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Improving the Accuracy of Eyewitnesses in the Presence of Misinformation with the Plurality Option

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Summary: Misinformation has negative effects in the accuracy of eyewitnesses' reports. We investigated whether those negative effects could be reduced when participants are allowed to decide how many answers to include in their answers, that is, to regulate the plurality option. Participants watched a slideshow and received misinformation through a narrative. In the recognition memory test, participants had to select, out of five alternatives, one (single) and then three alternatives (plural answer) and to indicate which one they preferred to report if they were in a courtroom. Perceived likelihood ratings were also collected. Results showed that the regulation of the plurality option increased accuracy even in the presence of misinformation and highlighted the importance of the perceived likelihood ratings in the decision to select a single or plural answer. In general, the results suggest that better testimonies could be obtained if witnesses are given some control over their answers.

When trying to determine what happened during a criminal event, the testimony of a witness is one of the most important pieces of information. For this reason, it is extremely important that the testimony be as accurate as possible, even in circumstances in which accuracy is expectedly low. A promising way to enhance eyewitness memory accuracy has been recently developed, namely the regulation of accuracy. There are two ways to regulate accuracy: the report option (Koriat & Goldsmith, 1996) and the grain-size option (Yaniv & Foster, 1995). In the report option, participants have the chance to report or withhold an answer depending on how they evaluate the quality of their memories. When participants are able to decide whether to report or withhold an answer in a forensic setting, their accuracy for reported answers increases (Evans & Fisher, 2011; Higham, Luna, & Bloomfield, 2011). In the grain-size option, participants have the chance to regulate the precision of their answers, for example, from the fine-grained answer 'the suspect was 1.80 metres tall' to the coarse-grained answer 'between 1.75 and 1.85 metres'. The grain-size option has also proven useful in enhancing accuracy in a forensic setting (Goldsmith, Koriat, & Pansky, 2005; Weber & Brewer, 2008).

Most of the past research has operationalised the grain- size option as a variation on the width of a numerical interval (Ackerman & Goldsmith, 2008; Goldsmith, Koriat, & Weinberg-Eliezer, 2002; Goldsmith et al., 2005). However, much of the useful information in a police investigation does not involve numbers, so this operationalisation is somewhat limited in its applicability to a forensic setting. To overcome this limitation, Luna, Higham, and Martín-Luengo (2011) developed a different operationalisation for the grain- size option, known as the plurality option, which involves controlling the number of alternatives selected. Both grain-size and plurality options differ in terminology, although they refer to the same kind of answers. The high informative-low accuracy answers are named precise-grained answers and

single answers for the grain-size and plurality option research, respectively. Similarly, the low informative-high accuracy answers are coarse-grained answers and plural answers. We maintained the terminology used by the original authors.

In the plurality option procedure, participants are presented with questions (e.g. What weapon did the robber use?) and five alternatives. Participants had to select one alternative (single answer, e.g. a revolver), a very informative answer that runs the risk of being inaccurate, and then had to select three alter- natives (the single answer plus two alternatives; plural answer, e.g. a revolver, a pistol, or a taser), a less informative answer but with a higher likelihood of being accurate. Finally, they had to select which answer, single or plural, they would report if they were witnesses in a trial. In two experiments, Luna et al. (2011) found that participants were able to increase accuracy by strategically regulating the number of alternatives included in their answer. In other words, the accuracy of the final choice was higher than the accuracy of all the single answers. Higham (2012) successfully replicated this effect in a classroom setting. The main objective of this research is to test if the regulation of accuracy with the plurality option could serve to increase accuracy in a situation in which it is expectedly low, i.e. when participants are exposed to misinformation (Loftus, Miller, & Burns, 1978; for a recent review, see Zaragoza, Belli, & Payment, 2006). In this situation, accuracy in misinformation items is usually lower than in control items (Holmes & Weaver, 2010; Luna & Migueles, 2007, 2008, 2009; Porter, Bellhouse, McDougall, ten Brinke, & Wilson, 2010). Any technique that increases accuracy even when misleading information has been presented can be highly relevant, bearing in mind the importance of witness testimony. The regulation of accuracy with the grain-size option has been used before to test if witnesses can increase the accuracy of their final report in conditions in which it is low. For example, Goldsmith et al. (2005) presented participants with a text about an argument in a pub between two men and the later assault of one of them. Participants then completed a grain-size test about quantitative questions (e.g. the height of the assailant) in which they had to provide in Phase 1 both a precise-grained answer and a coarse- grained answer and in Phase 2 to select one of them as their final selection. Accuracy for the precise answers in Phase 1 was lower after a week than when tested immediately, showing the typical decline in memory over time. Importantly, in Phase 2, the selection rate of coarse-grained answers increased from 43 percent when tested immediately to 75 percent after a week. By selecting more coarse-grained answers, the forgetting curve for Phase 2 was not as steep as for the precise answers in Phase 1. In other words, participants attempted to compensate for the decrease in accuracy over time by selecting coarse-grained answers that had a higher likelihood of being correct.

