Why do we remember? Research on memory is often concerned with the question of how our memory system works. It typically focuses on structural mechanisms, for example, how do we process and store information? How long can we hold information in our working memory? However, when thinking about the question why human memory exists, it seems unlikely that it only evolved to learn, process, and store abstract information. If our memory system is a solution to adaptive problems, shaped by the process of natural selection, then its structural properties should reflect their functionality (Tooby & Cosmides, 1992). However, what are the adaptive problems human episodic memory was designed to solve? Again, it seems implausible that its function is only to remember the past. It seems more plausible that we need to remember the past to predict the likelihood of events occurring in the future (Suddendorf & Corballis, 1997; Tulving, 2002). Specifically, memory could be designed to retain information relevant to survival, for example, remembering the location of food or water.

The survival processing effect

Nairne et al. (2007) claimed that nature “tuned” our memory systems to process and remember fitness-relevant information. Our ancestors therefore had survival advantages and were more likely to reproduce. In order to test this prediction, Nairne et al. (2007) asked participants to imagine a survival scenario (being stranded on the grasslands of a foreign country; see the classroom experiment in Text box 23.1 for the instructions) and then rate up to 30 words regarding their relevance to this situation. A second group of participants had to imagine a different scenario, namely moving to a foreign country (see the classroom experiment for the instructions). The task of this group was to rate the relevance of words presented to them according to the moving scenario. A third group had to rate the pleasantness of the words only. Each word was presented for five seconds, and participants were asked to rate the words on five-point scales, with 1 indicating totally irrelevant (or unpleasant) and 5 signifying extremely relevant (or pleasant). The material consisted of typical exemplars from 30 unique categories of concrete words. Since Nairne and collaborators were specifically interested in how survival versus non-survival processing affects retention in general, the words were randomly selected (e.g., chair, aunt, door) and did not follow a specific structure, schema, or script. A surprise retention test two minutes later showed that survival-based processing yielded better subsequent
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Retention than did the other encoding procedures. Figure 23.1 illustrates the results of the free-recall test for all three conditions.

In addition, Nairne et al. (2007) were able to show that the survival recall advantage holds for both free recall and for recognition memory tests irrespective of whether experimental conditions are manipulated within or between subjects. Other researchers have shown that the effect still occurs, for example, when using pictures instead of words (e.g., Otgaar et al., 2010), when survival processing is compared to other memory-enhancing encoding tasks (Kroneisen & Makerud, 2017; Nairne et al., 2008), or when using emotionally arousing control scenarios rather than the moving control scenario (e.g., Kang et al., 2008; Kroneisen et al., 2022). It could even be used to learn vocabulary in a second language (Kazanas et al., 2020). Furthermore, the survival processing advantage was successfully replicated as part of the Open Science Collaboration project (Open Science Collaboration, 2015). The survival processing effect also shows up in judgments of learning (Palmore et al., 2012), implying that participants are aware of the memorial benefits of survival processing during learning. The effect was replicated not only in various samples of young adults from all over the world (Howe & Derbish, 2010; Kroneisen & Erdfelder, 2011; Nairne et al., 2007; Otgaar et al., 2010) but also in children (Aslan & Bäuml, 2012; Otgaar & Smeets, 2010, Exp. 2) and in older adults (Nouchi, 2012). Overall, it is a stable effect with medium to large effect sizes (Scofield et al., 2017).

Moreover, Weinstein et al. (2008) found the survival processing effect only when ancestral survival scenarios were used, not when the scenario was changed to fit into a modern world (i.e., by replacing the grasslands scenario with a modern city scenario). Hence, the survival processing advantage appears to be limited to scenarios consistent with environments typical for human evolution (Nairne et al., 2009).

However, there is also considerable evidence that challenges the idea of an evolutionary nature of this effect. Howe and Derbish (2010) found that not only correct but also false recall is enhanced by survival processing. When both true and false recall and true and
Survival processing effect

