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Different bias mechanisms in recall and recognition of conceptual and perceptual information of an event

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The aim of this research was to study the memory and response bias for conceptual and perceptual information in the recall and recognition of an event. The participants watched a movie trailer video and their memory of verbal and visual actions and details was evaluated using specific recall questions or a true/false recognition task. The participants recalled and recognized actions better than details, and visual information better than verbal information. Memory biases affected recall and recognition differently. The participants showed a high tendency to accept false verbal actions consistent with the gist of the event as true in the recognition task, while in the recall task the participants were more likely to answer incorrectly questions involving visual perceptual details. These results reflect the different mechanisms which are involved in the processing and cognitive management of conceptual and perceptual information of an event.

The human cognitive system is governed by a principle of economy. The information processing system is based on using enough global aspects to be able to identify an event while ignoring specific details which require attention or processing resources (Schank & Abelson, 1977). This global/local (Förster, 2012), conceptual/perceptual, thematic/literal (Brainerd & Reyna, 1990), automatic/controlled style of processing is also characteristic of memory in the real world (Neisser, 1967; Cohen & Conway, 2008). For example, the distinction between gist (thematic and conceptual information) and literal or verbatim traces (perceptual features) in the *fuzzy trace theory* (e.g., Brainerd & Reyna, 1990) has been used to explain memory

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performance in everyday life. In terms of the *fuzzy trace theory*, two independent memory representations of an event are formed in parallel during encoding; a verbatim or literal trace that contains the surface structure and specific details, and a gist representation that maintains the general meaning or theme of the encoded event. While thematic information, plot and script of an event are processed generically and automatically, encoding specific details requires attention and greater processing ability. *Fuzzy-trace theory* principles of gist extraction and verbatim processing are compatible with script-driven processing in event memory, where prior knowledge or schemas guide encoding and retrieval. Predictions include that main actions that represent the event are better remembered than particular details that require attention, and that automatic script inferences of gist information can also be a source of error. The main objective of this study was to analyse the differences in memory between recall and recognition of conceptual and perceptual information of an event.

In event memory, actions involve more conceptual processing, make up the gist of the event, accurately capture the argument and sequence of facts, and require less cognitive effort to process than literal information or perceptual details. In the free recall of an event, participants remember the main actions better than the details and make very few mistakes (e.g., Migueles & García-Bajos, 1999; Woolnough & MacLeod, 2001). When asked specific questions about an event, participants also remember more conceptual than perceptual information correctly, however, compared with free recall, participants produce more errors, mainly in perceptual information items (García-Bajos, Migueles, & Aizpurua, 2014; Migueles, García-Bajos, Aizpurua, 2016). In recognition tasks, on the other hand, participants incorrectly accept as true more conceptual information, such as the actions contained in the script of the event, than perceptual details, and they do so with greater confidence (e.g., Migueles & García-Bajos, 1999). The divergence of the results in the recall and recognition for the actions and details of an event can be attributed, on the one hand, to differences in the ability to process conceptual and perceptual information (Förster, 2012; García-Bajos et al., 2014), and, on the other, to the different retrieval processes used in recall and recognition.

Regarding the type of memory evaluation tasks, a recall task requires greater cognitive effort than a recognition task (e.g., Danckert & Craik, 2013). While recall involves self-initiated search and retrieval, a recognition task provides more efficient retrieval cues and involves comparison processes between the available and the stored information. The mechanisms supporting recognition are mediated by two processes, familiarity and recollection (Mandler, 1980; for a review see Diana, Yonelinas, &

Ranganath, 2007), whereas successful recall depends largely on conscious recollection (Jacoby, Toth, & Yonelinas, 1993). Familiarity is an automatic process associated with the fluency with which an item is processed (Whittlesea & Leboe, 2000). In contrast, recollection is a strategic process, which involves reinstatement of the memory trace. While familiarity is unique to recognition, recollection is viewed as a recall-like process, implying that the active search for the memory trace is similar for recall and recognition. Even so, the recollection processes underlying recall and recognition are supported by dissociative neurocognitive mechanisms during retrieval (Sadeh, Maril, & Goshen-Gottstein, 2012). Recall involves generating information, while recognition does not, and thus recall is more demanding than recognition (Cabeza et al., 1997).

In everyday life, people often answer unbiased closed questions about the contents of daily events and respond to true/false recognition questions. In this study, we examined memory accuracy and biases for conceptual information (actions) and perceptual information (details) in a closed-questions recall task and in a recognition task using a video of a movie trailer. A novelty of the study is that the same memory contents were tested in recall and in recognition. We also made a distinction between the verbal and visual information modality of the event for both types of contents (actions and details). It has been known that memory for pictures and visual information is generally better than for words or verbal information (McBride & Dosher, 2002). It is also known that we store the meaning or gist of a message without reference to the original syntactic or lexical content using a process of abstraction (Alba & Hasher, 1983). However, the interactions between the type of contents (actions and details) and the sensory modality of the information (verbal, visual) have not been analysed before systematically for event memory.

In two recent studies (García-Bajos et al., 2014; Migueles et al., 2016), we discovered a tendency in participants to answer closed questions erroneously in the recall of an event when the items included perceptual details rather than conceptual information, while the opposite pattern is common in recognition tasks (e.g., Zaragoza, Mitchell, Payment, & Drivdahl, 2011). It is possible that, in the recognition task, the main source of errors may lie in the retrieval fluency of the conceptual information (Doss, Bluestone, & Gallo, 2016; Mirandola, Toffalini, Grassano, Cornoldi, & Melinder, 2014; Zaragoza et al., 2011). According to the *fuzzy trace theory* (Brainerd & Reyna, 1990), individuals establish and retain a well-integrated trace of the features shared among different contents of an event, and the information that is consistent or congruent with the gist of the event is fluently processed; consequently, individuals experience a strong sense of familiarity

or recollection when thematic information is presented at retrieval, which in turn might lead to recognition errors.

