinez & Banavente, 1998).

Participants were tested individually. They were seated 60 cm away from the computer monitor. Two stimuli were presented side by side, while one was designated as the target (i.e., to be remembered) and the other as context. The target stimuli were marked with a red border (8 cm × 8.5 cm) and the context stimuli were marked with a black border (see Appendix A). Half of the targets were presented in the left and half in the right hemispace. It should be noted that throughout the text, presentation in the left or right hemispace refers to the presentation of the target stimulus. At the learning phase, each pair was displayed for six seconds, followed by a cross that appeared at the center of the screen for 500 ms between each pair. Participants were instructed as follows: "In this experiment, you will view a series of face-pairs/word-pairs. Please focus your attention on the cross throughout the entire experiment and remember only the face/word that appears in the picture with a red border". The test phase immediately followed the learning phase. At the test phase, participants were presented with pairs of stimuli (words or faces depending on the group). As in the learning phase, two stimuli were presented side by side, the target stimuli were marked with a red border and the context stimuli were marked with a black border. For the conditions in which an "old" target was presented (1–3, see below), it was always presented in the same hemispace as during the learning phase. For the conditions in which the target was "new", half of the targets were presented in the right and half in the left hemispace. Participants were instructed to use their right index finger to press the letter "C" on the keyboard if the target (marked with a red border) was old or the letter "Z" if it was new.

Each presentation of pairs of stimuli met one of the five conditions described below, modeled in accordance with a previous design described by Vakil et al. (2007). Overall, the recognition test included 24 old targets and 24 new targets, as described below. Each pair of stimuli was presented on the screen until the participant decided whether the target was old or new.

1. Repeat (ToCos) = Target Old Context Old Same: a target stimulus that had been presented previously was presented again with the same context stimulus (8 pairs).
2. Re-pair (ToCod) = Target Old Context Old Different: an old target stimulus that had been viewed previously, paired with a different context stimulus that had been previously viewed (8 pairs).
3. New (ToCn) = Target Old Context New: an old target stimulus displayed with a new context stimulus that had not been previously viewed (8 pairs).
4. (TnCo) Target New Context Old: a new target stimulus paired with an old context stimulus that had been viewed before (16 pairs).
5. (TnCn) Target New Context New: a new target stimulus paired with a new context stimulus that had not been viewed before (8 pairs).

3. Results

Three separate mixed-design ANOVAs with repeated measures were conducted in order to analyze Hit rates for target information (words or faces) recognized and False Alarms (FA) for words and faces. It should be noted that Hit rates were analyzed for Repeat, Re-pair and New context conditions in which the target was old. FA rates were analyzed for TnCo and TnCn context conditions in which the target was new.

3.1. Hit rate

The effects of Hemispace (right vs. left), Context (Repeat, Re-pair, & New), and Group (Words vs. Faces) were analyzed using mixed-design ANOVA with repeated measures. Significant interaction was found between Group and Context, $F(2,116) = 5.79$, $p = 0.004$, $\eta^2 = 0.09$. The Group by Hemispace interaction reached significance as well, $F(1,58) = 4.94$, $p = 0.03$, $\eta^2 = 0.08$. No other main effects or interactions achieved significance (all p's > 0.42). As can be seen in Fig. 1, words were better remembered when presented in the right hemispace while faces were better remembered when presented in the left hemispace. These results should be interpreted cautiously because of the significant triple interaction, Group by Hemispace by Context, $F(2,116) = 3.24$, $p = 0.04$, $\eta^2 = 0.05$.

In order to interpret the triple interaction, two separate analyses were conducted for stimuli presented in the left and right hemispace. When stimuli were presented in the right hemispace, with the exception of a tendency towards a Group effect, i.e. words tended to be better recognized than faces, $F(1,58) = 2.87$, $p = 0.096$, $\eta^2 = 0.05$, no other main effects or interactions achieved significance (all p's > 0.57) (see Fig. 2a). When stimuli were presented in the left hemispace, Group by Context interacted reached significance, $F(2,116) = 9.07$, $p < 0.001$, $\eta^2 = 0.14$. No other main effects or interactions achieved significance (all p's > 0.51). Follow-up analyses using one-way repeated measures separately for each group confirmed that contrary to the findings above, context effect reached significance for both faces and words in this case, $F(2,58) = 6.10$, $p < 0.005$, $\eta^2 = 0.17$ and $F(2,58) = 3.35$, $p < 0.05$, $\eta^2 = 0.10$, respectively. Bonferroni for post hoc analysis revealed that for faces, significantly more hits were shown under the Repeat condition compared to Re-pair and New ($p < 0.05$), but Re-pair did not significantly differ from the New condition. The same analysis for words revealed that although the overall context effect is significant, the context conditions did not significantly differ from each other when Bonferroni for post hoc analysis was applied. As can be seen in Fig. 2b, opposite context effect patterns emerged for words and for faces. In the group that studied words, the highest Hits rate was recorded for the original context condition (i.e., Repeat), followed by for the Re-pair and then the New conditions, as expected. The group that studied faces displayed the poorest performance under the Repeat condition, better performance under the New condition and the best performance under the Repeat condition. Thus the groups differed primarily in the Repeat condition while the Re-pair and New conditions yielded similar results.

