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Picturing survival memories: Enhanced memory after fitness-relevant processing occurs for verbal and visual stimuli

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Recent studies have shown that processing words according to a survival scenario leads to superior retention relative to control conditions. Here, we examined whether a survival recall advantage could be elicited by using pictures. Furthermore, in Experiment 1, we were interested in whether survival processing also results in improved memory for details. Undergraduates rated the relevance of pictures in a survival, moving, or pleasantness scenario and were subsequently given a surprise free recall test. We found that survival processing yielded superior retention. We also found that distortions occurred more often in the survival condition than in the pleasantness condition. In Experiment 2, we directly compared the survival recall effect between pictures and words. A comparable survival recall advantage was found for pictures and words. The present findings support the idea that memory is enhanced by processing information in terms of fitness value, yet at the same time, the present results suggest that this may increase the risk for memory distortions.

Memory phenomena are often explained by focusing on all-purpose proximate mechanisms (Nairne, 2005). That is, researchers often use a set of general principles to explain memory phenomena (e.g., elaboration leads to detailed memories). However, it is very likely that memory has evolved to reflect specific selection pressures that were present in our ancestral past. Researchers (see Nairne & Pandeirada, 2008a, 2008b) have recently begun to explore such a functionalist approach into the field of memory phenomena, and they have found startling new insights. For example, Nairne, Thompson, and Pandeirada (2007) examined whether processing information relevant for survival leads to retention superior to that for processing information in nonsurvival conditions (i.e., moving to a foreign country, pleasantness, and personal relevance). Specifically, they instructed participants to imagine a scenario in which they were stranded in the grasslands of a foreign land without any basic necessities and in danger of predators. Next, the participants had to rate words for their relevance to the scenario. The participants recalled significantly more words in the survival scenario than in control scenarios, demonstrating that survival processing leads to improved memory performance.

In further research, it was found that the survival recall advantage persisted when control conditions were used that equated the survival scenario in terms of arousal, novelty, media exposure (Kang, McDermott, & Cohen, 2008), and schematic processing (Weinstein, Bugg, & Roediger, 2008), but also when scenarios were designed that presumed to tap ancestral priorities, such as hunting and gathering activities (Nairne, Pandeirada, Gregory, & Van Arsdall, 2009). These studies provide compelling evidence that survival processing results in improved retention, yet research into this area remains relatively scarce.

The above-mentioned studies were predominantly focused on the recall of words by a comparison of the survival scenario with matched-appropriate control conditions. One unexplored issue is whether the survival recall advantage also holds for other classes of stimuli, such as pictures. It is widely recognized that information is more likely to be recollected when it is presented in pictures rather than in words (Paivio, 1971; Rajaram, 1996). This issue is particularly interesting in terms of adaptive memory, since processing pictures (i.e., imagery) preceded the processing of language (e.g., words) in the evolution of human memory (Paivio, 2007). Thus, if memory has evolved to favor processing fitness-relevant information, it seems likely that rich visual stimuli (e.g., pictures) would benefit from survival processing. Clearly, examining this issue would advance our knowledge regarding the robustness of the survival recall advantage.

Our purpose in the present study was to examine whether the survival recall advantage could be elicited using pictorial stimuli. We conducted two experiments to test this issue. In Experiment 1, participants were randomly allocated to a survival, moving, or pleasantness scenario (see also Nairne et al., 2007). However, instead of words, the participants were presented with pictures, which they had to rate for their relevance to the scenario. Then they were given a surprise free recall test. We hypothesized that pictures would be more likely to be remembered in the survival scenario than in the other scenarios. Furthermore, we were also interested in

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whether pictures varying in arousal and valence would differentially impact the survival recall advantage. The hypothesis that it would was based on the idea that survival processing could result in more arousal or emotional processing (see Nairne et al., 2007). Since it has been shown that arousing and emotional stimuli can enhance retention (Levine & Pizarro, 2004), it could well be that the survival recall effect would be larger for arousing and emotional stimuli.