In contrast, an important source of errors in the recall of an event can be the activation of perceptual information accompanying retrieval (García-Bajos et al., 2014; Migueles et al., 2016). Although it has been observed that perceptive details seem to lend veracity to retrieved memories (Israel & Schacter, 1997; Mitchell & Johnson, 2009; Slotnick & Schacter, 2004; Storbeck, 2013) and that presenting information visually rather than aurally (Smith & Hunt, 1998) or using pictures instead of words at encoding (Dodson & Schacter, 2001; Schacter, Israel, & Racine, 1999) can reduce the incidence of false memories in recognition, errors in recall may be due to the vividness of the retrieval of perceptual information, particularly for visual details. For example, imagining the colour of a car or recreating a detail may enhance confidence that it actually occurred and lead to errors in recall tasks. The influential *reality-monitoring model* (Johnson & Raye, 1981) and the more general *source-monitoring theory* (Johnson, Hashtroudi, & Lindsay, 1993) have also been theoretically useful in examining conceptual and perceptual memory errors. Distortion and false memories are due to errors in discriminating between perceived information and related contents from other sources, such as internal recollections generated through inferences or thought, prior knowledge activation, later elaborations, or post-event details. In order to examine the effect of the type of contents and information modality on correct memory and errors, we examined the verbal and visual aspect of both the actions and the details of the event in the movie trailer.

In addition, we examined response confidence as a metamemory measure of belief in accuracy in recall and recognition. Recollection and belief in accuracy are distinct components of remembering (Rubin, 2006; Scoboria, Talarico, & Pascal, 2015). Belief in accuracy is the degree to which a recollected event is appraised to correspond to what was experienced at the time of the event. In other words, belief in accuracy indexes the monitoring of the quality of recollections. Subjective experience of response accuracy will test memory precision and bias mechanisms for verbal and visual actions and details in the recall and recognition of an event. Although no response confidence data are available for the recall of daily events, in eyewitness memory research it has been observed that confident witnesses are not necessarily accurate witnesses, as they can give incorrect answers in recall and accept false statements in recognition and do so with as high degree of confidence as if the information were true (e.g., García-Bajos, Migueles, & Aizpurua, 2012). In any event, response confidence will be also mediated by the type of contents evaluated and the processing style involved in recall and recognition. Thus, confidence will tend to be greater in the responses to

actions-related items than for perceptual details because conceptual information involves greater processing fluency (Doss et al., 2016). Confidence will be also greater for visual than verbal information because visual information provides perceptual evidence to recollective memory (e.g., Miller & Gazzaniga, 1998).

METHOD

Participants. Sixty eight volunteer psychology students from the University of the Basque Country UPV/EHU participated in the experiment, 56 women and 12 men, with an average age of 22.59 years (*SD* = 4.17). Half of the participants completed a recall task and the other half completed a recognition task. To confirm that the study had sufficient statistical power, an analysis using the G*POWER software (Faul, Erdfelder, Lang, & Buchner, 2007) was applied to determine how many participants would be required to achieve a power of 0.8 with an alpha of .05 to detect a medium effect size of $f = 0.25$. A 2 (contents: actions, details) x 2 (information modality: verbal, visual) within-participants factorial design, with memory tasks (recall, recognition) as between-groups measures would require 24 participants in each group, that is, less than the 34 participants tested in each group.

Materials. A movie trailer for *Confessions of a Shopaholic* (2009) directed by P. J. Hogan, http://www.youtube.com/watch?v=8-WMLeQeV3c, lasting 2.21 min, was used as the event. A movie trailer was chosen because they are attractive, briefly summarize the plot, include the main actions, and offer a range of specific details (see also García-Bajos et al., 2014).

Two memory tasks, a recall task and a recognition task, were used to evaluate the memory of the central aspects of the trailer. The recall task consisted of 32 questions, 16 items on actions and 16 on details. In both tasks, there were 8 verbal information questions (e.g., verbal action: What does the shopaholic say happens to her when she sees a shop?; verbal detail: What shoe brand does the shop assistant recommend?) and 8 visual information questions (e.g., visual action: How does she get her credit card back?; visual detail: What colour is the car she arrives to work in?). The recognition task consisted of 32 true/false statements examining the same contents as the recall task (e.g., verbal action: The shopaholic says she goes crazy when she sees a shop; verbal detail: The shop assistant recommends Prada shoes; visual action: She cracks open a block of ice with a shoe to get the credit card back; visual detail: The car she arrives to work in is yellow). The 32 true/false statements for verbal and visual actions and details in the recognition task were counterbalanced across participants. Half the participants were given one version of the task in which half the verbal and visual actions and details

were true and the other half false, while the other half of the participants received the opposite true/false version of the statements. The questions were ordered chronologically in both the recall and recognition tasks and there were no more than three consecutive items of the same type (verbal, visual, actions, details, true or false).

Design. A 2 (contents: actions, details) x 2 (information modality: verbal, visual) within-participants factorial design was used. The correct responses, commission errors, accuracy, and response confidence in the recall and recognition tasks were evaluated. In order to compare recall and recognition memory, for correct answers the correct responses in recall and hits in recognition were analysed, and for commission errors the incorrect responses in recall and false alarms in recognition were analysed.