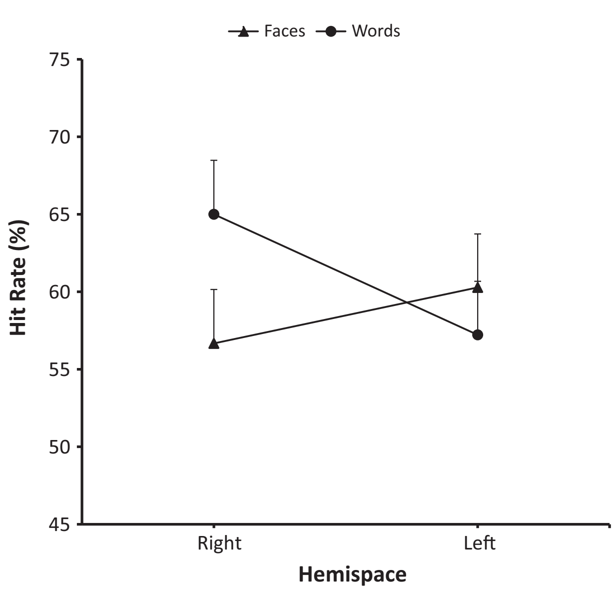

Fig. 1. Mean Hit rate and SE for words and faces as a function of right versus left hemispace presentation.

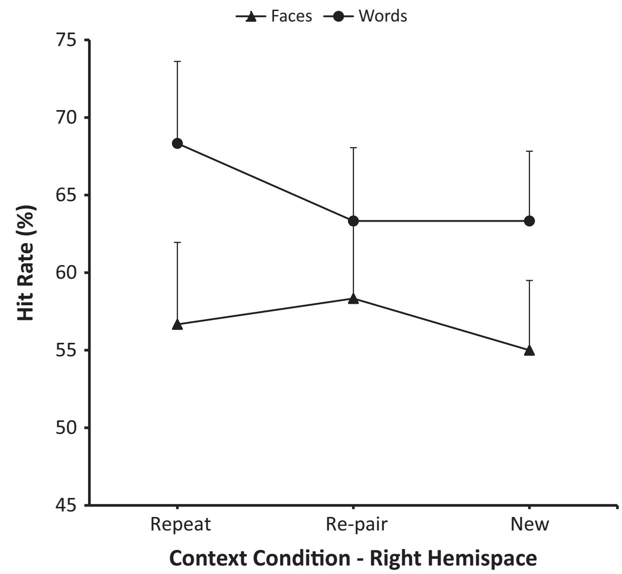

Fig. 2a. Mean Hit rate and SE for words and faces as a function of context when presented in the right hemispace.

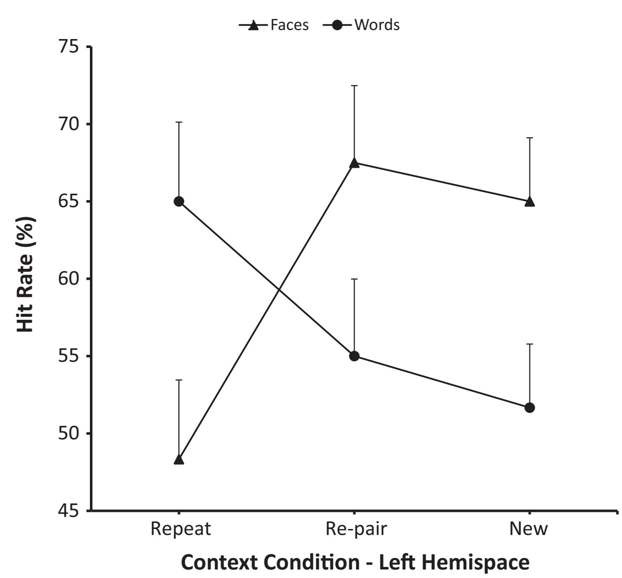

Fig. 2b. Mean Hit rate and SE for words and faces as a function of context when presented in the left hemispace.