false recognition were taken into account, a null effect of the survival advantage was observed (see also Otgaar & Smeets, 2010). Relatedly, Parker et al. (2021) more recently observed that survival processing not only boosts recall but also directed forgetting (i.e., more forgetting of material following the forget-cue in list-method directed forgetting). Also, survival processing does not enhance performance in a Stroop color-naming task (Kazanas et al., 2015). Apparently, considering one’s survival when performing attention-based and memory tasks does not enhance cognitive performance in general. In addition, no survival processing benefit was found for memory of faces (Savine et al., 2011), for memory of serial order (Wöstenfeld et al., 2020) or for indirect memory tests (Tse & Altarriba, 2010) or when presenting the scenarios in a second language (Saraiva et al., 2020). When the standard survival scenario was compared with threatening fictitious scenarios (a zombie attack), recall was even better for this unrealistic (i.e., evolutionary irrelevant) zombie scenario (Soderstrom & McCabe, 2011). Furthermore, when the survival scenario was compared to other fitness- or evolutionary-irrelevant scenarios, like being lost in space, the survival processing advantage sometimes disappeared (Kostic et al., 2012). Moreover, Klein (2013) demonstrated that no further context is necessary to produce the survival benefit on memory. He compared the grassland scenario with a context-free survival situation (“try to stay alive”). Both scenarios produced equivalent levels of recall. Klein also concluded that survival processing per se is too broad to be shaped by natural selection. These results suggest that, in contrast to the results of Weinstein et al. (2008), the mnemonic advantage of survival processing is not limited to ancestral contexts and does not show up in all types of memory measures. Thus, explaining the full pattern of results observed with respect to survival processing is not a trivial exercise.

Text box 23.1 Classroom experiment

Material

Stimulus materials are taken from the updated Battig and Montague norms (Van Overschelde et al., 2004) and consist of 30 typical members drawn from 30 unique categories (see list below). All words are presented in random order.

| Word material for experiments (taken from Nairne et al., 2007, p. 273) |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| truck           | juice           | silver          | door            | car             | silk            |
| diesel          | shoes           | orange          | broccoli        | sword           | teacher         |
| mountain        | finger          | whiskey         | bear            | apartment       | pan             |
| pepper          | aunt            | flute           | cathedral       | soccer          | sock            |
| book            | chair           | snow            | screwdriver     | emerald         | eagle           |

Design

The simplest design is used here, with only one randomized between-subject factor. One half of the participants receives the survival, the other half the moving scenario. All participants are asked to rate the same words, in one of the two rating scenarios.
The rating task should be followed immediately by a short two minutes distractor task prior to a final unexpected free-recall task. Except for the rating scenarios, all aspects of the design, including timing, are held constant across participants. Proportion correct recall serves as the dependent variable.

**Procedure**

Depending upon experimental condition, the participants first read one of the following instructions:

**Survival**

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

**Moving**

*In this task, we would like you to imagine that you are planning to move to a new home in a foreign land. Over the next few months, you’ll need to locate and purchase a new home and transport your belongings. We are going to show you a list of words, and we would like you to rate how relevant each of these words would be for you in accomplishing this task. Some of the words may be relevant and others may not – it’s up to you to decide.*

After reading the scenario description, stimuli should be presented for five seconds each, and participants should be asked to rate the words according to their relevance to the relevant scenario on a 5-point scale, with 1 = totally irrelevant and 5 = extremely relevant. Following the rating task, a short distractor task is presented, for example, a digit-recall task. For this task, seven digits ranging between zero and nine should be presented sequentially for one second each, and participants are required to recall the digits in order by writing responses into a text box. Following the distractor task, instructions for the surprise free-recall task should appear. Participants are instructed to write down the previously rated words, in any order, on a response sheet. The final recall phase proceeds for ten minutes.

**Possible mechanisms underlying the effect**

When trying to explain the survival processing effect, it is important to distinguish between ultimate and proximate explanations. Scott-Phillips et al. (2011) pointed out that,

> ultimate explanations are concerned with the fitness consequences of a trait or behavior and whether it is (or is not) selected. In contrast, proximate explanations are concerned with the mechanisms that underpin the trait or behavior – that is, how it works. Put another way, ultimate explanations address evolutionary function (the
‘why’ question), and proximate explanations address the way in which that function is achieved (the ‘how’ question).

(p. 38)

Nairne and colleagues (Nairne, 2010; Nairne & Pandeirada, 2008, 2010, 2011; Nairne et al., 2007, 2008) claimed that the survival processing effect can be seen as evidence that human learning and memory systems have been selectively tuned during evolution to process and retain information that is relevant to fitness (selective-tuning hypothesis). Therefore, the survival processing advantage reveals the ultimate function of human episodic memory, namely, to enable encoding, storage, and retrieval of survival-relevant information in the first place. We can remember information that was previously evaluated with respect to its survival relevance especially well because this skill facilitates adaptive behaviors that help us survive.