Procedure. This study was approved by the Research Ethics Board of the University of the Basque Country UPV/EHU. All participants provided full informed consent before completing this study. The participants were shown a video of the movie trailer on a 2.5 x 2 meter projection screen via computer. They were asked to pay close attention but they were not told that their memory of the event was going to be tested. After watching the trailer, the participants were asked to perform a distraction task in which they were given 5 minutes to list as many causes as possible for the current economic crisis, and a further 5 minutes to offer possible solutions to the crisis. Following this distraction task, 34 participants, out of the total of 68, were chosen at random to do the recall task while the remaining 34 carried out the recognition task. The recall task required the participants to answer 32 questions concerning the verbal and visual actions and details contained in the trailer. They were asked to attempt answering all the questions, but were allowed to leave them blank when they did not know the answer. The recognition task involved the participants responding true or false to 32 statements (half of which were true and the other half false) which tested the same contents as the recall task. In both tasks, the participants were required to rate their level of confidence in the response to each item, on a scale from 0 (no certainty) to 7 (absolute certainty). Participants took between 8 and 10 min to answer the 32 recall questions at their own pace and between 5 and 8 min to complete the recognition task. The entire session took approximately 35 minutes.

RESULTS

The recall task was scored by two judges, who assigned one point for every answered question, whether they were a correct response or a commission error. The overall interraters' agreement, calculated by the

Cohen's Kappa test, was very high (k = 0.91). The few discrepancies were resolved by a third independent judge. In the true/false recognition task, the corresponding correct hits and commission errors (false alarms) were evaluated. The proportion of correct responses and commission errors in recall (Table 1) were calculated by dividing the number of correct responses or commission errors by the total number of recall questions. The proportion of hits and false alarms in recognition (Table 2) were calculated by dividing the number of hits or false alarms by the total number of true or false statements in the recognition task. To compare recall and recognition results, the same procedure was used to calculate accuracy in recall and recognition (e.g., List, 1986). Accuracy in recall was calculated by dividing the proportion of correct responses by the sum of the proportion of correct responses and commission errors. Accuracy in recognition was calculated by dividing the proportion of hits by the sum of the proportion of hits and false alarms.

Recall. To analyse the proportion of correct responses, commission errors, unanswered questions and accuracy in the recall task of the verbal and visual actions and details in the movie trailer (Table 1), four 2 (contents: actions, details) x 2 (information modality: verbal, visual) within-participants factorial ANOVAs were used. The post hoc comparisons for analysing significant interactions were performed using the Bonferroni test.

Table 1. Mean proportion of correct responses, commission errors, unanswered questions and accuracy, and mean response confidence (0-7) in the recall of a movie trailer (SDs in parentheses).

Contents	**Actions**		**Details**	
Information	**Verbal**	**Visual**	**Verbal**	**Visual**
Recall				
Correct responses	.51 (.17)	.67 (.19)	.54 (.24)	.33 (.12)
Commission errors	.27 (.17)	.25 (.14)	.30 (.20)	.43 (.22)
Unanswered questions	.22 (.21)	.08 (.11)	.16 (.19)	.24 (.22)
Accuracy	.65 (.18)	.73 (.18)	.64 (.25)	.43 (.20)
Recall confidence				
Correct recall	4.65 (1.22)	5.75 (1.37)	5.83 (0.86)	4.79 (1.25)
Commission errors	3.34 (1.57)	3.63 (1.50)	2.95 (1.79)	1.96 (0.94)

Correct responses. In the proportion of correct recall the contents factor, $F(1, 33) = 41.62$, $p < .001$, η_p^2=.56, and the contents x information modality interaction, $F(1, 33) = 36.78$, $p < .001$, η_p^2=. 53, were significant. There was a greater proportion of correct responses in recall to action-related items (M = .59) than to details (M = .43). In addition, while there were no

significant differences in the correct responses between verbal actions and verbal details in recall (.51, .54; $p > .05$), the visual actions were remembered better than the visual details (.67 > .33, $p < .001$). These results reflect how difficult it is to recall specific visual details. The recall of visual actions may have been enhanced by the processing fluency of the actions contained in the video as well as the perceptual vividness of the visual information.

Commission errors. Among the proportion of commission errors in recall, the factors contents, $F(1, 33) = 17.68$, $p < .001$, $\eta_p^2 = .35$, and information modality, $F(1, 33) = 6.03$, $p = .02$, $\eta_p^2 = .15$, and the interaction contents x information modality, $F(1, 33) = 5.48$, $p = .025$, $\eta_p^2 = .14$, were significant. There was a greater proportion of commission errors in the recall of details ($M = .36$) than in the recall of actions ($M = .26$) and in the visual information ($M = .34$) than in the verbal information ($M = .28$). Furthermore, while there were no significant differences between the proportion of commission errors to verbal and visual actions (.27, .25; $p > .05$), there was a greater proportion of commission errors in the recall of visual details than in the recall of verbal details (.43 > .30, $p < .01$). These results indicate more perceptual memory biases than conceptual errors in the recall of an event when specific questions are used, particularly in the case of visual details.

Unanswered questions. In relation to the proportion of unanswered questions in recall, the contents factor, $F(1, 33) = 6.03$; $p = .02$; $\eta_p^2 = .15$, and the interaction contents x information modality, $F(1, 33) = 17.18$; $p < .001$; $\eta_p^2 = .34$, were significant. The participants left unanswered a greater proportion of detail questions ($M = .20$) than action questions ($M = .15$), showing their difficulty of recalling perceptual information. And the participants left unanswered a greater proportion of visual details questions than visual actions questions (.24 > .08, $p < .001$), without significant differences between verbal actions and verbal details questions (.22, .16; $p > .05$).