In addition, the regulation of accuracy has also proven to be useful in increasing accuracy in the presence of misinformation, although with the report option and not the grain-size or the plurality option. Higham et al. (2011) presented a slide- show about a crime along with misinformation. In a later recognition test, in addition to the answer, participants were asked to select whether they were willing to report their answer if they were involved in a trial or if they preferred to withhold it. For misinformation items, accuracy was higher for reported than for withheld items, showing that the report option allows the rejection of some incorrect answers, thus increasing the accuracy of the final report.

As mentioned, to date, no research has tested if the plurality option (or the grain-size option) can also increase accuracy when misinformation has been presented. However, Wright, Varley, and Belton (1996) used a related procedure. After presenting the misinformation, during the recognition test, four alternatives were offered. Participants' task was to put a '1' by the

alternative they thought was in the original event, a '2' by their second choice, a '3' by their third, and a '4' by their fourth. Participants who selected the misinformation alternative as their first choice selected the original information as their second more than expected by chance. Thus, if participants were given the chance to select two instead of one alter- native, accuracy would have been increased. Similarly, Blank (1998, Exp. 2) let his participants provide a second answer if they remembered two details (e.g. the original and the misinformation), although accuracy for this second alternative was not provided.

Our hypotheses for the effect of misinformation on the regulation of accuracy are derived from the importance of the perceived subjective likelihood that the answer is correct in the selection of the final answer, as stated by two recent theoretical models. Those models refer to the importance of confidence ratings, and not of likelihood ratings. Although theoretically different, Luna et al. (2011) showed that, as far as participants are concerned, both ratings are quite similar in the plurality option context. For this reason, we use both terms indistinctly here. The satisficing model states that a single answer will be reported if its rated confidence of being correct passes a response threshold (Goldsmith et al., 2002). For the dual-criterion model, on the other hand, the preferred answer is whichever passes two different thresholds or criteria, namely the confidence and the informativeness criteria (Ackerman & Goldsmith, 2008; see the Discussion section for further explanation of the role of informativeness in the present context). In addition, confidence tends to be higher for misinformation items (Dalton & Daneman, 2006; English & Nielson, 2010; Loftus, Donders, Hoffman, & Schooler, 1989; Luna & Migueles, 2009). It is not clear whether it is the presence of misinformation itself that increases confidence or if this increase is a side effect of some factor promoting the acceptance of misinformation, as for example the high credibility of the source (Ceci, Ross, & Toglia, 1987). This distinction notwithstanding, the fact is that confidence is higher for misinformation than for control items. Our hypotheses are as follows. If confidence is one of the variables that determine the final selection of a single or plural answer and if confidence is higher for misinformation than for control items, then (i) a higher selection of single answers is expected for misinformation than for control items. As some of those extra selected single answers would likely be incorrect, (ii) a decreased accuracy for the selected single answers for misinformation items when compared with control items (i.e. the misinformation effect) will be expected.

Regarding the plurality option, as its effects are strong under normal circumstances (i.e. without misinformation or any other intervening variables, Luna et al., 2011), it is expected that participants will be able to regulate accuracy even in the presence of misinformation. Such a result would be in line with the tradition in the misinformation literature that the original information is not overridden by the misinformation (McCloskey & Zaragoza, 1985) and that it can be accessed under appropriate conditions (see Wright et al., 1996). Thus, (iii) a higher accuracy for selected than rejected answers for both control and misinformation items is expected. This result will show the role of metacognition on the regulation of accuracy with the plurality option. If confirmed, it will show that participants select for their final report the single answer when its accuracy is high, but that when it is low, they turn to the plural answer in an attempt to keep accuracy high.