A subsidiary aim of Experiment 1 was to examine how survival processing would affect participants' memory for details of the pictures, both correct and incorrect (i.e., distortions). After the free recall test, participants had to describe the recalled pictures by writing down as much as they could remember about each of the pictures. We were interested in the correct details and the incorrect details (i.e., distortions) that the participants would report. One might expect that the participants in the survival scenario would report more correct and incorrect details than would those in the other scenarios because of the elaborate processing that occurs in this scenario (Craik & Tulving, 1975; Nairne & Pandeirada, 2008a). Tentative evidence for this prediction was found by Nairne et al. (2007), who showed that participants reported more intrusions (i.e., recall of nonpresented words) in the survival and moving scenarios than in the pleasantness scenario.

In Experiment 2, we sought to directly compare the magnitude of the survival effect for verbal and visual stimuli. In doing so, participants had to imagine a survival or moving scenario. Meanwhile, they were presented with pictures and words for which they had to indicate their relevance for the scenario. We predicted that the survival recall advantage would be elicited for pictures and words. On the one hand, we hypothesized that pictures would be recalled more often than words, irrespective of condition. This hypothesis is inferred from the *picture superiority effect* (Rajaram, 1996), which posits that memory is superior for pictures relative to memory for words. However, from an evolutionary stance, one could speculate that the survival effect might be larger for pictures than for words.

EXPERIMENT 1

Method

Participants. The participants were 75 undergraduate students (M_{age} = 21.27 years, SD = 3.47; 18 men) from Maastricht University. The students received a small amount of compensation for their participation (€5 or a small present). They were tested individually in sessions lasting approximately 30 min.

Materials. Stimuli were selected from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 1995). Thirty pictures were chosen that highly resembled the words used in previous experiments by Nairne et al. (2007). Only pictures for which the verbal labels were the main theme of the image were selected. For example, for the word *chair*, a picture of a chair was selected, and for the word *dog*, a picture of a dog was chosen. However, although most pictures closely resembled their verbal counterparts, pictorial versions of three words (i.e., *landscape*, *fruit*, *fire*) consisted of details (i.e., trees, different kinds of fruit, people on fire) that the original words did not possess.

Also, we divided our pictures into low- versus high-arousal pictures (arousal) and low- versus high-pleasure pictures (valence). To this end, we obtained arousal and valence ratings (1, *low arousal* or *low pleasure*; 9, *high arousal* or *high pleasure*) for the 30 IAPS pictures (Lang et al., 1995). Using a median split ($M_{arousal}$ = 4.47, $M_{valence}$ = 5.70), the 30 pictures were split into high- versus low-arousal pictures and high- versus low-pleasure pictures.

Design and Procedure. In the present experiment, we used a between-subjects design consisting of three groups (survival, moving, and pleasantness). The following dependent variables were measured: ratings of pictures, recall, number of words, correct details, and distortions. The participants were informed that they had to rate various pictures on different dimensions. Next, they were randomly assigned to the survival (n = 25), moving (n = 25), or pleasantness (n = 25) condition. Then they received a Dutch version of one of the following three rating instructions, which were identical to the ones used in Nairne et al. (2007). The only difference was that in our description, we, of course, used "picture(s)" instead of "words."

Survival. "In this task, we would like you to imagine that you are stranded in the grasslands of a foreign land, without any basic materials. Over the next few months, you'll need to find steady supplies of food and water and protect yourself from predators. We are going to show you some pictures, and we would like you to rate how relevant each of these pictures would be in this survival condition. Some of the pictures may be relevant and others not; it's up to you to decide."

Moving. "In this task, we would like you to imagine that you are planning to move to a new home in a foreign land. Over the next few months, you'll need to locate and purchase a new home and transport your belongings. We are going to show you some pictures, and we would like you to rate how relevant each of these pictures would be in this moving condition. Some of the pictures may be relevant and others not; it's up to you to decide."

Pleasantness. "In this task, we are going to show you some pictures, and we would like you to rate the pleasantness of each picture. Some of the pictures may be pleasant and others may not; it's up to you to decide."