3.2. False alarm rates

The effects of Hemispace (Right vs. Left), Context (TnCo and TnCn), and Group (Words vs. Faces) were analyzed using mixed-design ANOVA. The first two are within-subject variables and the latter is a between-subject variable. The Group main effect reached significance, $F(1,58) = 12.81$, $p = 0.001$, $\eta^2 = 0.18$, however this effect should be interpreted cautiously because of the significance shown for the Group by Hemispace interaction, $F(1,58) = 10.28$, $p = 0.002$, $\eta^2 = 0.15$. As can be seen in Fig. 3, while more FAs occurred when faces were presented in the right hemispace

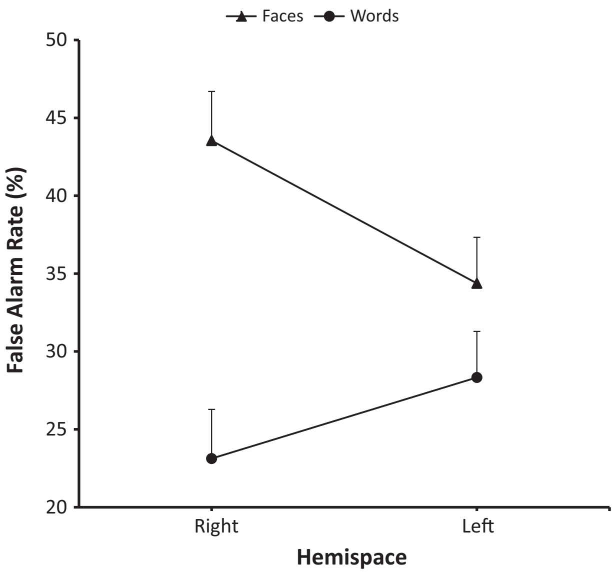

Fig. 3. Mean FA rate and SE for words and faces as a function of right versus left hemispace presentation.

compared to when there were presented in the left hemispace, the opposite was observed with words, i.e. more FAs occurred when the stimuli were presented in the left hemispace than to the right one. All other effects did not reach significance (all p's > 0.05). Thus in general, best memory for faces (i.e., high Hit rates and low FA rates) was evident when presented in the left hemispace. However, when words were presented, the opposite pattern was observed and performance was best when the words were presented in the right hemispace (i.e., high Hit rates and low FA rates).

4. Discussion

In the present study, we aimed to determine the advantages of presenting target information in the left vs. the right hemispace and the effect of context on recognition of this information (i.e., context effect) when using faces as targets compared to words. The differential role of the right and left cerebral hemispheres while processing faces and words respectively has been consistently shown using behavioral studies (Dundas et al., 2013), fMRI studies (Gainotti, 2014; Kelley et al., 1998) and ERP studies (Dundas et al., 2014; Mercure et al., 2008). However, to the best of our knowledge, this is the first study to test the differential role of the cerebral hemispheres in memory context effect tasks that incorporate recognition of words and faces serving as target versus contextual information.

The results of the present study were consistent with our hypothesis and with existing literature (Blanchet et al., 2001; Dundas et al., 2013; Guerin & Miller, 2009; Jordan et al., 2003; Maillard et al., 2010). Words were better recognized when presented in the right hemispace during the learning phase, while faces were better remembered when presented in the left hemispace. Further support for these findings comes from analysis of FA rates. Words yielded higher FA rates when presented in the left hemispace than when presented in the right hemispace, while faces showed the opposite pattern of results. In addition, these findings are of important methodological significance because they confirm that the free viewing paradigm used in the present study adequately activated the left and right hemispheres by presenting the stimuli in the right and left hemispace, respectively. These findings further support studies by Chiang et al. (2000) and Voyer et al. (2012) which showed that results when using free viewing paradigms are consistent with those yielded when presenting stimuli to one visual field using a tachistoscope, for example.