Accuracy. With regard to the accuracy in recall, the factors contents, $F(1, 33) = 28.79$, $p < .001$, $\eta_p^2 = .47$, and information modality, $F(1, 33) = 4.29$, $p = .046$, $\eta_p^2 = .12$, and the interaction contents x information modality, $F(1, 33) = 7.66$, $p < .01$, $\eta_p^2 = .19$, were significant. Accuracy was greater in the recall of actions ($M = .69$) than of details ($M = .53$) and in verbal ($M = .64$) than in visual information ($M = .58$). In addition, while there was no significant difference in accuracy between the recall of verbal and visual actions (.65, .73; $p > .05$), accuracy was greater for verbal than for visual details (.64 > .43, $p < .01$). The accuracy for visual details in recall ($M = .43$) was not significantly different ($p > .05$) from .50 random rate, reflecting the

difficulty and recall bias participants had when recalling specific visual details.

Confidence. Confidence in recall was rated on a scale of 0 (no certainty) to 7 (absolute certainty). The results are shown on Table 1. In order to analyse the degree of confidence in recall, a 2 (response accuracy: correct responses, commission errors) x 2 (contents: actions, details) x 2 (information modality: verbal, visual) within-participants factorial ANOVA was used. The post hoc comparisons for analysing significant interactions were performed using the Bonferroni test.

The factors response accuracy, $F(1, 23) = 206.99$, $p < .001$, $\eta_p^2 = .90$, and contents, $F(1, 23) = 6.56$, $p = .017$, $\eta_p^2 = .22$, were significant. Confidence in recall was greater in the correct responses ($M = 5.25$) than it was in the commission errors ($M = 2.97$) and in actions ($M = 4.34$) than in details ($M = 3.88$). The interactions response accuracy x contents, $F(1, 23) = 15.04$, $p = .001$, $\eta_p^2 = .39$, and contents x information modality, $F(1, 23) = 33.57$, $p < .001$, $\eta_p^2 = .59$, were also significant. In the correct responses there were no differences in confidence between actions and details (5.20, 5.31; $p > .05$), while in the commission errors responses confidence was significantly greater in actions than in details ($3.48 > 2.45$, $p < .01$). Furthermore, while there was no significant difference in confidence between verbal actions and details (4.00, 4.49; $p > .05$), confidence was greater in visual actions than in visual details ($4.69 > 3.37$, $p < .001$), illustrating the difficulty participants experienced when recalling specific visual details.

Recognition. In order to analyse the hits, false alarms and accuracy in the verbal and visual actions and details in the movie trailer (Table 2), three 2 (contents: actions, details) x 2 (information modality: verbal, visual) within-participants factorial ANOVAs were used. The post hoc comparisons for analysing significant interactions were performed using the Bonferroni test.

Table 2. Mean proportion of hits, false alarms and accuracy, and mean response confidence (0-7) in the recognition of a movie trailer (SDs in parentheses).

Contents	**Actions**		**Details**	
Information	**Verbal**	**Visual**	**Verbal**	**Visual**
Recognition				
Hits	.80 (.22)	.74 (.20)	.71 (.27)	.75 (.23)
False alarms	.80 (.17)	.43 (.25)	.43 (.23)	.40 (.24)
Accuracy	.50 (.09)	.63 (.16)	.62 (.19)	.65 (.14)
Recognition confidence				
Hits	5.15 (1.49)	5.75 (1.37)	5.70 (1.10)	5.40 (1.28)
False alarms	5.75 (0.92)	4.26 (1.78)	4.05 (2.14)	3.62 (2.01)

Hits. Neither the factors contents, $F(1, 33) = 1.15$, $p = .29$, $\eta_p^2 = .03$, or information modality, $F(1, 33) = 0.04$, $p = .84$, $\eta_p^2 = .01$, nor the contents x information modality interaction, $F(1, 33) = 2.49$, $p = .12$, $\eta_p^2 = .07$, were significant in the proportion of hits of the items contained in the event. These results were due to the fact that in the recognition task the participants were given the information and were only required to state whether or not it belonged to the event. The results also show that a recognition task is much easier than a recall task.

False alarms. In the proportion of false alarms, the factors contents, $F(1, 33) = 29.91$, $p < .001$, $\eta_p^2 = .47$, and information modality, $F(1, 33) = 24.35$, $p < .001$, $\eta_p^2 = .42$, and the interaction contents x information modality, $F(1, 33) = 28.62$, $p < .001$, $\eta_p^2 = .46$, were significant. The proportion of false alarms was greater in actions ($M = .61$) than in details ($M = .41$) and in verbal information ($M = .61$) than in visual information ($M = .41$). In addition, while there was a greater proportion of false alarms in verbal actions than in visual actions (.80 > .43, $p < .001$), there were no significant differences in the proportion of false alarms of verbal and visual details (.43, .40; $p > .05$). These results indicate different memory biases in the recall and recognition of an event. While there were more perceptual than conceptual commission errors in recall, more conceptual than perceptual false alarms were made in recognition. More specifically, in the recognition task the proportion of false alarms for verbal actions stood out compared with those for visual actions, verbal details and visual details (.80 > .43, .43, .40; $p < .001$), which all presented fairly similar results.

Accuracy. With regard to accuracy in recognition, the factors contents, $F(1, 33) = 7.72$, $p < .01$, $\eta_p^2 = .19$, and information modality, $F(1, 33) = 18.42$, $p < .001$, $\eta_p^2 = .36$, and the interaction contents x information modality, $F(1, 33) = 4.87$, $p = .034$, $\eta_p^2 = .13$, were significant. There was greater accuracy in the recognition of details ($M = .63$) than actions ($M = .56$) and of visual ($M = .64$) than verbal information ($M = .56$). Furthermore, while there were no significant differences in accuracy between verbal and visual details (.62, .65; $p > .05$), accuracy was poorer for verbal than for visual actions (.50 < .63, $p < .001$). The accuracy for verbal actions in recognition ($M = .50$) was not significantly different ($p > .05$) from .50 random rate, reflecting the memory bias of false recognition participants had for verbal actions.