The pictures were presented individually on a computer screen for 5 sec each. In all three conditions, the pictures were presented in the same random order. Before the rating task started, two practice pictures were presented in order to familiarize the participants with the task. The participants were asked to rate the pictures on a 5-point scale (1, *totally irrelevant* or *unpleasant*; 5, *extremely relevant* or *pleasant*). Their responses were written on a scoring sheet. All the participants were alerted that they had to respond within a 5-sec presentation window. They were not informed about the upcoming recall test.

Following the picture-rating task, the participants were given a 2-min distractor task (i.e., playing a Tetris game). Next, they were asked to recall as many of the pictures by their verbal labels as they could in 10 min. In this test, they were free to decide in which order they reported their responses. Only after the participants had recalled as many pictures as they could remember were they asked to provide a detailed description (e.g., color, number of objects or people) of the recalled pictures on a new blank sheet with their recall sheets in front of them. No time limits were set in this part.

Scoring. A picture was correctly recalled when the participants reported the correct verbal label of the picture. When they recalled pictures that were semantically related to the verbal labels and for which it can be assumed that expert knowledge is needed to differentiate between the verbal labels (e.g., *hawk* instead of *eagle*), these were also considered correctly recalled pictures. Details were scored as correct when the participants correctly described the color, the number of objects, and the number of people in the recalled pictures. The details were considered distortions when the participants incorrectly described the recalled pictures in terms of color, the number of objects, or the number of people, but also when the participants reported having seen nonpresented details. For example, 1 participant claimed to have seen a cat with red eyes, whereas the picture showed a cat with blue eyes. One point was assigned to each correct and each incorrect detail. To examine the reliability of the coding system, the descriptions of 20% of the participants were assessed by two independent raters. Interrater agreement using intraclass correlations was high: .92 for correct details and .91 for distortions.

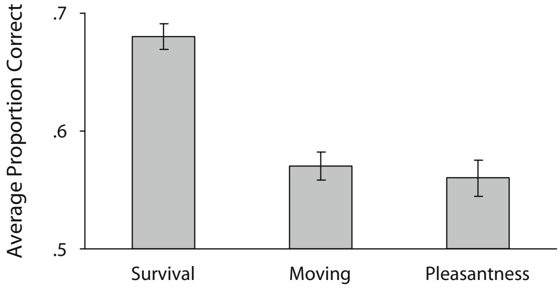

Figure 1. Average proportions of correct recall as a function of condition.

Results

Recall. One-way ANOVAs were performed on the dependent variables (rating of pictures, recall, number of words, correct details, and distortions). Post hoc comparisons were executed by means of Tukey honestly significant difference tests. Figure 1 presents the average proportion of correct recall per condition. The ANOVAs revealed a significant effect of condition [$F(2,72) = 9.57$, $p < .001$, $\eta_p^2 = .21$] for correct recall of pictures. Post hoc comparisons showed the survival recall advantage: The participants recalled significantly more pictures in the survival condition than in the moving and pleasantness conditions (ps $< .001$). The latter two conditions did not significantly differ from each other.

We conducted an ANOVA on the rating data to determine whether the three conditions differed in their ratings. This analysis yielded a significant effect of condition [$F(2,66) = 8.08$, $p < .001$, $\eta_p^2 = .20$; see Figure 2], with the participants in the survival condition providing higher mean ratings than did those in the moving condition ($p <$ .001). The other post hoc comparisons were not significant. To explore whether this effect had influenced our recall data, an ANCOVA with rating as a covariate was performed. An identical pattern of results was found, with the survival group performing significantly better than the other two groups [$F(2,65) = 5.40$, $p < .01$, $\eta_p^2 = .14$].