The second important finding was that neither Context nor Context by Group interaction reached significance when stimuli were presented in the right hemispace. However, when the stimuli were presented in the left hemispace, a significant Context by Group interaction emerged. The overall finding that it is presumably the right and not the left hemisphere that is sensitive to the contextual information is consistent with the hypothesis that the cognitive process rather than the content of the stimuli is what determines which hemisphere will be activated. As described in the introduction, several studies suggested that the right hemisphere is more efficient in processing global and contextual information regardless of whether verbal or non-verbal stimuli are displayed (Dien, 2009; Garoff et al., 2005; Kimchi & Merhav, 1991; Langerak et al., 2013; Lux et al., 2004; Yoshida et al., 2007).

As can be seen in Fig. 2b, the groups that studied words produced precisely the context effect pattern expected (i.e., context effect emerged only when information was presented in the left but not in the right hemispace). That is, target words were best recognized under the Repeat condition compared to the Re-pair condition or when the target was displayed with new context. However, contrary to our prediction, context effect on face recognition yielded an unexpected pattern of results, as shown in Fig. 2a (again only when presented in the left but not in the right hemispace). The study showed that face recognition was poorer under the Repeat condition than under the other two conditions. One possible, though admittedly post hoc, explanation for the fact that no advantage was shown for the Repeat condition over the other conditions, is that it is much more difficult to form meaningful associations or bindings between target and contextual facial stimuli than for words. Unlike faces, words have semantic meaning. Therefore with some effort, it is possible to find a meaningful association between two different words that could facilitate the ability to bind them. Therefore, contrary to the findings for words, there was no advantage to the Repeat condition when faces were used. However, this is an insufficient explanation because it does not explain why recognition under the Repeat condition was worse than under the Re-pair and New Context conditions. Thus, further research is required in order to elucidate this issue, possibly by encouraging binding between two faces as was done in the study conducted by Winograd and Rivers-Bulkeley (1977) that presented pairs of male and female faces and asked participants to make compatibility judgments.

The findings reported here that show an advantage for the left hemispace when viewing faces and an advantage for the right hemispace for words can be viewed as a reflection of a differential perceptual or attentional bias towards the left or right hemispace, respectively.

Several researchers have claimed that hemispatial neglect and pseudoneglect reflect the same underlying mechanism (McCourt & Garlinghouse, 2000). Heilman and Van Den Abell (1980) state that the right hemisphere can direct attention to the left and right hemispaces, while the left hemisphere directs attention only to the right hemispace. The well-known clinical finding that hemispatial neglect occurs more commonly following damage to the right hemisphere compared to the left hemisphere supports the claim that the right hemisphere plays a more dominant role in attentional processes. That also explains the pseudoneglect phenomenon, that is leftward bias reported for healthy individuals under free viewing conditions (McCourt & Garlinghouse, 2000).

Thus, the findings of the present study could be interpreted as reflecting attentional biases that are equivalent or greater than their reflection of structural differences between the hemispheres. That is, context effect emerges only when the context stimuli are presented to the left hemispace because the right hemisphere (unlike the left hemisphere) can direct attention to the contralateral as well as to the ipsilateral hemispaces. This enables processing of the target and context stimuli and emergence of the context effect.

In conclusion, the present study sheds some light on the ambiguity in existing literature on hemispheric differences regarding explicit memory for targets and implicit context effect on target memory, when the stimuli are either faces or words. It further demonstrates the complexity of the role of each cerebral hemisphere in various aspects of memory. On the one hand, the study showed that the type of target stimuli (words or faces) is what determined which hemisphere would show an advantage during recognition. On the other hand, contextual information affected target recognition whether words or faces were used only when presented in the left hemispace. Because brief presentation would not be sufficient to enable context effect to emerge, it is recommended to use eye tracking in future research in order to ensure unilateral presentation for longer exposure times as used in the present study. Further research using neuroimaging techniques (e.g., fMRI) could help clarify the different roles of the two cerebral hemispheres in the complex interaction between recognition of target information and context effect on the one hand, and the differences between words and faces on the other.

These results have significant implications on context memory literature that, to the best of our knowledge, has neglected to control hemispace presentation when viewing target and context information. As the present study demonstrates, the hemispace used is sensitive to the content of the target stimuli. In addition, this study indicates that contextual stimuli presented in the left hemispace are more likely to yield context effect than those presented in the right hemispace.

Appendix A

See Fig. A1.

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Fig. A1. A sample of pairs of faces and words (in Hebrew) presented to participants in the different groups (each pair presented on a separate screen).

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