



The survival processing advantage with the use of binary decisions

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Abstract

When information is processed in the context of survival, it is particularly well remembered: the survival processing advantage. This effect has been obtained virtually by using word-rating tasks in which participants judge the relevance of words to a survival scenario using Likert scales. Here, we wanted to examine whether the survival processing advantage could be obtained using binary decisions. Participants had to quickly decide whether words were relevant in a survival scenario by giving either binary (“yes” or “no”) or graded responses (using 5-point scales). These conditions were compared with pleasantness ratings, which were also given quickly as either binary or graded responses. In [Study 1](#), the survival effect was replicated in the form of correct recall rates for graded ratings given without any time constraint. In [Study 2](#), we found that the use of binary (vs. graded) responses did not alter the survival effect in correct recall rates. Clustering analyses provided little evidence of greater categorical clustering in the survival than in the pleasantness condition and revealed no reliable difference between the binary and graded decisions. Overall, there were more intrusions in the survival condition than in the pleasantness condition in [Study 1](#), while only a trend was observed in [Study 2](#). However, these were not affected by the type of response. Our studies extend the generality of the survival effect in memory and provide relevant information for discussing the potential involvement of elaboration as a proximate mechanism of this effect.

Keywords Adaptive memory · Survival processing · Binary/graded decisions

The survival processing advantage or survival effect in memory corresponds to the fact that words processed in relation to an imagined survival context, such as surviving in the African savannah or being lost at sea, are remembered better than words processed in a nonsurvival context, such as moving to a foreign country, or compared with deep encoding conditions such as rating words for their pleasantness or their ease of imaging (Kostic et al., 2012; Nairne et al., 2007, 2008; for a review, see Kazanas & Altarriba, 2015). This memory effect has been taken as evidence for the adaptive memory view, according to which human memory is the product of natural selection—that is, an adaptation that enabled our hunter–gatherer ancestors improve their

chances of survival (and ultimately of reproducing) by (for example) memorizing sources of food and drinking water, objects touched by sick individuals, or the location of potential predators (Bonin et al., 2019; Nairne, 2010; Nairne & Pandeirada, 2010).

In virtually all studies of the survival effect in memory, participants are asked to rate the relevance of various words in relation to survival problems. In the original demonstration of the survival processing advantage by Nairne et al. (2007), three survival problems were used within a grassland scenario:

- (1) Finding steady supplies of food,
- (2) Drinking potable water, and
- (3) Protecting from predators.

The important point, which is the subject of the present study, is that virtually all studies of the survival effect have used graded ratings by means of Likert scales, typically 5-point scales ranging from *not relevant* to *very relevant*. When rating each word for relevance (often using a keyboard with numbered keys), participants are generally not

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explicitly instructed to give their answers as quickly as possible,¹ their responses are spontaneous, and they are assured that there are no right or wrong answers. It should be noted at the outset that the survival effect can be obtained independently of relevance rating tasks (Coverdale et al., 2019; Nairne et al., 2019), a point to which we shall return in the General Discussion.

The question we ask here is this: Is the survival effect obtained when decisions about the relevance of words to the survival situation are binary? In other words, when participants quickly *decide whether or not* the word is relevant to finding food and drinking water or protecting from predators. Many binary tasks have been used for encoding in memory research inspired by the levels-of-processing theoretical framework (Craik & Lockhart, 1972; Craik & Tulving, 1975). These tasks involve decisions such as whether a word is capitalized or whether a particular letter (e.g., *e*) is present in a word, and these “superficial” tasks have been compared with semantic tasks, such as evaluating the pleasantness (vs. unpleasantness) of a word (e.g., Hyde & Jenkins, 1973, for a classic levels-of-processing study; Leding, 2018). Although the semantic tasks that are generally used ultimately require a binary response, they are akin to graded evaluation. A recurrent finding in this type of study is that deep processing, such as evaluating pleasantness, leads to better long-term retention than superficial processing (e.g., Hyde & Jenkins, 1973; Leding, 2018). While not directly testing binary versus graded decisions, these findings can be taken to suggest that graded decisions, by demanding more nuanced processing, are probably better than binary decisions in terms of memory outcomes. Interestingly, in the marketing field, it has been found that people answer forced-choice binary questions more quickly than questions calling for ordinal multicategory answer formats, such as Likert-type scales, and that these binary questions are perceived as being less difficult (Dolnicar et al., 2011; see also Grassi et al., 2007). To our knowledge, no study has addressed this methodological issue, which is not only interesting in itself but, as we explain below, may also yield results that have important theoretical implications for one important potential proximate mechanism involved in this memory effect, namely elaboration.

Elaboration in survival processing and correct recall

One of the mechanisms potentially involved in the survival effect is elaboration (Cho et al., 2018; Howe & Derbish, 2014; Kroneisen & Erdfelder, 2011; Otgaar et al., 2015). Broadly defined, “elaboration” is the process of making connections between a target item and information stored in memory. According to Otgaar et al. (2015), “Elaboration can be defined as the amount of information that is jointly encoded with each to-be-remembered piece of information” (p. 343). Two types of elaborative processes can be distinguished: relational processing and item-specific processing (Einstein & Hunt, 1980). In relational processing, the focus is placed on similarities among disparate items, while item-specific processing focuses on distinctive traits.² Some researchers seem to equate “elaboration” and “relational processing” (e.g., Howe & Derbish, 2014), while others use the expression “richness of encoding” (Bell et al., 2015; Kroneisen & Erdfelder, 2011; Kroneisen et al., 2013; Kroneisen et al., 2024a, b; Röer et al., 2013) to highlight *the distinctiveness of memory traces* resulting from elaboration. In the literature on the survival processing advantage, the terms “elaboration” and “richness of encoding” are generally used to refer to the same type of processing and we believe that “richness of encoding” and “item-specific processing” are conceptually very close.

Some studies have looked specifically at whether the survival advantage is due to relational processing, item-specific processing, or a combination of the two (Burns et al., 2011, 2013; Wöstenfeld et al., 2020). Burns et al. (2011) found that the survival processing advantage disappeared when the control condition encouraged the mobilization of both types of processing. In a subsequent study that used other control conditions (e.g., moving, vacation) and analyzed cumulative-recall curves, Burns et al. (2013) found that survival processing particularly boosted item-specific processing. In other words, the survival processing advantage was not driven by increased relational processing, an assumption which is also supported by other studies (Nairne et al., 2017; Wöstenfeld et al., 2020). However, the number of studies that have specifically investigated the role of relational processing in the survival effect is small. That is why we decided to examine this issue by considering clustering and intrusions, since they are considered to be indexes of this type of processing, as described below.