Confidence. Confidence in recognition was rated on a scale of 0 (no certainty) to 7 (absolute certainty). The results are shown on Table 2. In order to analyse the degree of confidence in recognition, a 2 (response accuracy:

hits, false alarms) x 2 (contents: actions, details) x 2 (information modality: verbal, visual) within-participants factorial ANOVA was used. The post hoc comparisons for analysing significant interactions were performed using the Bonferroni test.

In response confidence, the factors response accuracy, $F(1, 23) = 29.49$, $p < .001$, $\eta_p^2 = .56$, and contents, $F(1, 23) = 15.98$, $p = .001$, $\eta_p^2 = .41$, were significant. Confidence was greater in hits ($M = 5.50$) than it was in false alarms ($M = 4.42$) and it was greater for actions ($M = 5.23$) than for details ($M = 4.69$). The interactions response accuracy x contents, $F(1, 23) = 13.51$, $p = .001$, $\eta_p^2 = .37$, response accuracy x information modality, $F(1, 23) = 12.58$, $p = .002$, $\eta_p^2 = .35$, and response accuracy x contents x information modality, $F(1, 23) = 7.50$, $p = .012$, $\eta_p^2 = .25$, were also significant. While in hits there were no differences in confidence between actions and details (5.45, 5.55; $p > .05$), in false alarms there was more confidence in actions than in details ($5.00 > 3.83$, $p < .001$). Furthermore, while in hits there were no differences in confidence between verbal and visual information (5.42, 5.57; $p > .05$), in false alarms confidence was greater in verbal information than it was in visual information ($4.90 > 3.94$, $p < .01$). Finally, in hits there were no significant differences in confidence between verbal and visual actions (5.15, 5.75; $p > .05$), while in false alarms confidence was greater in verbal than in visual actions ($5.75 > 4.26$, $p < .001$), supporting the role of verbal fluency in false recognition.

DISCUSSION

Despite the fact that recall and recognition memory processes involve different cognitive (Tulving, 1982) and neural (Cabeza et al., 1997) retrieval mechanisms, little is known about how the type of evaluation task affects memory for an event when testing the same items. The most noteworthy novel aspect of this study is that the same contents (actions and details) and information modality (verbal and visual) were used in both the recall questions and the recognition statements of a movie trailer. Recall tasks involve self-initiated search, retrieval and generation, and require effort and cognitive capacity to retrieve the information from memory. Recognition is an easier task, participants are given the information and are only required to state whether or not it belongs to the event. In other words, recognition is based on a process of comparison between available information and stored information (Danckert & Craik, 2013). In this study, more correct answers were given in the recognition task than in the recall task. Furthermore, results show that conceptual and perceptual contents involve different cognitive

processing styles (Förster, 2012; García-Bajos et al., 2014) and different neural correlates (Garoff-Eaton et al., 2007; Gong et al., 2016). Consistent with this, in this study there were more correct answers and less unanswered questions for actions than details in recall. Actions represent the script of the event, and are processed easily and retrieved fluently while perceptual details require attention and cognitive effort (García-Bajos et al., 2014; Woolnough & MacLeod, 2001). While there were more correct responses for actions than details in the recall task, there were no significant differences between hits to actions and details in the recognition task. In keeping with *the fuzzy-trace theory* (Brainerd & Reyna, 1990), people may experience difficulty retaining literal information because perceptual verbatim information requires attention, time and effort to be encoded, so what we do remember about an event is basically the gist.

The very mechanisms which facilitate the recall and recognition of an event can also be a source of bias in event memory. Bias mechanisms are basically caused by the plasticity the cognitive system develops to cope with processing everyday information. Apart from the adaptive value of perceptual and cognitive illusions (Schacter, Guerin, & St. Jacques, 2011), memory retrieval can give rise to errors in event memory. Even though the recall and recognition tasks both tested the same contents, there were more false alarms in the recognition task than commission errors in the recall task. For this reason, it is not advisable to use recognition tests in situations where suggested information can have serious consequences, such as eyewitness memory or testimony (Evans & Fisher, 2011). In the recognition task, there were more false alarms to actions than to details and also to verbal information than to visual information. We lose literality as the message becomes more general, and eventually accept information that is consistent and congruent with the meaning. The loss of verbatim detail over time and greater reliance on gist is consistent with our data. Actions, which represent the gist of the event, are processed fluently, and may be more difficult to identify subsequently as part of the event than actual details, which may require more perceptual evidence to be accepted as having been part of the event. It may be that visual information provides a sensory signature to distinguish true from false memories (Slotnick & Schacter, 2004). Previous studies have shown, for example, that presenting word associations visually rather than aurally (e.g., Smith & Hunt, 1988; Smith & Engle, 2011) or pictures rather than words (e.g., Dodson & Schacter, 2002; Israel & Schacter, 1997) at encoding reduces false memories during recognition tests.