As a consequence of this regulation of the number of alternatives included in the answer, there will be (iv) a clear benefit to the accuracy of the final choice when compared with that of all the single answers (base rate accuracy when the regulation through the plurality option is not allowed) for both control and misinformation items. In other words, it is expected that the

accuracy for the final choice will be higher than for the single answer for both types of items. However, it is also expected that, because of the presentation of misinformation, (v) the accuracy benefit (i.e. the difference in accuracy between the final choice and all the single answers) will be lower for misinformation than for control items.

In addition, a secondary goal of this research is to examine the perceived likelihood ratings for misinformation items when the plurality option is available. As mentioned, a higher perceived likelihood for all single answers for misinformation than control items is expected. However, it is not expected that

(vi) this result will be confirmed when single answers are split into selected and rejected. The decision to select or reject a single answer is expected to be largely driven by perceived likelihood ratings, so (vii) perceived likelihood is expected to be higher for selected than rejected single answers. Once a single answer is rated with a high enough perceived likelihood, it will pass the confidence criterion and will be selected. Thus, a misinformation item with increased confidence will be more likely to be selected. For this reason, the higher perceived likelihood for misinformation items is expected to result in an increased single selection rate.

An experiment was conducted to test these hypotheses. After a slideshow about a crime, participants received misinformation through a narrative. They then completed a recognition memory test following the plurality option from Luna et al. (2011).

METHOD

Participants

Thirty-eight participants (32 women, mean age 18.74 years, *SD* = 1.86) from the University of Minho took part in this experiment in exchange for course credits. Participants were allocated randomly to one of two misinformation versions.

Materials

Original information

A longer version of the slideshow used by Higham et al. (2011) was used. This longer version was also used by Luna et al. (2011) and included 18 slides showing a car leaving a house, several rooms of the victim's home, and finally, the bathroom with a large knife covered with blood in the sink and a dead body in the bathtub. The slideshow included images only, without audio or text.

Narrative

The misinformation was presented by means of a narrative used by Higham et al. (2011, Exp. 2). The narrative was approximately 500 words long in nine paragraphs and summarised the slides in the first person, attempting to imitate eyewitness testimony. Ten objects presented in the original slides were identified, and a misinformation version was developed. For example, a telephone actually shown on top of the freezer was falsely mentioned in the narrative as a radio. Two versions of the narrative were created for counterbalancing purposes. In each version, five target elements were presented as misinformation and five target elements served as control items. Control items were not mentioned in the narrative.

Memory test

A recognition memory test with 15 questions and five alternatives was developed. Five of the questions were about items to which misinformation was presented, five were about control items, and five were filler about information presented only in the slideshow but for which a misinformation alternative was not previously arranged. For questions about misinformation (e.g. What picture was on the calendar below the kitchen clock?), the five alternatives included both the correct alternative (e.g. a kitty) and the misinformation (e.g. a puppy), along with three lures (e.g. a baby, a teddy bear or white flowers). For control questions, the correct alternative, the misinformation never presented before, and three lures were presented. For filler questions, the correct alternative and four lures were presented. The memory test was the same for all participants. The memory test was presented on a computer. The first screen with the instructions mentioned that the test had 15 questions with five alternatives each and that only one answer was correct. No mention of the misinformation was included. The first task was to select one of the five alternatives (single answer) and to rate the likelihood that this alternative was correct. The second task was to select three alternatives (plural answer) and to rate the likelihood that the correct answer was one of them. The three alternatives selected had to include the one selected in the single alternative, and if participants failed to do that, a pop-up window required them to do so, preventing them from advancing to the next question. The third task was to select which answer, single or plural, they would report if they were a real witness in a trial.

Each question was presented on a separate screen. The question was presented in the upper part of the screen, and the five alternatives, numbered from one to five, were immediately below. The order of presentation of the alternatives was deter- mined by chance. After the alternatives, a brief sentence to remind the participants about the task for the single answer was included, and below that, a text box labelled with the letter A was provided in which to write the number of the selected alternative. Immediately below that was a likelihood scale from 0 to 100 percent divided into deciles. Under that, there was another brief sentence as a reminder about the task for the plural answer, and below that, three text boxes labelled with the letter B and with the same likelihood scale. Finally, in the bottom part of the screen, a brief sentence as a reminder about the task was followed by two radio buttons labelled with ‘A (1 alternative)’ and ‘B (3 alternatives)’.