¹ A number of studies have used a response deadline (e.g., 5 seconds maximum; e.g., Nairne et al., 2007), thus imposing a relative time pressure. There are only very few studies in which participants have been explicitly instructed to give their answers as quickly as possible (e.g., Alban & Annibal, 2022).

² Interestingly, Hodge and Otani (1996) found that relational processing was more efficient in a free recall task involving words because it helps organize items. They also found that item-specific processing was more efficient in a word recognition task because it reinforces the discrimination of items.

Researchers have hypothesized that survival contexts would facilitate greater elaboration than nonsurvival contexts, such as a moving scenario (Kroneisen & Erdfelder, 2011). More precisely, Kroneisen and Erdfelder (2011) maintained that when participants rate words for their relevance to survival, they tend to think about different possible uses of the items more than when they are asked to rate their relevance for other purposes, such as moving to a foreign country, and this generates more distinctive memory representations. The words are thus encoded more richly. When the participants are then asked to recall the rated words, the words encoded in a survival scenario are recalled better because more memory cues are available. This process is assumed to require cognitive resources (Kroneisen et al., 2024a, Kroneisen et al., 2014; Nouchi, 2013). There is evidence to support the hypothesis that elaboration plays a role in the survival effect in memory. For example, Kroneisen and Erdfelder (2011) observed that when the number of survival problems was reduced to one (finding drinking water) rather than three, as in the seminal study by Nairne et al. (2007), this change in the instructions for the survival scenario led to a reduction in the survival effect compared with the original survival situation (for similar findings, see Otgaar et al., 2015). According to Kroneisen and Erdfelder (2011), this result can be explained by the fact that participants have less opportunity to elaborate in a restricted than in a “full” survival scenario. Contrary to what Kroneisen and Erdfelder (2011) observed in their study, other studies have found a survival effect with restricted scenarios: Nairne and Pandeirada (2010) observed a survival effect when only the predation problem was considered, while Bonin et al. (2024) obtained a survival effect when the survival problems corresponding to food and drinking water, predation and contamination were considered independently. Another form of evidence supporting the idea that elaboration may be a proximate mechanism of the survival effect is its reduction in dual-task paradigms. For example, Nouchi (2013) observed that when participants had to memorize a series of six randomly sampled digits in parallel while simultaneously evaluating words for their relevance to survival, the survival effect was reduced compared with a situation with no memory load (see also Kroneisen et al., 2014; Yang et al., 2021; but also Kroneisen et al., 2016; Stillman et al., 2014, for discussion). The hypothesis that richness of encoding underpins the survival processing advantage is supported by the findings that (1) the strength of the survival processing effect varies as a function of the number of unique relevance arguments generated per item (Röer et al., 2013); (2) the survival processing effect is greater for objects low (vs. high) in functional fixedness (i.e., objects that can be used in multiple ways; e.g., a piece of string) versus objects associated with a specific function (e.g., a traffic light; Kroneisen et al., 2021); (3) in idea association tasks, more ideas are generated

when participants perform the task in the context of surviving in the grassland rather than in the context of moving to a foreign country (Röer et al., 2013); (4) ideas generated in a survival scenario are rated as being more creative than those generated in a moving scenario (Bell et al., 2015).

Elaboration in survival processing and illusory memory

Another phenomenon that has been examined in relation to the survival processing advantage is illusory memory and some studies have found that processing words in terms of their relevance to survival gives rise to more false memories (intrusions) than other control conditions, such as pleasantness processing (e.g., Howe & Derbish, 2010; Nairne et al., 2007; Nairne & Pandeirada, 2008; Otgaar & Smeets, 2010; Otgaar et al., 2014; Smeets et al., 2012). Moreover, survival-related information (fight, spiders, water, disease, etc.) increases both true (e.g., Bonin et al., 2024; Howe & Derbish, 2010; Otgaar et al., 2014; Wilson et al., 2011) and false memories (e.g., Howe & Derbish, 2010; Otgaar et al., 2014) in adults as well as in children (Otgaar & Smeets, 2010). It should be mentioned, however, that this type of finding has not always been observed, with certain studies reporting only a trend for intrusions to be more numerous in a survival than in a pleasantness condition (Otgaar et al., 2015), no significant difference in the number of intrusions between a survival and a moving (control) scenario (Forester et al., 2020a), and sometimes the opposite—that is to say, a reduced number of intrusions in the survival condition compared with a control condition (Forester et al., 2020a, b).

One explanation of the proximate mechanisms underlying the memory illusions observed in survival processing is that they are the result of a relational type of elaborative encoding that is strongly encouraged by this form of processing (Burns et al., 2011): Survival processing causes the activation of highly interconnected conceptual networks, and the activated concepts include some that have not been explicitly rehearsed during the encoding phase (Howe & Derbish, 2010; see also Howe et al., 2009). Certain researchers have looked at the conceptual framework proposed by fuzzy trace theory (FFT: Brainerd & Reyna, 2002). According to this theory, two types of processing can take place during encoding: gist processing and item-specific processing. Item-specific processing leads to the encoding of surface features and sources (i.e., verbatim representations), whereas gist processing results in the creation of general senses for items, including their semantic connections. Memory performance is based on verbatim and gist traces, with verbatim traces corresponding to detailed descriptions, while gist traces constitute a more general overview of stored information. It has been suggested that true memory is primarily the result of

verbatim traces and false memory that of reconstructive processes inherent in gist traces. Within this theoretical framework, survival processing is thought to lead participants to rely more heavily on gist processing, which affects both true and false memory (Bialer et al., 2024; Otgaar & Smeets, 2010). In other words, “FFT assumes that survival processing produces even stronger semantic connections than other deep processing tasks and that this increase causes increases in both true and false memory” (Bialer et al., 2024, p. 414).

Objectives of the present research

Beyond the methodological question of studying whether the survival effect continues to be observed when binary decisions are used, another important question motivating the present work was to investigate whether implementing nuanced decisions would require more elaboration than making more straightforward decisions. The idea is that the potential scope of this mechanism is likely to be greater when nuanced rather than binary decisions are involved, given that nuanced decisions presumably require more elaborate processing than binary decisions. Thus, if elaboration is the leading proximate mechanism in the survival effect, the use of binary decisions should reduce this effect—here on correct recall—compared with the use of graded scores. We also considered the “dynamics” of word recall in graded versus binary encoding situations.