While memory biases have been widely observed in recognition tests involving such diverse materials as lists of associated words (Roediger & McDermott, 1995), visual scenes (e.g., Miller & Gazzaniga, 1998), or the

events in a robbery (e.g., García-Bajos et al., 2012), scant information exists on the type of errors people make when answering specific questions about the verbal and visual actions and details of a daily event. One of the remarkable results of this study is the tendency of participants to answer recall questions involving visual details even when they are not confident about the answers. In fact, the same distinctive visual details which serve to reduce false memories in the recognition test tend to lead to erroneous responses in the recall task. For example, when asked "What colour was the car the main character arrived to work in?", black and white was frequently given as the answer, even though the car was actually yellow. These specific retrieval commission errors are similar to other specific encoding effects such as the *production effect* (Hopkins & Edwards, 1972; pronounced/unpronounced words) or the *generation effect* (Slamecka & Graf, 1978; generate/read conditions), which can lend distinctiveness to the to-be-remembered false items. The production and generation effects require participants to actively engage with the material at study, benefit overall memory performance by incrementing distinctiveness, and similarly to other elaboration studies (i.e., manipulations of levels of processing) have found to enhance recollection and familiarity in both recall and recognition (see Ozubko, Gopie, & MacLeod, 2012, for a summary). Similarly, active generation and production strategies in retrieval can provide distinctiveness to the elements generated, true or false.

In addition, the results reveal that different event memory biases come into play in recall and recognition tasks. Conceptual commission errors seem to affect recognition tasks more than recall tasks (e.g., Danckert & Craik, 2013; García-Bajos et al., 2012), while perceptual errors are more common in recall tasks (Migueles et al., 2016). In this study, the most striking finding concerning the recall task was the number of commission errors to visual details, while what drew most attention in the recognition task were the number of falsely recognized verbal actions. Although both conceptual and perceptual fluency can contribute to elicit memory illusions (Lanska, Olds, & Westerman, 2014), familiarity and the processing fluency of conceptual information are characteristic of false memories in recognition tasks (Doss et al., 2016; Reinitz, Séguin, Peria, & Loftus, 2012). Processing fluency affects actions more than details and verbal information more than visual information. The perceptual distinctiveness of visual details can lend veracity to commission errors in the recall task. So the activation of perceptual information can lure the subject, cognitively speaking, into accepting false information. An alternative explanation of the phenomenon can be found in the theory of *reality and source monitoring* (Johnson & Raye, 1981; Johnson et al., 1993). According to this theory, confusion arises when determining the

source of our memories and this gives rise to both types of errors. Participants may have difficulty discriminating between perceived information and related contents from other sources, such as internal recollections generated through imagination, prior knowledge activation, or post-event details. However, future research is needed to better understand how the interactions between different memory tests and contents impact the generation of false memories in the real world.

Memory accuracy depends on both correct and incorrect answers, and was greater for the actions in the movie trailer than it was for the details. From a fuzzy trace perspective, actions include the gist of the event and the most representative happenings, while the literal representation is more specific, requires greater concentration and involves precise perceptual details of the event (Brainerd & Reina, 1990). The participants were more accurate about what they saw happening than what they heard. In the recall task, more commission errors were made in details, particularly visual details, than in actions, so accuracy was greater for actions than for details and for verbal rather than visual information. Alternatively, in the recognition task, more false alarms were made in actions than in details, so accuracy for details was greater than for actions and for visual than for verbal information. These results reveal the importance of the type of task used, because it affects memory for the different contents and information modality of an event.

In relation with the material used in this experiment some considerations should be done. A movie trailer was used as stimulus material because trailers can represent real life events quite well. They briefly synthesize the script of the event, include main actions and give many details. However, movie trailers may be a rather special type of stimulus material that may differ from real events in some aspects. For instance, the composition of movie trailers might enhance a sense of gist, but at the same time they do not include full scenes from beginning to end, and they present many events with various sensory aspects in quick succession and in a short time, which can reduce attention for details. These aspects may have affected the results in some way, although, consistent with processing predictions, the patterns of results do not differ too much from those using other video materials. In this sense, the relation between the actions and details recalled and recognized in the present study mimics, for example, the results using short videos or film sequences that summarise criminal events (e.g., Migueles et al., 2016) or the results with case studies of actual crimes (e.g., Woolnough & MacLeod, 2001) in eyewitness memory. It can be concluded that real and staged events might be confronted with a similar cognitive processing style. That is, retaining the main actions to capture the gist of the events and processing less detailed information, as in everyday life.

In this study we were also interested in examining how aware the participants were of the accuracy of their answers. Their level of confidence in their responses was greater for the correct answers than for the commission errors, showing that participants are, in general, aware of the accuracy of their memory of an event. Greater confidence was shown in the recognition task than in the recall task, but only in the commission errors. The participants were more confident about accepting false information in the recognition task than in the recall task because it is easier to accept information that is suggested, or seems familiar or is fluently processed (Reinitz et al., 2012), than it is to generate false information. For this reason, it is advisable to use recall tasks rather than recognition tasks to avoid effects of suggestion, in, for example, eyewitness memory (García-Bajos et al., 2012).

In summary, in the recall task the participants incorrectly answered more items including perceptual details, while in the recognition task participants were more likely to erroneously accept conceptual information. The participants showed a greater bias towards accepting false verbal actions consistent with the gist of the event in the recognition task, and towards incorrectly answering questions including visual perceptual details in the closed-questions recall task. Furthermore, in the recognition task, while there were no differences in confidence between hits and false alarms for verbal actions, the participants were less confident in their false alarms than in their hits to visual details items. These results show that different mechanisms are involved in the processing and cognitive management of conceptual and perceptual information of a complex event. Therefore, the theoretical and practical implications of these findings should be considered in future naturalistic and laboratory memory assessment.