Also of interest was whether pictures varying in arousal (low vs. high arousal) and valence (low vs. high pleasure) would differentially affect recall in the three conditions (see Table 1). A repeated measures ANOVA with arousal as a within-subjects factor on the recall data showed that the high- and low-arousal pictures were more likely to be recalled in the survival condition than in the other conditions [$F(2,72) = 5.81$, $p < .01$, $\eta_p^2 = .14$]. The pairwise comparison between the moving and pleasantness groups was not significant ($p > .05$). We found that regardless of condition, high-arousal pictures were better recalled than low-arousal pictures [$F(1,59) = 4.37$, $p < .05$, $\eta_p^2 = .06$]. Also, the interaction between arousal and condition failed to reach significance ($p > .05$). A similar analysis on the high- versus low-pleasure pictures showed that, overall, high- and low-pleasure pictures were more often remembered in the survival condition than in the other conditions [$F(2,59) = 6.19$, $p < .01$, $\eta_p^2 = .15$]. The moving and pleasantness groups did not differ significantly ($p > .05$). Furthermore, we found that the high-pleasure pictures were more likely to be remembered than the low-pleasure pictures, independent of condition [$F(1,59) = 81.10$, $p <$ .001, $\eta_p^2 = .53$]. No significant interaction between valence and condition was detected ($p > .05$).

Details. To control for differences in the amount of recalled pictures, we calculated for each participant individually the mean number of words and (in)correct details. Although more words were present in the survival (M = 12.56, SD = 4.84) and pleasantness (M = 11.39, SD = 4.43) conditions than in the moving condition (M = 10.84, SD = 5.26), this difference did not reach statistical significance [$F(2,59) = 0.81$, n.s.]. With regard to correct details, a marginally significant effect of condition [$F(2,72) = 2.72$, $p = .07$, $\eta_p^2 = .07$; see Figure 3] emerged. Thus, the participants had more correct details in their descriptions in the pleasantness condition than in the moving condition, and the survival descriptions contained more correct details than did the moving descriptions. However, neither pairwise comparison reached statistical significance (both ps $> .05$). We also found a significant effect for distortions [$F(2,72) = 6,.28$, $p < .01$, $\eta_p^2 = .14$; see Figure 4], in that in the survival condition, significantly more distortions were present than in the pleasantness condition ($p < .05$). The post hoc comparisons between the moving and pleasantness conditions and between the survival and moving conditions were not significant (ps $> .05$).

Discussion

Our purpose in Experiment 1 was to examine whether the survival recall advantage could be elicited when using pictures and whether this leads to improved memory for details. We found evidence that the survival group had retention superior to that of the moving and pleasantness groups. Furthermore, our findings show that high-arousal/pleasure pictures were recollected more often in all conditions than were low-arousal/pleasure pictures. Also, the participants in the survival group were more likely to have distortions in their descriptions than were the participants in the pleasantness group.

Our finding that superior pictorial recall was obtained in the survival condition relative to the other conditions provides further evidence that memory has evolved to favor information that is processed for its fitness value. Moreover, our experiment shows that the survival recall advantage can be generalized to more ecologically valid stimuli (i.e., pic-

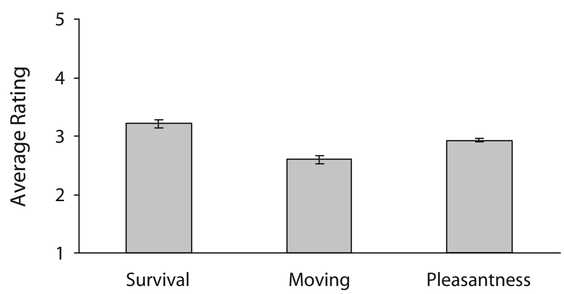

Figure 2. Average rating (1–5) as a function of condition.

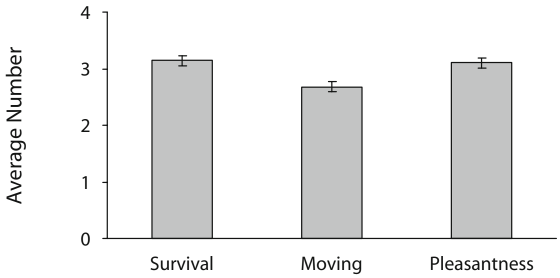

Figure 3. Average numbers of correct details per recalled picture as a function of condition.

tures). That is, if memory has truly evolved to favor processing of survival-relevant stimuli, this evolutionary process would likely be the result of selecting rich visual stimuli that possess fitness value over those without fitness value.