As explained in the Introduction, if we take the view that elaboration is involved in both relational processing and item-specific processing (Einstein & Hunt, 1980), then it is interesting to focus on clustering (i.e., the grouped recall of items based on shared characteristics: animals, objects, vegetables), because this can also provide information about the way relational processing is involved in survival processing. However, if we consider that elaboration more particularly relates to item-specific processing, then the cluster results (as well as number of intrusions; see below) are not critical with regard to the involvement of elaboration in the survival effect. Few studies have examined clustering in relation to survival processing (e.g., Burns et al., 2013; Nairne & Pandeirada, 2008). In the Nairne and Pandeirada (2008) study, no reliable difference was found in the adjusted ratio of clustering scores between survival and pleasantness processing. Given that clustering is assumed to index the mobilization of elaborative processes (i.e., relational processing; Burns, 2006), it would appear that if survival processing involves more elaboration (in particular, more relational processing) than pleasantness processing, then more clustering should be observed in tasks geared toward survival rather than pleasantness processing. More importantly, if binary decisions prevent the use of elaboration, then less clustering should be observed when these, rather than graded, responses are

required, and this effect should be greater for survival than for pleasantness processing.

The analysis of intrusions also makes it possible to test whether and to what extent elaboration is involved in the survival effect. As explained with regard to illusory memory above, intrusions are thought to be the result of elaborative encoding, which is boosted by survival processing (Otgaar & Smeets, 2010; Otgaar et al., 2015). Consequently, more intrusions should be observed in the survival condition than in the pleasantness condition. If binary decisions impede elaboration, fewer intrusions should be observed with binary than with graded decisions, especially in the survival condition. However, as mentioned above with regard to clusters, if elaboration is limited to the concept of the distinctiveness of memory traces, then the number of intrusions may be considered to be less important in terms of the involvement of this mechanism in survival processing.

In summary, this research has two main objectives. The first is methodological. It is an attempt to identify a memory survival effect based on binary rather than graded decisions. To our knowledge, no previous study has used this type of assessment. The second is theoretical. The results obtained for the survival effect with binary decisions allow us to further discuss the potential involvement of elaboration as a proximate mechanism in this memory effect. Several studies have suggested that the pleasantness condition is a relevant control condition for the survival scenario, since it constitutes a fairly prototypical deep encoding condition. It may be considered a quintessential form of “deep processing” (Nairne et al., 2015). It is also one of the most powerful types of deep encoding and leads to long-term retention (Packman & Battig, 1978). That is why we decided to use this control condition.³ Also, unlike studies that do not select words a priori in terms of their relevance to survival issues (predation, food, and water), we used survival norms to select words that are a priori related to survival. More specifically, we chose words that were all associated with a *moderate survival value*. This last aspect is important because we have shown that the survival effect depends on the type of items used (Bonin et al., 2024). Based on a normative study, Bonin et al. (2024) selected two types of words:

³ We could indeed have opted for the “moving” condition instead of the pleasantness condition. Our choice of pleasantness ratings was motivated by the fact that these are widely used in the literature on the survival processing advantage and considered to be a benchmark control condition (Bonin et al., 2024; Nairne et al., 2019). Interestingly, certain studies have found that memory performance in a pleasantness condition does not differ significantly from performance in schematic control conditions such as the moving scenario (e.g., Nairne et al., 2007; Otgaar et al., 2010).

- (1) Words that were strongly related to a single survival problem (e.g., avoidance of dangerous animals, avoidance of pathogens, search for food/drinking water) and
- (2) Words that were weakly related to a survival problem. In our memory experiments, these types of words were randomly presented and two encoding conditions were used: survival versus pleasantness.

The results showed that highly survival-related words were remembered much better across the three memory experiments than low survival-related words, including in the survival encoding condition. However, low survival-related words (low relevance to the survival problem of avoiding predators or pathogens, respectively) were not remembered better in the survival condition (e.g., avoiding predation or pathogens) than in the pleasantness condition. It was only in a third experiment, which used the survival problem of finding drinking water and food, that we demonstrated a memory advantage for weakly related words in the survival condition compared with the pleasantness condition. Bonin et al. (2024) did not test the memory survival effect with words that were moderately related to survival issues (e.g., food/drinking water, pathogen avoidance, predation). As we modified the word evaluation procedure in Study 2, we were able to use a more conventional word evaluation protocol to ensure that the selected words could give rise to a memory survival effect. Finally, in Study 2, we explicitly told participants in the instructions to make their decisions quickly in both binary and graded conditions. To anticipate the results, we obtained a survival effect in memory in Study 1.

Study 1. Survival processing with a new set of words

Method

Participants Eighty-four volunteers ($M = 19.44$ years, $SD = 1.29$, 77 women) took part, and most of whom were students at Université de Bourgogne. They were randomly assigned to one of the two groups ($n = 42$ in each group), which experienced two different encoding conditions (survival vs. pleasantness). All were native speakers of French. The participants received course credits for their participation. All the study procedures were approved by the Statutory Ethics Committee of the University Bourgogne Franche-Comté.

The number of participants was chosen on the basis of Scofield et al.'s (2018) meta-analysis of the survival processing advantage in memory. The set of studies using between-subjects designs included in their analysis had a mean of

37.5 participants per group. Given an $\eta_p^2 = .075$ —a value situated at the center of the survival η_p^2 effect size interval—estimated between .06 and .09—the sample size required to obtain a power of .8 in a unilateral test at the .05 level was equal to 78 (2×39).⁴

Stimuli The word list was created based on Bonin et al.'s (2024) Study 1, in which predation, food/water, and pathogen norms were collected for 732 words. Ratings collected in Study 1 of Bonin et al. (2024) ranged from 1 (*totally irrelevant*) to 5 (*totally relevant*) with regard to the problems of (1) finding steady supplies of food and water, (2) protecting oneself from predators, and (3) avoiding being contaminated by pathogens and becoming ill. We selected 30 words that were moderately relevant for the survival problems of food and water ($M = 2.9$, $SD = .43$), predation ($M = 2.9$, $SD = .50$), and pathogens ($M = 2.18$, $SD = .42$). As in most studies investigating survival processing (e.g., Bonin et al., 2019; Nairne et al., 2007; Wang et al., 2023; Weinstein et al., 2008), the words belonged to different semantic categories. Indeed, there were four semantic categories: 13 were objects (e.g., pan, ladder), five were means of transport (e.g., canoe, car), four were shelters (e.g., city, barn), and eight were animals (e.g., goose, wolf). The list of words together with their English translations is provided in the Supplemental Material (Supplemental Material A). The semantic category of each word is also indicated.

Apparatus The script of the experiment was created using PsyScope (Cohen et al., 1993) running on an Apple computer.

Procedure The participants were tested individually in a quiet room. Written informed consent was obtained from all the participants before the beginning of the experiment. We started by collecting demographic information: gender, age, native language, educational level, and use of neuroleptics. The participants were then randomly assigned to one of the two encoding conditions: “survival in the grasslands” or “pleasantness.” Next, the participants were given the instructions for the rating task, which was presented on the computer screen.