However, this ultimate explanation does not suffice for a complete understanding of the survival processing effect. An answer to the question why there is a mnemonic advantage of survival processing does not provide us with an answer to the question how this advantage comes about. More precisely, knowing why our memory system contributes to inclusive-fitness maximization does not imply anything with regard to how memory works in specific encoding and retrieval contexts. In the following, we focus on proximate explanations of the survival processing advantage with the goal to uncover the memory mechanisms driving this effect. As several possible proximate mechanisms are already ruled out conclusively, we included only the most promising explanations in our review (for a more detailed overview, see Erdfelder & Kroneisen, 2014).

**Proximate explanations of the survival processing effect**

**Planning**

Klein et al. (2010, 2011) saw memory as future-orientated. According to their theory, “memory can be viewed as the result of the complex interplay of a set of processes that enable the organism to draw on past experiences to guide current behaviour and plan for future contingencies” (p. 122). They explain the survival processing effect by assuming that survival processing encourages future-oriented thoughts of planning more strongly than control conditions do, thus serving the ultimate function to facilitate future decisions. In their experiments, Klein et al. (2011) compared different groups that either read scenarios involving (1) survival without planning, (2) planning without survival, or (3) both survival and planning. In line with their prediction, recall performance was highest for groups engaged in planning (with and without the survival component) and lowest for that group engaging in survival processing without any planning component. The authors concluded that planning for future events is “a specific, evolved set of mechanisms designed to help solve a general problem — how to remain alive long enough to reproduce and care for one’s offspring” (p. 135).

**Affective explanations**

One influential explanation of the effect maintains that the survival processing advantage is due to emotional arousal. This idea was already discussed by Nairne et al. (2007). There is evidence that items or stimuli that represent threats (e.g., guns, snakes, or aggressive
faces) affect attention and memory (e.g., Kensinger, 2007). The survival processing effect can be seen as a variant of emotional influences on memory: Survival processing stimulates negative emotions, which may in turn recruit additional resources that may support the encoding and retrieval of information (D’Argembeau & van der Linden, 2004; Doerksen & Shimamura, 2001). However, the effects of emotion on memory are not straightforward. Sometimes negative information can be remembered better (Baumeister et al., 2001), sometimes positive information is prioritized (D’Argembeau & van der Linden, 2011).

The survival processing literature provides no evidence that the survival processing advantage is mediated by emotional arousal (Kang et al., 2008; Kroneisen et al., 2022; Soderstrom & McCabe, 2011) or by stress (Smeets et al., 2012). However, there is some support for the assumption that the survival processing effect is moderated by the perceived threat within the survival situation such that higher perceived threat boosts the survival processing advantage (Olds et al., 2014; Soderstrom & McCabe, 2011).

Soderstrom and McCabe (2011), for example, constructed different control scenarios identical to Nairne et al.’s (2007) grasslands survival scenario except that two words were exchanged. In one set of conditions, the word “grasslands” was replaced by “city”, transforming the ancestral survival scenario in a modern survival scenario. In a different set of conditions, the word “predator” was exchanged for “zombie”, transforming the realistic survival scenario into an unrealistic threat scenario. Complete cross-classification of the scenario types resulted in four different scenarios, namely, survival-grassland, survival-city, zombie-grassland, and zombie-city. The two scenarios involving “zombies” were associated with higher arousal levels and were evaluated more negatively than the other conditions. Furthermore, the zombie scenarios produced highest levels of recall. However, the differences in arousal and valence ratings could not fully explain the observed pattern in recall rates. Even when the effects of arousal and valence ratings were statistically controlled, the mnemonic benefit of zombie processing compared to predator processing remained (Soderstrom & McCabe, 2011).

It is also possible that it is not arousal in general that explains the effect but specific aspects of arousal. Hart and Burns (2012) claimed that survival contexts evoke the thought of death. There are several studies suggesting that death awareness results in emotional and behavioral changes, some of which may also affect encoding and retrieval (e.g., Landau et al., 2009, 2004). In three experiments, Hart and Burns (2012) were indeed able to show that, compared to two different control conditions unrelated to death, priming of death-related thoughts prior to providing pleasantness ratings enhanced later recall significantly (DTR-, dying-to-remember, effect). However, they did not include the survival scenario as a control condition. When the survival processing scenario was compared to a death-related scenario, the results were somewhat mixed. Burns et al. (2014b) found that the DTR-effect was completely eliminated when thoughts of mortality were combined with an orienting survival processing task. They concluded that processing induced by mortality salience is redundant to that required by the survival orienting task. Bell et al. (2013), in contrast, compared the standard survival scenario with the moving scenario and a clearly death-related control scenario (floating in outer space with dwindling oxygen supplies). Here, the death-related scenario did not improve recall. Similar results were observed by Klein (2012). He compared a modified death scenario with both the standard survival scenario and a pleasantness rating control condition. Recall rates in the death scenario
condition did not differ significantly from the control condition but were significantly worse than in the survival processing condition. However, Burns et al. (2014a) conducted a series of studies using dying and survival scenarios and were able to demonstrate that a dying scenario is equivalent to the survival scenario when specific variables are controlled. In their experiments, the scenarios were matched on thematic structure, concreteness, and relevance. In addition, possible congruity effects (see next paragraph) were controlled. When matched on these dimensions, no difference between the survival and the dying scenario was found.