RESUMEN

Diferentes mecanismos de los sesgos en el recuerdo y reconocimiento de información conceptual y perceptual de un evento. El objetivo de esta investigación fue estudiar la memoria y sesgos de respuesta para información conceptual y perceptual en el recuerdo y reconocimiento de un evento. Los participantes vieron el video del tráiler de una película y se evaluó su memoria de las acciones y detalles, verbales y visuales, usando preguntas específicas en una tarea de recuerdo y frases con los mismos contenidos en una tarea de reconocimiento verdadero/falso. Los participantes recordaron y reconocieron mejor las acciones que los detalles y la información visual que la información verbal. Los sesgos de memoria afectaron de manera diferente al recuerdo y reconocimiento. Los participantes mostraron mayor tendencia a aceptar las acciones verbales falsas consistentes con la esencia del evento

como verdaderas en la tarea de reconocimiento, mientras que en la tarea de recuerdo los participantes fueron más propensos a responder incorrectamente preguntas que implicaban detalles visuales. Estos resultados reflejan mecanismos diferentes implicados en el procesamiento y gestión cognitiva de la información conceptual y perceptual de un evento.

REFERENCES

Alba, J. W., & Hasher, L. (1983). Is memory schematic? *Psychological Bulletin, 93*, 203-231. doi:10.1037/0033-2909.93.2.203

Brainerd, C. J., & Reyna, V. F. (1990). Gist is the grist: Fuzzy-trace theory and the new intuitionism. *Developmental Review*, *10*, 3-47. doi:10.1016/0273-2297(90)90003-M

Cabeza, R., Grady, C. L., Nyberg, L., McIntosh, A. R., Tulving, E., Kapur, S., Jennings, J.M., Houle, S., & Craik, F. I. (1997). Age-related differences in neural activity during memory encoding and retrieval: A positron emission tomography study. *The Journal of Neuroscience*, *17*, 391-400.

Cohen, G., & Conway, M. A. (Eds.). (2008). *Memory in the real world* (3rd Ed.). London: Psychology Press.

Danckert, S. L., & Craik, F. I. (2013). Does aging affect recall more than recognition memory? *Psychology and Aging*, *28*, 902-909. doi:10.1037/a0033263

Diana, R. A., Yonelinas, A. P., & Ranganath, C. (2007). Imaging recollection and familiarity in the medial temporal lobe: a three-component model. *Trends in Cognitive Sciences*, *11*, 379-386. doi:10.1016/j.tics.2007.08.001

Dodson, C. S., & Schacter, D. L. (2001). "If I had said it I would have remembered it:" Reducing false memories with a distinctiveness heuristic. *Psychonomic Bulletin & Review*, *8*, 155-161. doi:10.3758/BF03196152

Dodson, C. S., & Schacter, D. L. (2002). Aging and strategic retrieval processes: Reducing false memories with a distinctiveness heuristic. *Psychology and Aging*, *17*, 405-415. doi:10.1037/0882-7974.17.3.405

Doss, M. K., Bluestone, M. R., & Gallo, D. A. (2016). Two mechanisms of constructive recollection: Perceptual recombination and conceptual fluency. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *42*, 1747-1758. doi: 10.1037/xlm0000273

Evans, J. R., & Fisher, R. P. (2011). Eyewitness memory: Balancing the accuracy, precision and quantity of information through metacognitive monitoring and control. *Applied Cognitive Psychology*, *25*, 501-508. doi:10.1002/acp.1722

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*POWER 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*, 175-191. doi:10.3758/BF03193146.

Förster, J. (2012). GLOMOsys: The how and why of global and local processing. *Current Directions in Psychological Science*, *21*, 15-19. doi:10.1177/0963721411429454

García-Bajos, E., Migueles, M., & Aizpurua, A. (2012). Bias of script-driven processing on eyewitness memory in young and older adults. *Applied Cognitive Psychology*, *26*, 737-745. doi:10.1002/acp.2854

García-Bajos, E., Migueles, M., & Aizpurua, A. (2014). Conceptual and perceptual encoding instructions differently affect event recall. *Cognitive Processing*, *15*, 535-541. doi:10.1007/s10339-014-0615-3

Garoff-Eaton, R. J., Kensinger, E. A., & Schacter, D. L. (2007). The neural correlates of conceptual and perceptual false recognition. *Learning & Memory*, *14*, 684-692. doi:10.1101/lm.695707

Gong, L., Wang, J., Yang, X., Feng, L., Li, X., Gu, C., ... & Cheng, H. (2016). Dissociation between conceptual and perceptual implicit memory: Evidence from patients with frontal and occipital lobe lesions. *Frontiers in Human Neuroscience*, *9*, 722. doi.org/10.3389/fnhum.2015.00722

Hopkins, R. H., & Edwards, R. E. (1972). Pronunciation effects in recognition memory. *Journal of Verbal Learning and Verbal Behavior, 11*, 534-537. doi:10.1016/S0022-5371(72)80036-7

Israel, L., & Schacter, D. L. (1997). Pictorial encoding reduces false recognition of semantic associates. *Psychonomic Bulletin & Review*, *4*, 577-581. doi:10.3758/BF03214352

Jacoby, L. L., Toth, J. P., & Yonelinas, A. P. (1993). Separating conscious and unconscious influences of memory: Measuring recollection. *Journal of Experimental Psychology: General*, *122*, 139-154. doi:10.1037/0096-3445.122.2.139

Johnson, M. K., Hashtroudi, S., & Lindsay, D. S. (1993). Source monitoring. *Psychological Bulletin*, *114*, 3-28. doi:10.1037/0033-2909.114.1.3

Johnson, M. K., & Raye, C. L. (1981). Reality monitoring. *Psychological Review*, *88*, 67-85. doi:10.1037/0033-295X.88.1.67

Lanska, M., Olds, J. M., & Westerman, D. L. (2014). Fluency effects in recognition memory: Are perceptual fluency and conceptual fluency interchangeable? *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *40*, 1-11. doi:10.1037/a0034309

List, J. A. (1986). Age and schematic differences in the reliability of eyewitness testimony. *Developmental Psychology*, *22*, 50-57. doi: 0012I649/86/S00.75