For the survival rating task, the scenario was adapted from previous survival processing experiments (Bonin et al., 2024; Nairne et al., 2007). The participants were asked to imagine that they were stranded in the grasslands of a foreign land without any basic survival materials and told that over the next few months, they would need to find steady

⁴ The computations were done with G*Power (Version 3.1.9.7; Faul et al., 2007).

supplies of food and water and protect themselves against predators. The participants had to rate the words for their relevance in the corresponding scenario using Likert scales (1 = the word is *totally irrelevant* to 5 = the word is *extremely relevant*) by pressing a key (labeled 1 to 5) on the keyboard. In the pleasantness condition, the participants had to rate the words for their pleasantness (1 = *very unpleasant* to 5 = *very pleasant*). The words were randomly presented one-by-one in the center of the screen and remained on display until the participant's response. The participants were instructed to rate the words spontaneously and were told that there were no right or wrong answers. After the encoding task, the participants were given two interfering tasks that lasted about three minutes in total: the “plus–minus” task from Jersild (1927) and Spector and Biederman (1976), and the “X–O” letter-comparison task (Salthouse et al., 1997). The surprise recall test took place immediately after the two interfering tasks. The participants had 5 minutes to write down as many of the previously presented words as they could remember on a sheet of paper. Finally, the participants were debriefed regarding the research goals. The whole experimental session lasted about 20 minutes.

Results

The data from [Study 1](#) are publicly available at the Open Science Framework website (<https://osf.io/zghb7/>).

Correct free recall A significant mnemonic advantage was found when words were rated for survival ($M = .56$, $SD = .11$) rather than when they were rated for their pleasantness ($M = .39$, $SD = .11$), $t(82) = 7.18$, $p < .0001$, Hedges's $g = 1.11$. We also analyzed the rates of correct recall as a function of the different semantic categories in our list (animals, objects, shelters, transport). The detailed results are available in the Supplemental Material B, but the key finding is that the survival effect was present across categories.

Clustering We calculated category clustering using the adjusted ratio of clustering, or ARC score (Roenker et al., 1971). This score measures the extent to which members of the same semantic category tend to be recalled together. An ARC score of 1 indicates perfect clustering, while a score of 0 indicates chance-level clustering.⁵ ARC scores were above zero in both the survival and pleasantness conditions—survival: $t(41) = 4.23$, $p = .0001$, $M = .20$, $SD = .30$; pleasantness: $t(41) = 3.15$, $p = .003$, $M = .13$, $SD = .27$ —with no

reliable differences between them, $t(82) = 1.03$, $p = .3064$. (Including the semantic category classification of intrusions⁶ in the calculation of the ARC scores did not change the pattern of results within and between conditions.)

Intrusions The number of extralist intrusions ($M = .6$, $SD = .75$) was low, with more intrusions in the survival ($M = .79$, $SD = .81$) than in the pleasantness condition ($M = .4$, $SD = .63$), $t(82) = 2.41$, $p = .0184$. We report detailed descriptive statistics on the distribution of the intrusions in the various categories and their relevance for survival in the Supplemental Material B.

Encoding times The time taken to rate the words did not differ significantly between the two encoding conditions, $t(82) = 0.78$, $p = .4393$, Hedges's $g = .12$ (survival: $M = 2,400$ ms, $SD = 725$; pleasantness: $M = 2281$ ms, $SD = 685$). In addition, there were positive and roughly comparable correlations between recall rates and encoding times in both conditions (survival: $r = .36$, $p = .0206$; pleasantness: $r = .34$, $p = .0269$).

Relevance ratings The average relevance ratings did not differ significantly between the survival and pleasantness conditions, $t(82) = 0.98$, $p = .3303$ (survival: $M = 3$, $SD = 0.36$; pleasantness: $M = 2.93$, $SD = 0.31$).

Discussion of Study 1

[Study 1](#) replicated the survival effect using instructions generally used in the literature (i.e., a survival scenario in the grasslands of a foreign land with three survival problems—finding drinking water, steady supplies of food, and protection from predators—and using 5-point Likert scales with ratings made spontaneously and without time pressure). However, we used standardized material, an approach which is very different from studies on the survival effect that do not select their material based on a priori survival norms. Thus, the survival effect on recall performance in the present task was obtained with words that had moderate survival values on the survival issues of “finding food and drinking water” and “protecting from predators.” The analysis on clustering (as indexed by ARC scores) revealed that survival and pleasantness did not differ significantly. Finally, there were more intrusions in the survival than in the pleasantness condition. The observation that encoding times did not differ between the survival and pleasantness conditions could be taken as evidence that similar amounts of elaboration were

⁵ Negative values can occur and indicate that participants are recalling words in a manner that actively runs counter to conceptual clustering (Boustani et al., 2023).

⁶ Three independent observers classified the intrusions using the same categories as those employed for the words to be recalled. The classification agreement was 100%.

performed in both types of encoding task. However, we shall return to this issue in the General Discussion.

Study 1 was a necessary step before addressing the question of what happens to the survival effect in a binary task. **Study 2** therefore focused on a comparison between binary and graded decisions, with the participants in both conditions being told that it was important to respond quickly. We chose to add this instruction to give meaning to the binary decisions, since this type of decision is usually made quickly. It also makes sense from an evolutionary point of view, because certain situations, such as facing a predator or a dangerous congener, require fast, decisive action. Someone who hesitates about the possible uses of an object, such as a bottle, in the face of a dangerous animal can quickly find themselves in great danger.

Study 2. Survival processing with a binary versus classical decision

Method

Participants One hundred and sixty volunteers ($M = 20$ years, $SD = 2.53$, 128 women) took part, most of them being students at Université de Bourgogne. They were randomly assigned to one of the four groups ($n = 40$ per group), which experienced different encoding conditions (classical survival, binary survival vs. classical pleasantness, binary pleasantness). All were native speakers of French. The participants received course credits for their participation.

Stimuli and apparatus The same list of words as in **Study 1** was used and the script for the experiment was again created using PsyScope (Cohen et al., 1993) running on an Apple computer.

Procedure The beginning of the experiment was exactly the same as in **Study 1**. After being randomly assigned to one of the four encoding conditions, the participants were given the instructions for the rating task. For the “classical” survival rating task and the “classical” pleasantness rating task, the instructions were the same as in **Study 1**. The only exception was that the participants were told to respond quickly and spontaneously because they were in danger (survival) versus because the task required it (pleasantness). The instructions were identical for the two binary conditions (survival and pleasantness) except that the Likert scales were replaced by binary choices (i.e., “yes” = the word is relevant/pleasant for survival/pleasantness or “no” = the word is irrelevant/unpleasant for survival/pleasantness). After the encoding task, the participants performed arithmetic calculations for

3 min. The surprise recall test took place immediately after the interfering task and lasted 5 minutes.