Our survival recall advantage was demonstrated by an effect size that was almost twice as large as the effect size reported in the original article, in which words were used (Nairne et al., 2007; $\eta_p^2 = .16$ vs. $\eta_p^2 = .09$). Specifically, Nairne et al. (2007) found that the survival group produced an enhancement relative to the moving and pleasantness groups of around 8%–10%, whereas we found an enhancement of 12%. This finding is probably related to the *picture superiority effect* (Rajaram, 1996), which holds that pictures are processed in more depth than words. Moreover, this result fits nicely with the dual-coding theory (e.g., Craik & Lockhart, 1972; D'Agostino, O'Neill, & Paivio, 1977; Hyde & Jenkins, 1973; Paivio, 2007), which predicts that pictures activate verbal and nonverbal (pictorial) codes in memory. This leads to memory performance for pictures superior to that for words. Indeed, the participants in the present experiment recalled nearly 10% more stimuli than did the participants in other studies (e.g., Kang et al., 2008; Nairne & Pandeirada, 2008b; Nairne, Pandeirada, & Thompson, 2008).

We also found that when pictures were split into high- versus low-arousal and high- versus low-pleasure pictures, all types of pictures were more likely to be recalled in the survival condition than in the other conditions. This result further supports the idea that the survival recall advantage is a robust phenomenon that is independent from well-known mediating factors (see also Nairne et al., 2008) and that persists when other types of stimuli (i.e., pictures and words, high-arousal/pleasure and low-arousal/pleasure pictures) are used. Indeed, Nairne et al. (2007) also showed that emotional arousal did not affect their results.

We did find that, independently of condition, high-arousal pictures were remembered better than low-arousal pictures. This effect is in line with research showing that emotional/arousing stimuli are more likely to be recalled than low-arousal stimuli (e.g., Bradley, Greenwald, Petry, & Lang, 1992; Kensinger & Corkin, 2003). Surprisingly, high-pleasure pictures were more likely to be reported in all conditions than were low-pleasure pictures. This finding is reminiscent of the Pollyanna effect (Matlin & Stang, 1978), which refers to the finding that memory is better for pleasant than for neutral stimuli. However, other studies also show that arousal, not pleasantness, predominantly affects memory performance (Bradley et al., 1992). Obviously, this issue awaits further empirical scrutiny.

The participants in the survival condition displayed more distortions in their descriptions than did the participants in the pleasantness condition. This finding is in accordance with Nairne et al. (2007), in which the survival and moving groups reported more nonpresented words than did the pleasantness group. Presumably, processing information in the survival condition leads to more schematic activation. Research shows that schematic activation increases the risk of memory distortions (e.g., Kleider, Pezdek, Goldinger, & Kirk, 2008). Thus, one may tentatively conclude from our data that although survival processing leads to superior retention of information, this appears to come at the cost of increased erroneous recollections.

In summary, the findings of Experiment 1 clearly show that the survival recall advantage is also present when pictorial stimuli are used. However, an unexplored issue is whether processing information in terms of survival value differentially affects verbal and visual stimuli. In Experiment 2, we addressed this issue by directly comparing the survival effect for pictures and words.

EXPERIMENT 2

Our main objective in Experiment 2 was to examine the difference in survival recall for pictures and words. Since, in Experiment 1, the size of our recall effect was larger than the size of the original recall effect (Nairne et al., 2007) and because one might expect that adaptive memory favors processing rich visual stimuli (i.e., pictures), one could hypothesize that the survival recall effect would be larger for pictures than for words.

Method

Participants. Sixty undergraduate students (M_{age} = 21.65 years, SD = 4.69; 12 men) from Maastricht University participated in this experiment. They received financial compensation in return for their participation (€5). Sessions lasted approximately 30 min. These students did not participate in Experiment 1.