Procedure

Participants completed the experiment individually. All the materials and instructions were presented on a computer screen. After entering the laboratory, participants sat in front of a computer and watched the slideshow. The initial slide said that a slideshow about a crime was to be presented and prompted them to press a key when ready. No mention was made of the subsequent memory test. The slides advanced automatically every two seconds with one second of blank screen in between. In the last slide, a request to call the experimenter was included. Immediately after the slides, the participants answered some demographic questions and completed a distractor task for five minutes consisting of solving anagrams (unscrambling sets of six- to eight-letter words). After that, the narrative with the misinformation was presented. The nine paragraphs of the narrative were scrambled and labelled with letters from (a) to (i). Participants were asked to put them in chronological order by writing the letters in text boxes presented below the paragraphs. This way of presenting the misinformation has often been used because it encourages the encoding of the misinformation (Zaragoza & Lane, 1994). Participants completed this task at their own pace.

After completing a second filler task for 10 minutes (writing down items in 10 categories, such as professions, fruits or sports, for one minute each), participants were presented with the instructions for the memory test and read them at their own pace. When they finished, they pressed a button to start the first question. The 15 questions were presented in chrono- logical order, and there was no time limit to complete the task. When finished, participants were debriefed and dismissed. The experiment lasted approximately 35 minutes.

RESULTS

Unless otherwise stated, *p*-values are less than .05. Our hypotheses start from the premise that perceived likelihood (or confidence) for single answers will be higher for misinformation than for control items. For this reason, this analysis is reported in the paragraph immediately below. Then, the analyses of the proportion of selection of single answers, of the regulation of accuracy, and of the benefits of the plurality option on accuracy are reported. Finally, other analyses with perceived likelihood as dependent variables that can help understand the effects of the regulation of accuracy are presented.

To test whether the single answer to questions for which misinformation was presented was rated with a higher perceived likelihood, we conducted a repeated-measures one-way analysis of variance (ANOVA). As expected, perceived likelihood that a single answer (either selected or rejected) was correct was higher for misinformation (M = 69.47, SD = 12.86) than for control items (M = 56.32, SD = 15.04), $F(1, 37) = 27.47$, MSE = 119.7, $\eta^2 = 0.43$.

Proportion of single selected answers

For all 15 questions, participants selected to report the single answer 41 percent of the time (SD = 0.18). To test the first hypothesis that the selection rate of single answers will be higher for misinformation than control items, we conducted a repeated-measures one-way ANOVA. As predicted, for the five misinformation items, the single answers selection rate was higher (M = 0.54, SD = 0.28) than for the five control items (M = 0.34, SD = 0.20), $F(1, 37) = 24.48$, MSE = 0.08, $\eta^2 = 0.40$.

Regulation of the plurality option

Luna et al. (2011) have shown that participants are able to successfully regulate accuracy through the plurality option to improve performance by choosing the single answer when its accuracy is high, but choosing the plural answer when it is low. To examine whether participants successfully regulated accuracy using the plurality option with control and misinformation items, we conducted four one-way ANO- VAs. Several participants were lost because they had no data for all conditions, as reflected in the degrees of freedom. An ANOVA with both single choice (selected, rejected) and item (control, misinformation) was not considered appropriate because of the different single selection rate for control and misinformation.

Main statistics are presented in the upper part of Table 1. The analyses confirmed the negative effects of the misinformation in the selected answers as predicted in the second hypothesis, with higher accuracy for selected control than for selected misinformation items, $F(1, 33) = 38.79$, MSE = 0.08, $\eta^2 = 0.54$, whereas no differences arose for rejected items, $F < 1$. In addition, in support of the third hypothesis, accuracy for selected answers was higher than for rejected answers for both control, $F(1, 34) = 75.89$, MSE = 0.08, $\eta^2 = 0.69$, and misinformation

items, $F(1, 32) = 8.62$, $MSE = 0.09$, $\eta^2 = 0.21$. These results show that the regulation of accuracy worked even when misinformation was presented.

Accuracy benefits of the regulation of the plurality option

To examine the benefits of the regulation of accuracy with the plurality option with both control and misinformation items, we conducted a 2 (answer: single, final choice) × 2 (item: control, misinformation) repeated-measures ANOVA with accuracy as a dependent variable. Single answers were included in the analysis because they serve as a base rate, and the final choice was included because it is the product of the regulation of the plurality option. Therefore, plural answers were not included in this analysis.