**Item congruity**

Nairne et al. (2007) already discussed the possibility that the survival advantage might be mediated by a congruity effect (Schulman, 1974). Historically, the term congruity effect refers to the phenomenon that participants remember word stimuli previously judged with respect to their fit into sentence frames better when the words received a “yes” response than when they received a “no” response, presumably because these words were linked to the conceptual framework in which they were encoded and therefore better retrieved later on (e.g., Craik & Tulving, 1975; Moscovitch & Craik, 1976). To avoid congruity-biased item pools, Nairne et al. (2007) used random word lists from a variety of semantic categories with no obvious links to any of the scenario conditions. In addition, they compared average ratings between experimental conditions to check whether the survival recall advantage was confounded with higher survival relevance ratings, giving rise to a congruity effect explanation. According to their findings, the survival processing effect emerged in recall rates even when the average relevance ratings did not differ between conditions.

However, different results were obtained by Butler et al. (2009). In their first experiment, they not only found the survival processing advantage but also a correlation between relevance ratings and recall rates for both, the survival and the moving scenario. Similar results were repeatedly observed by other researchers (e.g., Kroneisen & Erdfelder, 2011; Kroneisen et al., 2013, 2014, 2016; Palmore et al., 2012), suggesting that within-list congruity effects are involved in either condition. Moreover, Butler et al. (2009) compared the survival scenario with a robbery scenario based on list items that were either highly relevant (e.g., “alarm” or “car” for the robbery scenario; “lion” and “fire” for the survival scenario) or irrelevant (e.g., “couch” or “jazz”) to the respective scenarios. Compared to recall performance in the robbery-scenario condition, the results showed a survival processing memory advantage for survival-related word lists, a survival processing disadvantage for robbery-related words and no differences between scenarios for irrelevant words (Butler et al., 2009, Exp. 2 and Exp. 3, respectively). Importantly, the recall rate of robbery-congruent words in the robbery scenario condition was not worse than the recall rate of survival-congruent words in the survival scenario condition (for similar results, see Palmore et al., 2012).

However, not all results of Butler et al. (2009) were replicated. Nairne and Pandeirada (2011) still found the survival processing advantage even when they used the word lists from Butler et al. (2009). More precisely, they detected a survival processing effect when using only scenario-incongruent items (Nairne & Pandeirada, 2011, Exp. 2), only scenario-congruent items (Nairne & Pandeirada, 2011, Exp. 3), and equal amounts of congruent and incongruent items (Nairne & Pandeirada, 2011, Exp. 4).
Another idea to explain the survival processing effect was already suggested by Nairne et al. (2007; Nairne & Pandeirada, 2008): the idea that survival processing is a form of deep processing that leads to enhanced elaboration. Following this reasoning, Kroneisen and Erdfelder (2011) argued that the survival processing effect can be traced back to the richness of encoding triggered by the relevance-rating task. According to Craik and Tulving (1975), one important factor in depth of processing is not merely semantic encoding of information but rather the richness and distinctiveness with which information is encoded. Kroneisen and Erdfelder (2011) maintained that, in the survival-relevance rating task, participants are implicitly encouraged to think about different possible uses of objects in a complex survival context, both standard and nonstandard uses. This process generates a highly distinctive memory representation of list items during encoding, providing a large number of powerful memory cues (i.e., thoughts about different object functions) for the retrieval situation later on. Kroneisen and Erdfelder (2011) called this the richness-of-encoding (RE) hypothesis.