Materials. The 30 pictures that we used in the previous experiment were divided into two sets of 15 pictures (Sets A and B). Verbal labels for these pictures were used as word stimuli (Word Sets A and B, corresponding to Picture Sets A and B, respectively), thereby ensuring that there were no conceptual differences between the pictures and words. This procedure resulted in four versions that were counterbalanced between participants and across condition: (1) Picture Set A (15 pictures) and Word Set B (15 words corresponding to

Table 1
Average Proportions and Standard Deviations of Pictures Varying in Arousal (Low vs. High Arousal) and Valence (Low vs. High Pleasure) per Condition

	Arousal				Pleasure			
	High		Low		High		Low	
Condition	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Survival	.41	.09	.36	.13	.47	.12	.30	.10
Moving	.33	.08	.31	.16	.38	.12	.26	.10
Pleasantness	.33	.12	.27	.15	.37	.14	.22	.11

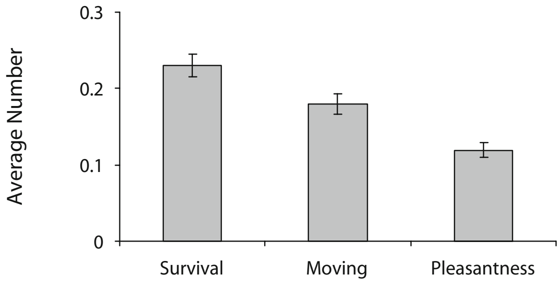

Figure 4. Average numbers of distortions per recalled picture as a function of condition.

Picture Set B), (2) Picture Set B (15 pictures) and Word Set A (15 words corresponding to Picture Set A), (3) Word Set A (15 words corresponding to Picture Set A) and Picture Set B (15 pictures), and (4) Word Set B (15 words corresponding to Picture Set B) and Picture Set A (15 pictures).

Design and Procedure. In Experiment 2, we employed a 2 (condition: survival vs. moving) × 2 (stimuli: pictures vs. words) mixed design, with the latter factor being a repeated measure. The participants were told that they had to rate pictures and words for relevance for the scenario. Then they were randomly allocated to the survival ($n = 30$) or moving ($n = 30$) condition. The participants received the same version of the survival and moving conditions as did those in the previous experiment. However, they were now told that pictures *and* words had to be rated.

The pictures and words were displayed individually on a computer screen for 5 sec each. Before the rating task started, one practice picture and one practice word were presented in order to familiarize the participants with the task. The participants were instructed to rate the pictures on a 5-point scale (1, *totally irrelevant* or *unpleasant*; 5, *extremely relevant* or *pleasant*). The pictures and words were presented in separate blocks. The participants' responses were written on a scoring sheet. They were notified that they had to respond within a 5-sec presentation window. No mention was made about a recall test.

Following the picture- and word-rating task, the participants had to play a Tetris game for 2 min. Next, they were asked to recall as many of the pictures and words as they could in 10 min. In this test, they were free to decide in which order they recalled their responses. In contrast to Experiment 1, we did not ask them to describe the pictures that they had seen. This was done because the mixture of words and pictures in this experiment made collecting these data difficult. More important, Experiment 2 was primarily designed to test the difference in survival recall for pictures and words.

Results

A repeated measures ANOVA was performed with the independent variables condition (survival vs. moving) and stimuli (pictures vs. words) and the dependent variable amount of correctly recalled pictures and words. Figure 5 shows the average proportion correct recall of pictures and words per condition. No significant interaction was found ($p > .05$). The repeated measures ANOVA revealed a significant main effect of condition [$F(1,58) = 17.97$, $p < .001$, $\eta_p^2 = .24$], with the survival group remembering more pictures and words than the moving group. Furthermore, we found a significant effect of stimuli [$F(1,58) = 31.12$, $p < .001$, $\eta_p^2 = .37$], indicating that in both conditions pictures were better remembered than words.

To examine whether the ratings differed in the two conditions, we performed an ANOVA on the relevance rating data. We found a significant effect of condition [$F(1,58) = 13.26$, $p < .001$, $\eta_p^2 = .19$], with the participants rating the stimuli higher in the survival ($M = 3.36$, $SD = 0.51$) than in the moving ($M = 2.90$, $SD = 0.45$) condition. A repeated measures ANCOVA with rating as a covariate was conducted in order to examine whether the ratings affected our recall findings and showed that the covariate did not significantly affect the recall data.