Analyses By-participants recall rates and encoding (rating) times were considered as dependent variables in two analyses of variance including type of response (Likert-scale/graded vs. binary) and encoding condition (survival vs. pleasantness) as between-subjects independent variables. Survival and pleasantness ratings were compared for each type of rating using independent t -tests. In addition, for the binary decision tasks only, recall rates, numbers of recalled words, and encoding times were considered in turn in analyses of variance (ANOVAs) using binary decision (yes vs. no) as a within-subjects independent variable and task (survival vs. pleasantness) as a between-subjects factor. The data from **Study 2** are publicly available at the Open Science Framework website (<https://osf.io/zghb7/>).

Results

Correct free recall Recall rates were higher in the survival than in the pleasantness condition, $F(1, 156) = 75.13$, $p < .0001$, $n_p^2 = .325$ (see Fig. 1). Type of response, $F(1, 156) = 0.16$, $p = .6925$, $n_p^2 = .001$, and the interaction effect, $F(1, 156) = 2.21$, $p = .1393$, $n_p^2 = .014$, were not significant. The analysis of correct recall as a function of the different semantic categories is available in the Supplemental Material B. Similarly to **Study 1**, the survival effect was present across categories.

Clustering ARC scores were not significantly different from zero only in the pleasantness condition with the use of ratings, $t(39) = 1.63$, $p = .1112$, $M = .08$, $SD = .3$; survival + ratings: $t(39) = 3.47$, $p = .0013$, $M = .16$, $SD = .29$; survival + binary responses: $t(39) = 6.15$, $p < .0001$, $M = .25$,

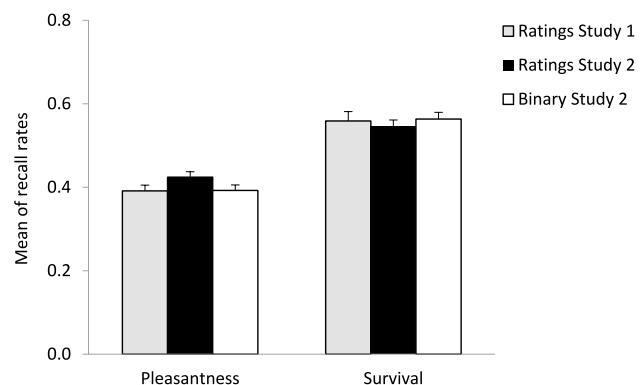


Fig. 1 Recall rates as a function of type of response (ratings vs. binary) and encoding condition (pleasantness vs. survival) in **Study 1** and **Study 2**. Note. Error bars represent the standard errors of the means

Table 1 Mean encoding times and their standard deviations (ms) as a function of encoding conditions (survival vs. pleasantness) and type of responses (binary vs. ratings)

	Survival	Pleasantness
Binary	1,422 (567)	1,190 (312)
Ratings	2,044 (631)	1,913 (742)

$SD = .25$; pleasantness + binary responses: $t(39) = 2.96$, $p = .0052$, $M = .14$, $SD = .3$. Clustering was significantly higher in the survival scenario ($M = .20$, $SD = .28$) than in the pleasantness condition ($M = .11$, $SD = .3$), $F(1, 156) = 4.22$, $p = .0417$, $n_p^2 = .026$, while the main effect of the type of response factor failed to reach significance, $F(1, 156) = 2.94$, $p = .0885$, $n_p^2 = .018$, ratings: $M = .12$ and $SD = .29$, binary: $M = .19$ and $SD = .28$, and there was no significant interaction, $F(1, 156) = 0.06$, $p = .8006$, $n_p^2 < .001$. However, when the classification of intrusions⁷ into the different semantic categories was included, the ARC scores were all above zero, survival + ratings: $t(39) = 4$, $p = .0003$, $M = .18$, $SD = .28$; survival + binary responses: $t(39) = 7.03$, $p < .0001$, $M = .28$, $SD = .25$; pleasantness + ratings: $t(39) = 2.37$, $p = .0229$, $M = .11$, $SD = .29$; pleasantness + binary responses: $t(39) = 3.69$, $p = .0007$, $M = .18$, $SD = .31$. Both main effects failed to reach significance: encoding condition, $F(1, 156) = 3.56$, $p = .0612$, $n_p^2 = .022$, survival: $M = .23$, $SD = .27$, and pleasantness: $M = .14$, $SD = .3$; type of response, $F(1, 156) = 3.43$, $p = .0659$, $n_p^2 = .022$, ratings: $M = .15$ and $SD = .29$, binary: $M = .23$ and $SD = .28$, and there was no significant interaction, $F(1, 156) = 0.11$, $p = .7362$, $n_p^2 < .001$.

Intrusions The number of extralist intrusions was descriptively about the same for both types of responses in the survival scenario (ratings: $M = 0.95$, $SD = 1.01$; binary decisions: $M = 1.02$, $SD = 1.48$) and slightly lower with binary decisions in the pleasantness condition (ratings: $M = 0.8$, $SD = 1.02$; binary decisions: $M = 0.52$, $SD = 1.01$), with the main effect of encoding conditions failing to reach significance, $F(1, 156) = 3.21$, $p = .0751$, $n_p^2 = .02$. Furthermore, the main effect of the type of response factor was also not significant, $F(1, 156) = 0.3$, $p = .5822$, $n_p^2 = .002$, and neither was that of the interaction effect, $F(1, 156) = 0.93$, $p = .3361$, $n_p^2 = .006$. The same descriptive statistics as in [Study 1](#) were calculated on the intrusions across semantic

categories and their relevance to survival and are reported in the Supplemental Material B.

Encoding times There was a main effect of the type of response factor, $F(1, 156) = 52.87$, $p < .0001$, $n_p^2 = .253$, with it taking longer to judge the words when using the 1–5-point scale than when using binary decisions (see [Table 1](#)). The time taken to judge was descriptively but not significantly higher in the survival scenario condition than in the pleasantness task, $F(1, 156) = 3.84$, $p = .0518$, $n_p^2 = .024$, whereas the interaction effect was not significant, $F(1, 156) = 0.3$, $p = .5817$, $n_p^2 = .002$. None of the within-conditions correlations between rating times and recall rates was significant, $max(r) = .19$, $min(ps) = .2459$.