As in previous studies with the plurality option procedure (Luna et al., 2011), accuracy was higher for the final choice ($M = 0.65$, $SD = 0.23$) than for single answers ($M = 0.40$, $SD = 0.20$), $F(1, 37) = 262.31$, $MSE = 0.01$, $\eta^2 = 0.88$. Accuracy was also higher for control ($M = 0.58$, $SD = 0.23$) than misinformation items ($M = 0.47$, $SD = 0.26$), $F(1, 37) = 8.72$, $MSE = 0.06$, $\eta^2 = 0.19$. The interaction failed to reach significance, $F(1, 37) = 3.73$, $MSE = 0.02$, $p = .06$, $\eta^2 = 0.09$. To test the fourth hypothesis that the plurality option will increase accuracy for both control and misinformation items, we conducted several post-hoc analyses with the Student's *t*-test. They confirmed that accuracy increased from single to final choice for both control, $t(37) = 10.95$,

Table 1. Mean (standard deviation) accuracy and perceived likelihood as a function of the item and the answer

	Single				
	Selected	Rejected	All single	Final choice	All plural
Accuracy					
Control	0.81 (0.29)[a]	0.23 (0.23)[a]	0.43 (0.16)	0.73 (0.19)	0.78 (0.16)
Misinformation	0.46 (0.34)[b]	0.24 (0.32)[b]	0.36 (0.23)	0.57 (0.24)	0.77 (0.17)
Perceived likelihood					
Control	89.38 (14.52)[a]	39.00 (15.20)[a]	56.32 (15.04)	64.89 (15.93)	63.74 (18.89)
Misinformation	89.85 (11.75)[b]	43.56 (18.41)[b]	69.57 (12.86)	73.63 (12.56)	70.26 (18.57)

Note: Means for *All Single* and *All Plural* were computed from all answers of a given type, regardless of whether they were later selected for report. Means for *Final Choice* were based on participants' selections for reporting, either single or plural.
[a]$n = 35$.
[b]$n = 33$. The n's do not always match those of the analyses presented, as can be noticed in the degrees of freedom, because sometimes one participant who was included in one analysis was not in another. Changes in n had only a minimal effect on the statistics reported. Mean and standard deviations for each condition and each analysis are available upon request from the first author.

Cohen's $d = 1.67$, and misinformation items, $t(37) = 7.15$, Cohen's $d = 0.87$. Thus, as predicted, the regulation of accuracy with the plurality option serves to increase the accuracy of the finally reported answer even when misinformation is presented. However, the fifth hypothesis that the presence of misinformation will result in a lower increase in accuracy from single to final choice was not completely supported by the data, although the interaction showed a clear tendency in the expected direction and a moderate effect size. Thus, the conclusion for the fifth hypothesis is that the benefit of the plurality option could likely be lower for misinformation items, but also that our data failed to show it clearly.

Another way to test the negative effect of the misinformation in the regulation of accuracy is to compare the loss of accuracy due to the selection of single answers. A participant with the exclusive aim of accuracy would have selected only plural answers and would have obtained a certain level of accuracy. As they sometimes selected single answers, accuracy decreased from that level. To test whether the loss of accuracy was higher for misinformation than for control items, we calculated the accuracy for plural minus accuracy for the final choice for both control and misinformation items and the means compared with a one-way ANOVA. Accuracy loss was, indeed, higher for misinformation ($M = 0.21$, $SD = 0.20$) than for control items ($M = 0.06$,

SD = 0.13), *F*(1, 37) = 18.45, *MSE* = 0.02, η^2 = 0.33, showing that the misinformation limited the accuracy gains that could have been obtained from the regulation of the plurality option.[1]

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[1] We are grateful to Rakefet Ackerman for suggesting this analysis.