In their first two experiments, Kroneisen and Erdfelder (2011) tested this hypothesis by comparing the standard survival and moving scenarios with a reduced survival scenario. In this reduced scenario, only a single survival problem (i.e., lack of potable water) was addressed. The authors argued that, as a consequence of the less complex encoding context, distinctiveness of memory representations diminishes and fewer retrieval cues are available in the subsequent free-recall test compared to the standard scenario that addresses three survival problems (i.e., lack of potable water, lack of food, and predators). In line with these ideas, the survival processing advantage vanished both in within-subjects and between-subjects designs for the reduced scenario (Kroneisen & Erdfelder, 2011, Exp. 1 and 2, respectively). As shown in their third experiment, similar effects can be achieved by dispensing with the relevance-rating task and asking participants instead to state a single object use (simple encoding context) versus four different object uses (complex encoding context) for the survival versus moving scenarios. As predicted, there was a strong survival processing advantage for the complex encoding context but no such effect for the simple encoding context (Kroneisen & Erdfelder, 2011, Exp. 3).

Notably, when replacing the relevance rating task by an interactive imagery task (i.e., imagining use of an object in the respective scenario and rating the ease of this interactive imagery), the survival processing effect was also shown to vanish (Kroneisen et al., 2013). More precisely, interactive imagery reduced recall performance particularly in the survival, not in the moving condition. According to Kroneisen et al. (2013), forcing participants to engage in interactive imagery appears to distract them from the type of information processing that underlies the survival processing effect in standard relevance rating tasks. Corroborating the RE hypothesis more directly, Röer et al. (2013) showed that the strength of the survival processing effect is a function of the number of unique relevance arguments generated per item. In line with this, Wilson (2016) showed that the survival scenario elicited more alternative uses in the Guilford’s Alternate Uses Test compared to non-survival related conditions. Accordingly, Kroneisen et al. (2021) found that the survival processing effect is more pronounced for objects low in functional fixedness (i.e., objects that can be used in multiple ways) compared to objects high in functional fixedness that are linked to a
specific function. Moreover, Bell et al. (2015) demonstrated that rating the usefulness of objects compared to rating the dangerousness of objects in a survival scenario leads to better recall.

Domain-general encoding processes such as elaboration and distinctive processing involve consciously controlled forms of encoding that are cognitively demanding. Therefore, they require working memory capacity. Hence, the survival processing effect should diminish when working memory resources are scarce. This conflicts with the evolutionary view that maintains stability of the survival processing advantage irrespective of working memory resources. Four independent studies indeed showed that survival processing diminishes under working memory load (Kroneisen et al., 2014, 2016; Nouchi, 2013; Yang et al., 2021; see, however, Stillman et al., 2014, and Kroneisen et al., 2016, for some discrepant results and a potential explanation).

If participants generate unique relevance arguments during survival processing selectively (e.g., using a chair to defend oneself against predators; melting snow to drink it later …), this should not only help them to recall or recognize these items later on, it should also allow them to specifically attribute the item to the survival scenario context. More precisely, participants should remember well that an item was encoded in a survival condition (i.e., they should have better source memory for the survival scenario compared to alternative scenarios). Indeed, there is evidence that survival processing improves memory for context (Clark & Bruno, 2016; Kroneisen & Bell, 2018; Misirlisoy et al., 2019; Nairne et al., 2012). However, there are also studies that did not find a source memory advantage for words processed in a survival scenario (Bröder et al., 2011; Savine et al., 2011; Nairne et al., 2015; Hou & Liu, 2019).

Current research goes beyond what can be learned from behavioral measures alone. Recently, Event Related Potential (ERP) research demonstrated that survival processing is associated with an increased frontal slow wave (Forester et al., 2019, 2020a). These findings suggest that survival processing is not associated with lower level encoding processes, which are sensitive to motivation and stimulus salience, but rather with more elaborate forms of encoding. This is also in line with the finding that reward motivation does not moderate the survival processing effect (Forester et al., 2020b).

In sum, all these studies suggest that a domain-general encoding process previously discussed in the depth-of-processing literature — richness of encoding — appears to be an important determinant of the survival-processing advantage.