Pleasantness and survival ratings

As far as the Likert scale ratings are concerned, the mean of the survival ratings was a little higher than 2.5, the center of the scale, $M = 3.11$, $SD = 0.53$, $t(39) = 7.23$, $p < .0001$, and the same was true of pleasantness ratings, $M = 2.97$, $SD = 0.35$, $t(39) = 8.38$, $p < .0001$. The difference between the two encoding conditions was not reliable, $t(78) = -1.38$, $p = .1724$. Turning to binary decisions, the mean proportion of words judged relevant for survival was a little higher than 50%, $M = .59$, $SD = 0.15$, $t(39) = 3.69$, $p = .0007$, but this was not the case for words judged for their pleasantness, $M = .49$, $SD = 0.18$, $t(39) = -0.42$, $p = .6768$. The difference between the latter two proportions was significant, $t(78) = 2.69$, $p = .0087$. With the exception of a significant positive correlation between Likert survival relevance ratings and recall rates, $r = .38$, $p = .0156$, the other within-condition correlations between recall rates and ratings or percentages of words judged relevant were not reliable, $max(|rsl|) = .17$, $min(ps) = .3028$. Finally, the correlations between the by-word means of the Likert ratings and the by-word percentages of “yes” responses among participants were very high, $r = .95$, $p < .0001$, when words were judged for their survival relevance and $r = .91$, $p < .0001$, when their pleasantness was rated.

Comparisons of “yes” and “no” responses in the binary task

In the analysis of recall rates as a function of the binary decision results (yes and no responses) and encoding conditions (survival vs. pleasantness), only the main effect of the encoding condition factor was significant, $F(1, 78) = 44.3$, $p < .0001$, $n_p^2 = .362$, with a higher proportion of words recalled in the survival condition, $M = .56$, $SD = 0.1$, than in the pleasantness condition, $M = .39$, $SD = 0.08$. As far as encoding times are concerned, only the main effect of encoding condition was significant, $F(1, 78) = 5.1$, $p = .0267$, $n_p^2 = .061$, with the mean decision-making time being longer

⁷ The same three independent observers from [Study 1](#) classified the intrusions into the same categories as the words to be remembered. The observers disagreed on ten intrusions, which were assigned to the most frequently chosen category.

for survival ($M = 1441$ ms, $SD = 584$) than for pleasantness ($M = 1204$ ms, $SD = 316$).

Combined analysis of Study 1 and 2

Data obtained in the rating tasks of Studies 1 and 2 were analyzed using studies and encoding conditions as between-participants factors. Only two main effects were significant. The encoding conditions factor had a significant effect on recall rates, $F(1, 160) = 67.11$, $p < .0001$, $\eta_p^2 = .296$, with greater recall of words rated for survival ($M = .55$, $SD = 0.126$) than for pleasantness ($M = .41$, $SD = 0.1$). The study factor significantly affected the time taken to judge the relevance of the words, $F(1, 160) = 11.05$, $p = .0011$, $\eta_p^2 = .065$, with less time taken in Study 2 when participants were instructed to answer quickly ($M = 1978$ ms, $SD = 688$) than in Study 1, in which there was no such time pressure ($M = 2341$ ms, $SD = 704$). No significant effects were observed in the analysis of the ratings.

Discussion of Study 2

In Study 2, a survival effect was obtained with binary responses. This is a new result which has never previously been reported in the literature. It is interesting to note that the survival effect with binary decisions was not affected by the nature of the decision (yes vs. no), a finding which lends credence to the hypothesis it is the “processing mode” rather than the nature of the items that matters in the survival effect (Nairne & Pandeirada, 2010), although the a priori relevance of the items to survival is not without influence (Bonin et al., 2024).⁸ The survival effect was also replicated with 5-point Likert scales. As shown by the combined analysis, it should be emphasized that the speed of decision-making did not alter the survival processing advantage. The difference in clustering between survival and pleasantness was only significant when ARC scores were calculated without considering intrusions. Moreover, no difference in clustering was found between the binary and graded decisions. Finally, although more intrusions were observed in the survival condition than in the pleasantness condition, this difference was not significant. The type of response had no reliable effect on the number of intrusions. The theoretical implications of these results are discussed in the General Discussion.

⁸ It is interesting to note, however, that although only a main effect of encoding condition was significant in the analysis comparing “yes” and “no” responses in the binary task, the recall rate was descriptively slightly higher for words judged to be relevant to survival ($M = 58.5\%$) than for words judged to be irrelevant ($M = 53.3\%$).

General discussion

The first aim of the present research was to examine whether a methodological change in the experimental procedure used to demonstrate the survival processing advantage effect in memory (i.e., the use of binary decisions to rate words for their relevance in a survival situation) would have any effect on this memory phenomenon compared with a situation in which relevance ratings were made using 5-point Likert scales. The instructions emphasized the need to make both binary and graded relevance decisions quickly, firstly, because binary decisions are generally made quickly, and secondly, because decisions such as whether to flee or fight a predator often have to be made without hesitation in survival situations. The second aim was theoretical, as the results from these two different ways of assessing word relevance make it possible to discuss the potential involvement of elaboration as a proximate mechanism of this effect. Indeed, we hypothesized that if elaboration is involved in the survival effect, the potential scope of this process should be greater when using nuanced rather than binary decisions, since nuanced decisions presumably requires more elaborate processing than binary decisions. What do the results tell us?

First, we were able to replicate a “standard” survival effect in free recall when words were rated using Likert scales without time pressure (Study 1). It is important to note that the survival effect in Study 1 was obtained using survival norms to select words, and the selected words were of medium survival value with regard to the problems of finding food and water and protecting from predators (slightly less than 3 on a 5-point scale). These norms also made it possible to select words for which the mean survival values were similar for the two survival problems identified in the instructions: food and drinking water, and predation. Second, and more interestingly, a survival effect was obtained in Study 2 when the decisions were binary, just as in the “standard” survival condition. This is a novel finding that adds to the literature on the survival processing advantage. It is interesting to note that the supplementary analyses that took account of the different semantic categories of the words in the list (animals, objects, shelters, transport) revealed that the survival effect in free recall was observed across all the semantic categories of the word lists in both studies. Third, we found that the recall performance in the pleasantness control condition was also unaffected by response modality (and “time pressure” as revealed by the combined analysis). Fourth, analyses of encoding times revealed an effect of the type of decision (ratings vs. binary decisions) for both survival and pleasantness processing, with shorter mean times for binary decisions than for graded decisions. In the combined analysis of the ratings obtained in Studies 1 and 2, only a main effect of the study factor

was significant, with less time being taken to decide on the relevance of the words when participants were instructed to answer quickly. Fifth, clustering analyses revealed no difference in ARC scores between the binary and graded decisions. Regarding encoding conditions, the difference in ARC scores between survival and pleasantness was significant only in [Study 2](#) when ARC scores were calculated without considering intrusions, but not otherwise (see also Nairne & Pandeirada, 2008, for a failure to find a significant difference in ARC scores between survival and pleasantness encoding). Finally, the analyses of intrusions showed that there were more intrusions overall in the survival condition than in the pleasantness condition, although this difference, which was clearly significant in [Study 1](#), was only a trend in [Study 2](#). It is important to note that intrusions were not affected by the type of response. (Other interesting aspects concerning intrusions are discussed below.)