Mandler, G. (1980). Recognizing the judgment of previous occurrence. *Psychological Review*, *87*, 252-271. doi:10.1037/0033-295X.87.3.252

McBride, D. M., & Dosher, B. A. (2002). A comparison of conscious and automatic memory processes for picture and word stimuli: A process dissociation analysis. *Consciousness and Cognition*, *11*, 423-460. doi:10.1016/S1053-8100(02)00007-7

Migueles, M., & García-Bajos, E. (1999). Recall, recognition, and confidence in eyewitness testimony. *Applied Cognitive Psychology*, *13*, 257-268. doi:10.1002/(SICI)1099-0720(199906)13:3%3C257::AID-ACP566%3E3.0.CO;2-7

Migueles, M., García-Bajos, E., & Aizpurua, A. (2016). Initial testing does not necessarily affect eyewitness recall assessed by specific questioning. *Applied Cognitive Psychology*, *30*, 294-300. doi: 10.1002/acp.3205

Miller, M. B., & Gazzaniga, M. S. (1998). Creating false memories for visual scenes. *Neuropsychologia*, *36*, 513-520. doi:10.1016/S0028-3932(97)00148-6

Mirandola, C., Toffalini, E., Grassano, M., Cornoldi, C., & Melinder, A. (2014). Inferential false memories of events: Negative consequences protect from distortions when the events are free from further elaboration. *Memory*, *22*, 451-461. doi:10.1080/09658211.2013.795976

Mitchell, K. J., & Johnson, M. K. (2009). Source monitoring 15 years later: What have we learned from fMRI about the neural mechanisms of source memory? *Psychological Bulletin*, *135*, 638-677. doi:10.1037/a0015849

Neisser, U. (1967). *Cognitive psychology*. New York, NY: Appleton-Century-Crofts.

Ozubko, J.D., Gopie, N., & MacLeod, C.M. (2012). Production benefits both recollection and familiarity. *Memory & Cognition*, *40*, 326-338. doi:10.3758/s13421-011-0165-1

Reinitz, M. T., Séguin, J. A., Peria, W., & Loftus, G. R. (2012). Confidence-accuracy relations for faces and scenes: Roles of features and familiarity. *Psychonomic Bulletin & Review*, *19*, 1085-1093. doi:10.3758/s13423-012-0308-9

Roediger, H. L., & McDermott, K. B. (1995). Creating false memories: Remembering words not presented in lists. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *21*, 803-814. doi:10.1037/0278-7393.21.4.803

Rubin, D. C. (2006). The basic-systems model of episodic memory. *Perspectives on Psychological Science*, *1*, 277-311. doi:10.1111/j.1745-6916.2006.00017.x

Sadeh, T., Maril, A., & Goshen-Gottstein, Y. (2012). Encoding-related brain activity dissociates between the recollective processes underlying successful recall and recognition: A subsequent-memory study. *Neuropsychologia*, *50*, 2317-2324. doi:10.1016/j.neuropsychologia.2012.05.035

Schacter, D. L., Guerin, S. A., & St. Jacques, P. L. (2011). Memory distortion: An adaptive perspective. *Trends in Cognitive Sciences*, *15*, 467-474. doi:10.1016/j.tics.2011.08.004

Schacter, D. L., Israel, L., & Racine, C. (1999). Suppressing false recognition in younger and older adults: The distinctiveness heuristic. *Journal of Memory and Language*, *40*, 1-24. doi:10.1006/jmla.1998.2611

Schank, R. C., & Abelson, R. (1977). *Scripts, plans, goals, and understanding*. Hillsdale, NJ: Lawrence Erlbaum.

Scoboria, A., Talarico, J. M., & Pascal, L. (2015). Metamemory appraisals in autobiographical event recall. *Cognition*, *136*, 337-349. doi:10.1016/j.cognition.2014.11.028

Slamecka, N. J., & Graf, P. (1978). The generation effect: Delineation of a phenomenon. *Journal of Experimental Psychology: Human Learning and Memory*, *4,* 592-604. doi:10.1037/0278-7393.4.6.592

Slotnick, S. D., & Schacter, D. L. (2004). A sensory signature that distinguishes true from false memories. *Nature Neuroscience*, *7*, 664-672. doi:10.1038/nn1252

Smith, R. E., & Engle, R. W. (2011). Study modality and false recall. *Experimental Psychology*, *58*, 117-124. doi:10.1027/1618-3169/a000076

Smith, R. E., & Hunt, R. R. (1998). Presentation modality affects false memory. *Psychonomic Bulletin & Review*, *5*, 710-715. doi:10.3758/BF03208850

Storbeck, J. (2013). Negative affect promotes encoding of and memory for details at the expense of the gist: Affect, encoding, and false memories. *Cognition & Emotion*, *27*, 800-819. doi:10.1080/02699931.2012.741060

Tulving, E. (1982). Synergistic ecphory in recall and recognition. *Canadian Journal of Psychology*, *36*, 130-147. doi:10.1037/h0080641

Whittlesea, B.W.A., & Leboe, J.P. (2000). The heuristic basis of remembering and classification: Fluency, generation, and resemblance. *Journal of Experimental Psychology: General*, *129*, 84-106. doi:10.1037/0096-3445.129.1.84

Woolnough, P. S., & MacLeod, M. D. (2001).Watching the birdie watching you: Eyewitness memory for actions using CCTV recordings of actual crimes. *Applied Cognitive Psychology*, *15*, 395-411. doi:10.1002/acp.717

Zaragoza, M. S., Mitchell, K. J., Payment, K., & Drivdahl, S. (2011). False memories for suggestions: The impact of conceptual elaboration. *Journal of Memory and Language*, *64*, 18-31. doi:10.1016/j.jml.2010.09.004

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