Single-item and relational processing

Item-specific processing is concerned with encoding individual characteristics of items, whereas relational processing is concerned with encoding of the relationships between list items (Burns et al., 2011). It is known that item-specific processing enhances the distinctiveness of items within a memory trace, whereas relational processing provides a structure for organizing these items within the trace (Burns, 2006). The combination of both, item-specific and relational processing, may also play an important role for the survival advantage (Burns et al., 2011). It is conceivable that survival-processing tasks prompt participants to engage in both item-specific and relational processing at the same time, a combination that has previously been shown to boost episodic memory (Einstein & Hunt, 1980; Hunt & Einstein, 1981; Hunt & McDaniel, 1993).
If relational processing is an important aspect for the survival advantage, then, according to Nairne and Pandeirada (2008), the survival processing effect should diminish when semantically unrelated words are replaced by categorized word lists from different semantic categories. Since these categorized word lists invite relational processing by default, additional relational processing due to survival processing should not lead to significantly better recall. However, Nairne and Pandeirada (2008) still found the survival processing effect in their experiment and therefore concluded that relational processing does not play a role in this effect. Burns et al. (2011), in contrast, criticized these studies because the categorized item material of Nairne and Pandeirada (2008) was survival-related (i.e., fruits, four-footed animals, …) and their measure of relational processing (i.e., the categorized list) may thus have been insensitive. In their experiments, they aimed at demonstrating that survival tasks require participants to engage in both item-specific and relational processing. Burns et al. (2011) compared the survival task with control tasks that involve either item-specific or relational or both processing forms. According to their results, the survival processing advantage is robust when the control condition contains only one component (item-specific or relational processing). However, when the control task involves both processing forms, the survival processing effect disappeared in their study.

However, there are still open questions that cannot be answered by the experiments conducted so far. For example, why does the survival processing task promote more item-specific and relational processing than control tasks do? Is it possible to modify the survival processing task so that single-item or relational processing increase or decrease selectively? A complete theoretical account of the survival processing effect should provide answers to research questions like these.

Conclusions
It is still an open debate which cognitive mechanisms are involved in the survival processing effect. In this chapter, we discussed different proximate explanations. However, we chose not to review all explanations mentioned in the literature but focused on the most promising mechanisms discussed so far, namely, (1) planning, (2) arousal, (3) item congruity, (4) richness of encoding, and (5) the combination of single-item and relational processing. These mechanisms of human memory, most of which are well-known from related research on long-term episodic memory, have proven to be successful in accounting for many results on moderators and possible mediators of the survival processing effect documented in the empirical literature (for a similar conclusion, see Howe & Otgaar, 2013).

As outlined in the literature summarized in this chapter, the survival processing advantage in free recall and recognition is a robust and general phenomenon. In fact, the data support the conclusion that it is one of the most efficient encoding procedures identified in human episodic-memory research so far. Given this robustness and generality, we do not consider it likely that this effect is accidental. It appears to reflect an evolved adaptive function of human episodic memory that contributes to inclusive-fitness maximization (Nairne et al., 2007). Nevertheless, we believe that this ultimate explanation of the survival processing advantage does not necessarily imply a domain-specific proximate explanation of the mechanisms driving this effect. As discussed above, there is considerable evidence that well-known domain-general mechanisms of human episodic memory such as richness of encoding can account for variations in the strength of the survival
Survival processing effect. Therefore, these domain-general mechanisms are promising candidates for a complete proximate explanation of the survival processing advantage.

Summary

- Episodic memory helped our ancestors to solve adaptive problems related to survival. The operating characteristics of episodic memory should thus “bear the imprints of the specific selection pressures that shaped their development” (Nairne & Pandeirada, 2010, p. 977).
- The survival processing effect is a strong and rather general memory advantage for word-material processed in a survival-related context.
- Ultimate explanation: Nature “tuned” our memory systems to process and remember fitness-relevant information.
- Proximate explanations:
  - Planning: Survival processing encourages future-oriented thoughts of planning.
  - Affective explanations (arousal and mortality salience): The survival processing effect is partly determined by the perceived threat and stress within the survival situation. However, the empirical evidence for this account is inconsistent.
  - Item congruity: The survival processing effect benefits from congruity of item content with the scenario. Whereas Butler et al. (2009) found evidence for congruity effects, Nairne and Pandeirada (2011) did not.
  - Richness of encoding: The survival scenario fosters distinctive processing and elaborative encoding. Survival relevance ratings encourage persons to think about various possible uses of objects in a survival context, both typical and atypical uses. Thoughts about object functions later serve as powerful retrieval cues.
  - Single-item and relational processing: The survival scenario encourages both, item-specific and relational processing, resulting in improved memory performance.

Further reading

We recommend the original article of Nairne et al. (2007) as an introduction to the survival processing literature. A rather comprehensive overview of the literature can be found in Erdfelder and Kroneisen (2014) and in Kazanas and Altarriba (2015). Howe and Otgaar (2013) provided a more concise overview on proximate explanations of the survival processing advantage. In addition, there is a special issue of Memory (Howe & Otgaar, 2014) that covers selected theoretical and empirical aspects of the survival processing effect.

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