Elaboration and survival processing

Elaboration is one of the proximate mechanisms thought to be involved in the survival effect (Cho et al., 2018; Howe & Derbish, 2014; Kroneisen & Erdfelder, 2011; Otgaar et al., 2015). The idea behind using binary decisions in survival processing was that they would influence the implementation of elaborative encoding. As a result, the survival effect on correct recall rates, ARC scores, and intrusions would be reduced when the task requires binary decisions rather than graded judgments. (As set out in the Introduction, this interpretation of the ARC scores and number of intrusions does not hold if elaboration is understood as referring to the distinctiveness of memory traces.) It is worth recalling that a key idea for proponents of the richness-of-encoding hypothesis is that survival processing provides more opportunity to generate original ideas from words than nonsurvival processing (e.g., a moving scenario), such as the idea of using a bottle to hit a dangerous animal or breaking it to use it as a knife. As Kroneisen et al. (2021) write, “The survival scenario encourages participants to generate creative ideas about how to use items. This effect should be strongest for items that do not fit in the scenario (i.e., objects with low relevance ratings), because in these cases people are forced to think about novel uses of these objects” (p. 330) or “The more novel and distinct functions of objects a person is able to generate, the better later memory retrieval” (p. 330). As mentioned in the Introduction, there is some evidence for this hypothesis, such as the observation that ideas generated during survival processing are judged to be more original (Bell et al., 2015). However, other data are less consistent with this hypothesis. Let us take Bonin et al.’s (2024) study as an example. Bonin et al. collected survival norms for French words and then used these norms to conduct three studies comparing the effect of survival

processing in relation to three specific survival problems which were considered independently: finding drinking water and steady supplies of food, protecting oneself from predators, and avoiding contamination by pathogens. Survival processing was compared with pleasantness processing. The selected words were either a priori highly relevant or weakly relevant to each survival problem studied. According to the elaboration and richness-of-encoding hypothesis, the survival context should have stimulated the generation of more, and more original, ideas for words that were weakly related to survival than for those that were strongly related. However, the findings showed that the survival effect was greater for words that were strongly related to survival (e.g., *shield*, *apricot*) than for those that were very weakly related (e.g., *stamp*, *carpet*). The reduction of judgment times due to binary decisions combined with time pressure should have limited the number of possible uses of the items generated by participants in a survival context. Thus, the observation that the survival effect in correct recall rates is not modulated by the type of decision (and the use of time pressure) does not fit well with the hypothesis that elaboration is a key proximate mechanism of this effect. The same applies to the clustering analyses. While clustering reflects a form of elaboration, the fact that there were no reliable differences in ARC scores between the survival and pleasantness conditions (with the exception of [Study 2](#), for which ARC scores were calculated without intrusions included), and especially between binary and graded decisions, does not suggest that this mechanism is heavily involved. (However, this reasoning again no longer holds if elaboration is understood as concerning only the distinctiveness of memory traces.) It is also possible that the implementation of elaborative processes was not, or was only very minimally, impacted in the condition in which participants provided binary decisions. Thus, participants would implicitly always continue to generate more, and more distinctive, ideas in the survival than in the control condition, resulting in an equivalent survival effect for both response modalities. It is possible that participants think “in a graded fashion” but ultimately settle on a binary conceptual output.⁹

With regard to encoding times, one possible line of reasoning would be that elaboration requires time and that more encoding time therefore corresponds to more elaboration. If elaboration is responsible for the survival effect, we should have observed a similar survival effect in memory when the encoding times themselves were similar, and a reduced survival effect when the experimental manipulation led to a reduction in encoding times. However, a survival effect in recall was obtained in [Study 1](#) even though there was no difference between encoding times in the survival and pleasantness conditions. In [Study 2](#), although graded responses

⁹ We thank Bennett Schwartz for this suggestion.

took longer than binary ones, a very similar survival effect was observed with these two response modalities. Again in line with the reasoning that encoding times reflect “more elaboration,” there should have been more elaboration and therefore better recall when participants used the more time-consuming graded response type rather than the binary response type. Again, this was not the case, as graded word evaluations did not produce better recall than binary evaluations. If elaboration is indeed involved in the survival effect, then the data seem to support the idea that its mobilization is independent of the times taken to evaluate the words—here referred to as encoding times. This is a phenomenon that has been documented in the literature ever since the discovery of this effect by Nairne et al. (2007).

It would be premature to rule out the involvement of elaboration in the survival processing advantage in memory. However, since none of the three outcomes used to index the mobilization of elaboration—correct recall rates, clustering indices and number of intrusions—was affected by an experimental manipulation designed to reduce its mobilization, the pattern of results found in the present study leads us to doubt that elaboration is highly involved in this memory phenomenon. Similarly, Nairne et al. (2017) failed to find significant differences in measures of temporal, semantic or rating clustering between the survival and moving conditions. This led these authors to suggest that their data provided no direct support for the hypothesis that the survival processing advantage is due to elaboration. At present, *no single proximate mechanism* has been clearly identified as underlying this memory phenomenon. Some studies suggest, however, that several proximate mechanisms are involved in the survival effect. Let us take self-reference. The mnemonic advantage associated with the survival effect tends to “disappear” when encoding occurs in a context involving the survival of someone other than oneself (e.g., a familiar person; Cunningham et al., 2013), except in the case of genetic relatives, who can be viewed as extensions of oneself at the genetic level (Dawkins, 1976) and for whom survival effects have been observed (e.g., biological children: Bonin et al., 2020; Seitz et al., 2018; grandchildren: Bruno et al., 2025). In other words, encoding with reference to the self is a critical component of the survival effect (Cook et al., 2023; Cunningham et al., 2013). Another potential proximate mechanism is mental imagery. Individuals with low mental imagery ability have been observed to exhibit a lower survival effect than those with high imagery ability (Nouchi, 2011), suggesting that mental imagery is involved in the survival processing advantage in memory. Finally, planning—projecting concrete future actions—is also a driver of this effect (Klein et al., 2011).