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Perceived likelihood ratings

Several ANOVAs were conducted to examine the effect of the misinformation in the perceived likelihood that the answer is correct when the plurality option is available. Main statistics for perceived likelihood are presented in the bottom part of Table 1. Data for all the main conditions are included for completeness. As mentioned, perceived likelihood was higher for all single answers for misinformation than for control items. Two ANOVAs were conducted to examine the sixth hypothesis about whether this difference was replicated for selected and rejected single answers separately. It was not replicated for either selected, *F* < 1, or rejected answers, *F*(1, 33) = 3.52, *MSE* = 133.30, *p* = .07 *ns*, η^2 = 0.09. However, these results do not imply that perceived likelihood was unaffected by the presentation of misinformation. The rate of selection of single answers for misinformation items was higher than for control items, meaning that more of the single answers for misinformation items were rated with high perceived likelihood. Thus, our data support that the presence of misinformation increases the perceived likelihood that the answer is correct. This increase has the unexpected consequence that participants failed to metacognitively notice the beneficial effects on accuracy of selecting three alternatives rather than one for misinformation items. A 2 (answer: single, plural) × 2 (item: control, misinformation) ANOVA failed to show global differences between the perceived likelihood for single and plural answers, *F*(1, 37) = 2.79, *MSE* = 229.34, *p* = .10 *ns*, η^2 = 0.07, although the interaction, *F*(1, 37) = 11.47, *MSE* = 36.44, η^2 = 0.37, showed that this non-effect was replicated only for misinformation items, *t* < 1, and not for control items, *t*(37) = 2.97, Cohen's *d* = 0.43. Finally, we tested the seventh hypothesis that perceived likelihood drives the selection or rejection of the single answer. Indeed, this was the case for both control, *F*(1, 34) = 289.92, *MSE* = 153.00, η^2 = 0.90, and misinformation items, *F*(1, 32) = 167.27, *MSE* = 211.00, η^2 = 0.84. For both items, perceived likelihood was higher for selected than rejected single answers.

DISCUSSION

The objective of this research was to test if the regulation of accuracy with the plurality option could increase the accuracy of the final report when misinformation was presented. The main outcome was that, despite the negative effect of misinformation on accuracy, when participants are allowed to select how many answers they want to include in their final report, they can still increase accuracy. This result is important because it shows the potential of metacognition and that this potential can be used in a forensic setting.

In the context of the regulation of accuracy with the plurality option, metacognition allows to select or reject a single answer. If some sort of metacognition was not involved in this decision, then similar accuracy between single selected and single rejected answers would have been

expected, but this was not the case. The clear benefits of metacognition and the plurality option in these contexts notwithstanding, it is important to note that they were unable to completely eliminate the negative effects of misinformation on memory. Actually, participants could have obtained better accuracy if their use of the plurality option was optimal, but as metacognition in general is imperfect, any benefit derived from its use will likely have some limitations.

One of the main focuses of the research on misinformation has been to signal ways to reduce or eliminate its negative effects on memory. Warning participants about the presence of misinformation (Eakin, Schreiber, & Sergent-Marshall, 2003), asking about the source of the memories (Lindsay & Johnson, 1989), or using the logic of opposition, in which participants are asked to discount any information presented after the original event (Lindsay, 1990), have all proved successful in reducing the misinformation effect. However, this study, and the regulation of accuracy in general, takes steps towards a perspective not yet widely explored regarding misinformation. This perspective is that, in a real- world scenario, it is almost impossible to avoid the many external sources of misinformation (e.g. police, media, other witnesses, relatives, or prosecutors), not to mention the internal sources of error, that is, our cognitive system itself (cf. schemata, Luna & Migueles, 2008). Thus, if misinformation acceptance has to occur, maybe it is best to focus on 'damage limitation', rather than on attempting to control those sources. Following this approach, Oeberst and Blank (2012) examined the reversibility of the misinformation effect and found that participants who first accepted the misinformation were able to avoid its negative effects on accuracy after some instructions ('enlightenment') that ensured an adequate representation of the memory task. Similarly, in our research, we have focused on trying to obtain the best report possible from the witness even in the event that misinformation has been presented. To this end, the regulation of accuracy with the plurality option has proven to be a useful tool in the laboratory.

One of the main strengths of the regulation of accuracy is that it is based on the witnesses' own metacognitive abilities and not on the manipulation of any variable that could or could not be applied in a forensic setting. As a result, the plurality option procedure could be easy to apply. For example, in an interrogation, it could be possible to tell the witness that sometimes it is best to provide an answer with several alternatives than a single answer that might be wrong. Although a witness might be reluctant to give a plural answer because it is not the expected kind of answer in that situation (Grice, 1975), some benefits could be obtained when witnesses are given the chance to provide a plural answer if they feel that it is appropriate.