Discussion

Our aim in Experiment 2 was to examine whether survival processing would be quantitatively different for pictures than for words. Our results show that a survival recall advantage was present for pictures *and* for words. Moreover, we found that the participants were more likely to recall pictures than words across conditions.

Critically, the magnitude of the survival effect did not differ between pictures and words. Thus, although Experiment 1 showed that the effect size was almost twice as large as the effect size in the original article (Nairne et al., 2007), the data from Experiment 2 suggest that pictures do not benefit more from survival processing than do words.

Our finding that memory for fitness-relevant information is superior when words and pictures are included as stimuli lends further support to the idea that the survival recall advantage is a robust phenomenon. We also showed that, independent of condition, pictures were more likely to be reported than words. Obviously, this result is in accordance with the picture superiority effect (Rajaram, 1996), which states that pictures are better recollected than words.

GENERAL DISCUSSION

Our primary goal in the present study was to examine whether a survival recall advantage could be elicited when pictures were used. In two experiments, we showed that such an effect indeed occurs with pictorial stimuli. Moreover, we found that this effect was equally large for pictures and for words (Experiment 2). In Experiment 1, we also found that the survival group provided more distortions in their descriptions than did the pleasantness group. Our result that memory for pictures and words is enhanced

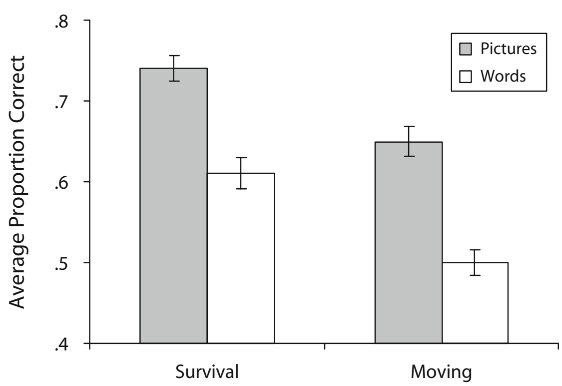

Figure 5. Average proportions of correct recall of pictures and words as a function of condition.

when information is processed in terms of fitness value extends previous research on adaptive memory.

Although some studies show that the survival recall advantage remains present even when appropriate control conditions are used (e.g., Nairne et al., 2009; Weinstein et al., 2008), no studies have focused on whether other classes of stimuli (e.g., pictures) would also be affected by survival processing. Our study is the first to demonstrate that the survival recall effect can be elicited when another type of stimuli is used. So our study contributes to the growing body of evidence showing that the survival recall effect is a robust and universal phenomenon.

Although one might have expected that pictures would produce a larger survival recall effect than would words, our data suggest that survival processing affects pictures and words similarly. In addition, both arousal and valence affected recall performance overall in Experiment 1, but neither significantly changed the size of the survival processing advantage. To the extent that these mnemonic effects are mediated by a common mechanism, such as the degree of elaboration, one might have expected to see interactions. One might also have expected, from an evolutionary perspective, that highly arousing stimuli would benefit more from survival processing than would low-arousal stimuli. However, no interaction was obtained.

In Experiment 1, we found that when participants had to describe their recalled pictures, the participants in the survival condition had more memory distortions than did the participants in the pleasantness condition. Perhaps, then, survival processing leads to more schematic activation, which in turn promotes the development of memory distortions (see Kleider et al., 2008; Nairne et al., 2007). An alternative explanation is that survival processing results in more spreading activation, thereby increasing the likelihood of memory distortions. However, our data also showed that the survival and moving groups did not differ significantly from each other in terms of memory distortions. This result suggests that it is not survival processing per se that affected memory distortions but, perhaps, more schematic processing that influenced the memory distortions in the survival condition. Since our study was not designed to specifically examine the occurrence of memory distortions in adaptive memory, these explanations remain speculative.

All in all, the present study adds to the accumulating evidence that memory evolved to favor fitness-relevant information. It shows that the survival recall advantage can be elicited at similar rates when pictorial and word stimuli are used. Meanwhile, survival processing also seems to be related to a heightened susceptibility to memory distortions. Accordingly, future studies regarding adaptive memory should focus on both veridical and erroneous recollections.

AUTHOR NOTE

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