False memory and survival processing

As described in the Introduction, survival processing (and survival-related items) increases not only true memory but also false memory. But why is this the case? And is this not problematic for an ultimate (evolutionary) explanation of the survival processing advantage? It has been claimed that the increase in false memories with survival processing is consistent with an ultimate type of explanation (Howe, 2011; Howe & Derbish, 2010; Otgaar & Smeets, 2010). To illustrate, if an individual erroneously remembers encountering a ferocious animal such as a bear in a particular place where they thought they heard animal noises and/or saw paw prints, this may increase their chances of survival by preventing them from going there again or by encouraging them to be extra-vigilant if they have to return there (McMillan et al., 2024). In a way, it is a good thing to misremember a threat because if the threat does turn out to be real, this illusory memory will prompt life-saving avoidance behaviors. False memories, especially those related to survival, might also be useful in helping us find solutions to certain problems (e.g., insight-based problems, such as finding a conceptual link between triplets of items, Garner & Howe, 2014; Howe et al., 2010).¹⁰ It should be noted that illusory memory has received less attention than correct memorization in the literature on the survival processing advantage. Few researchers have systematically analyzed intrusions and attempted to explain them within a specific theoretical framework, such as the Fuzzy Trace Theory (Bialer et al., 2024; Otgaar & Smeets, 2010) mentioned in the Introduction. It is difficult to assess the stability of the results on the survival effect and memory illusions because researchers often do not report the errors identified in their studies, or do so in relatively little detail. However, in studies in which memory illusions have been analyzed, survival processing generally increases both the number of intrusions and correct recall (e.g., Howe & Derbish, 2010; Nairne et al., 2007; Nairne & Pandeirada, 2008; Otgaar & Smeets, 2010; Otgaar et al., 2014; Smeets et al., 2012; but see also Forester et al., 2020a, b, for reduced false-memory intrusions). In the first study, we observed more intrusions in the “survival” condition than in the “pleasantness” condition. In the second, we made the same observations but only at a descriptive level. This pattern of results is consistent with the FTT, according to which survival processing is thought to lead participants to rely more heavily on gist processing, which affects both

¹⁰ The Compound Remote Associate Task (CRAT) is one such particular instance of “insight problems.” Participants are presented with three words (e.g., *spa*, *mental*, and *care*), and are asked to find a word which connects them all (*health*) (The example is taken from Garner & Howe, 2014.)

true and false memories. Supplementary analyses (available in the Supplemental Material B) carried out on the intrusions collected in the two studies showed that intrusions corresponded to objects more often than to other categories. Furthermore, when intrusions were analyzed in relation to the survival norms available in the Bonin et al. (2024) study, which provides scores indicating the relevance of a large set of French words to the survival problems of (1) finding steady supplies of food and drinking water and (2) protecting oneself from predators, it was found that intrusions were generally related to survival in that they corresponded to words with survival scores that tended to be higher than those of the words to be remembered.

Ultimate considerations on the survival processing advantage

The data described here add to the very long list of data reported in the literature showing that the survival effect is a robust memory effect (Open Science Collaboration, 2015; Scofield et al., 2018), whose ultimate explanation is that it helped our ancestors to solve survival issues. Although our study focused on the role of the proximate mechanism of elaboration in the survival effect in memory, it also provides information about ultimate aspects of the survival effect, as we discuss briefly below. First of all, the observation that the survival effect is obtained in a situation where a rapid decision must be made is consistent with an evolutionary interpretation of this effect. When faced with a predator or a dangerous congener that is threatening you, it is best not to dither over the potential uses of a bottle and quickly remember that this object can be used as a weapon. Second, there is some debate in the literature on the survival advantage on the need to consider “evolutionary-ultimate” explanations as being equally valid when explanations based on basic-proximal mechanisms are also available to explain the phenomenon in question (e.g., Erdfelder & Kroneisen, 2014). However, these two types of explanation are not mutually exclusive, but complementary (Howe & Otgaar, 2013). As pointed out by Kazanas and Altarriba (2015), there is no inherent contradiction between the elaboration hypothesis of the survival effect and the evolutionary account of the survival advantage. As claimed by Nairne and Coverdale (2021): “In fact, evolved adaptations often co-opt other evolved mechanisms to achieve their intended effect. The immune system is an adaptation, but it co-opted the circulatory system to function”, or again: “Adaptations often recruit basic processes as part of their normal response repertoire. In fact, the coordination of co-opted mechanisms is often the central feature of an evolved adaptation (e.g., the fight-or-flight response)”. We can therefore hypothesize that elaboration is either an evolved mechanism, or that this

basic mechanism has been co-opted and coordinated with other basic mechanisms, such as self-reference, imagery and planning, and that this coordinated set of mechanisms is better suited to the function of remembering information related to survival and reproduction. However this may be, these two hypotheses will need to be specifically tested in future research.

Before concluding, we would like to briefly discuss a methodological point. As noted in the Introduction, survival effects have not only been obtained using word relevance ratings. Coverdale et al. (2019) obtained a survival effect using a task in which participants had to choose which of a pair of items they thought would be most useful in a survival or (control conditions) moving or scavenging context. Using this procedure, they observed a survival effect for both selected and nonselected items. Nairne et al. (2019) demonstrated a survival effect using an idea generation task based on inductor words. For each word presented (e.g., DOOR), participants had to generate an expression describing a situation containing the word and related to survival (e.g., DOOR: “I’m in a house that’s on fire, and I can escape through the door”). This condition was compared with various control conditions such as a 5-point agreeableness judgment task, the generation of an autobiographical memory involving an interaction with the object evoked by the inducing word, and the generation of an unconventional use of the object evoked by the word. Forester et al. (2020a) adapted Coverdale et al.’s (2019) approach and used a choice procedure in which participants had to make relative judgments between two items presented sequentially (i.e., decide which word was more *relevant* to the survival [vs. moving] scenario). More recently, Cook et al. (2023) observed a survival effect using stories of a character who was either stranded in the grasslands or who moved to a foreign country. The participants involved in this study remembered objects and story details better when the character was in a survival rather than in a moving situation, and larger effects were found when the participants were told to imagine themselves as the protagonist. Overall, using different response formats for the words to be encoded does not fundamentally alter the survival processing advantage in memory observed more conventionally with a graded evaluation procedure.

Conclusion

To conclude, we were able to show that the use of graded versus binary decisions when evaluating words for their survival value does not make any difference to the emergence of the survival processing advantage in memory. This is a novel and interesting finding that adds to the literature on this intriguing and important memory effect.

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Code availability Not applicable.

Declarations

Conflicts of interest/Competing interests The authors have no relevant financial or nonfinancial interests to disclose.

Ethics approval This study was performed in line with the principles of the Declaration of Helsinki. All the study procedures were approved by the Statutory Ethics Committee of the University of Bourgogne Franche-Comté.

Consent to participate Written informed consent was obtained from all participants before the beginning of the study.

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