It should also be noted that all the work to date with the plurality option procedure has used recognition tests in which the number of alternatives of the plural answer was fixed. To date, no published research has investigated how often participants would report a plural answer when it is not fixed to a specific number of alternatives, that is, when participants can select as many alternatives as they want, or in response to an open question, that is, when no alternatives are provided. Those two forms of memory reporting are similar in that participants have more control over the answer than in the procedure used in the present research and in that the implicit norm that communications have to be informative (Grice, 1975) could prevent reporting plural answers. However, they also differed considerably because in the former the alternatives are presented, but they are not in the latter. In a recent experiment conducted in our lab, participants were presented with general knowledge questions and six alternatives and were explicitly allowed to select as many alternatives as

they wanted, from one to five (Luna & Martín-Luengo, 2012). Preliminary analyses showed that participants chose to report one single alternative only nine percent of the time, thus supporting the idea that reporting many alternatives is not a completely odd idea and that communication norms could be flexible when explicitly altered. However, this result does not answer the question of how many plural answers will be reported in an open question in which alternatives are not provided. This question should be addressed in future research.

The benefits on accuracy of the regulation of the plurality option are not free of cost because they are based on an accuracy–informativeness trade-off (Goldsmith et al., 2002). In other words, each time a witness selects a plural answer, the likelihood that the answer is correct increases, but its informativeness decreases. Less informative answers, that is, plural answers, are likely to be less useful to a police investigation, although under certain circumstances the increase in accuracy may well be worth some loss of informativeness. This could be the case, for example, in situations where the odds are high that the testimonies are of poor quality or contaminated, such as when they are compiled after a long time, or in cases where media coverage has been extensive and witnesses have probably received misinformation. In those situations, sacrificing informative- ness of some answers to guarantee a more accurate testimony might be a good idea.

The usefulness of the plurality option could be of special interest in circumstances in which there are several witnesses and their testimonies can be compared. The loss of informativeness in the plural answers of a given witness can be compensated with the information gathered in the testimonies of other witnesses. In addition, several plural answers could help to be closer to the correct answer. In a recent paper, Dunn and Kirsner (2011) examined the testimonies of survivors of the battle between the German ship HSK Kormoran and the Australian HMAS Sydney II during the Second World War. After the battle, both ships sank in an unknown location. The testimonies about the last location of the ships, which differed in position and precision, were examined by means of a cladistic or phylogenetic analysis. Finally, the authors obtained a good estimate of the location of the wreckages, which were finally found in 2008. This research suggests that plural answers from several witnesses, when compared with each other, could also convey some information and, in an ideal situation, point towards the actual correct response.

The confidence–informativeness trade-off is reflected in the evolution of the theoretical models, from the satisficing model that includes only a confidence criterion to the dual-criterion model that also includes a second criterion of informativeness. Our results support the importance of the confidence or likelihood ratings in the regulation of accuracy, although they say little about the role of the informativeness of the answer. Thus, our experiment cannot distinguish between the satisficing and the dual criterion model, and it cannot help us know why participants chose single answers: whether because they were more informative, because they were rated with higher confidence, or both.

The regulation of accuracy with the plurality option adds to the literature that shows that it is possible to improve accuracy, sometimes with new and imaginative procedures and sometimes with well-known and established ones. For example, between the new and imaginative procedures to increase accuracy, Perfect et al. (2008) found that participants recalled more correct information when they were instructed to close their eyes, although in this study no misinformation was presented. In another study, in this case with misinformation, Parker, Buckley, and Dagnall (2009) found that asking participants to follow a dot with their eyes back and forth on the right and left of the screen in a bilateral eye

movement after the misinformation improved accuracy when compared with vertical eye movement or no eye movement conditions. It could be an interesting venue for future research to apply two or more of those procedures that increase accuracy (plurality option, eye closure, bilateral eye movements, or report option) to examine their combined effects. In the best scenario, an interaction would show a large increase in accuracy with a very straight-forward procedure to apply.

Between the well-known procedures, the cognitive interview (Fisher & Geiselman, 1992) has received extensive empirical support. Although the cognitive interview defends the main use of open questions, more direct questions are not forbidden, but they are allowed if a specific detail is of interest or to explore a particular situation not spontaneously mentioned. Thus, it could also be of interest to test the plurality option in the broad context of the cognitive interview when the chance of obtaining a certain piece of information with open questions is low.

In summary, the plurality option is a simple and ecological way of questioning witnesses that has the desirable consequence of enhancing accuracy even when it is decreased by the presence of misinformation. However, this increase in accuracy comes at the cost of reduced informativeness in some answers.

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