A Dissertation

entitled

Survival Processing Effect on Memory for Social Information

by

Xinni Chan

Submitted to the Graduate Faculty as partial fulfillment of the requirements for the

Doctor of Philosophy Degree in Experimental Psychology

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An Abstract of

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Recent research has suggested that our memory systems have evolved to prioritize processing information that enhances our fitness (e.g., location of food, distance of predators). In a provocative line of research, a number of studies have shown that people who merely think about survival demonstrate enhanced recall for word lists compared to those in control conditions who think about non-survival topics (e.g., Kang, McDermott, & Cohen, 2008; Nairne, Thompson, & Pandeirada, 2007; Weinstein, Bugg, & Roediger III; 2008). Researchers have attributed this to an evolved sensitivity to fitness-relevant content, which enhances attention and memory processes when prompted to think about survival contexts. More recent research has suggested cognitive explanations rather than evolutionary motives, such as encoding stimuli in ways that are congruent with the context, explain these effects (Butler, Kang, & Roediger III, 2009). To date, nearly all tests of the survival processing advantage have been conducted in non-social domains involving word lists and no study has assessed the functional value of the survival processing advantage for outcomes other than memory, such as judgments and decisions.
Given the proximal role of social information in modern and ancestral life, this dissertation tested between evolutionary and cognitive explanations (i.e., a congruency-incongruency account) of the survival processing advantage for social memory and judgments/decisions. After establishing the appropriateness of stimuli in a pilot study, participants in the main study were randomly assigned to read one of two scenarios: a survival scenario where participants imagined being stranded in foreign grasslands or a non-survival scenario where they imagined leading the robbery of a well-guarded bank. As part of the task, participants were told that they needed to connect with other social groups to assist in meeting the scenario goal, wherein information about four social groups were presented. Critically, the groups possessed different numbers of characteristics that were congruent or incongruent with survival and leading a robbery. The main dependent measures were recall and recognition of the group characteristics and the accuracy of participants’ decisions and judgments about the groups (e.g., whether they decided to join the group possessing the most goal-relevant traits). Overall, the results more clearly supported the congruency-incongruency account than the survival processing account. First, participants recalled social traits best when the traits were congruent with the scenario context, regardless of whether it was a survival or robbery context. However, recognition did not differ as a function of condition or trait type. Second, participants in the robbery and survival conditions chose the “correct” group at equivalent and greater-than-chance levels and judged groups with the most goal-relevant traits more favorably than groups with the least goal-relevant traits. This latter set of results suggests that participants used the scenario context in a functional way to guide
their judgments and decisions. Implications for several different research literatures are discussed.
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Chapter One

Introduction

Many scholars have suggested that the human memory system evolved to selectively attend to fitness-relevant content in the environment (e.g., Aslan, & Bäuml, 2012; Burns, Burns, & Hwang, 2011; Howe & Otgaar, 2013; Kang, McDermott, & Cohen, 2008; Klein, 2014; Kroneisen, & Erdfelder, 2011; Kroneisen, Erdfelder, & Buchner, 2013; Nairne, Thompson, & Pandeirada, 2007; Weinstein, Bugg, & Roediger III; 2008). That is, evolution has shaped human brain structures and mechanisms to select for a memory system that is hard-wired to process survival-relevant information, such as the location of food or the presence of predators. The value of such a brain system is that it enhances the survival odds for the organism.

A modern byproduct of this evolved system is that cues in the environment related to fitness or survival enhance a person’s vigilance, attention, and memory. Empirically, one piece of evidence for this notion comes from a large body of research investigating recall for words following primes for survival content. In representative studies, participants are primed with a context involving a fitness-relevant goal (e.g., surviving in a grasslands of a foreign land), a fitness-irrelevant goal (e.g., moving into a new home, leading a bank robbery), or a control condition not involving any context. Then, participants read a list of words and evaluate how relevant each word is to the context. The typical result is that participants have substantially higher recall when primed with a fitness-relevant context than a fitness-irrelevant context or no context. The explanations for the effect vary (described in more detail below) and there are boundary conditions, but the finding appears quite consistent and robust.
The current research builds on this prior research in a number of ways. First, nearly all prior research on the so-called survival processing effect has focused on non-social stimuli. Given the importance of social information for humans and the fact that research has found that the processing of social and non-social information differs neuroanatomically (e.g., processed in different brain regions) and psychologically (e.g., emotional and motivational differences; Gamond, Tallon-Baudry, Guyon, Lemarechal, Hugueville, & George, 2012; Mitchell, Banaji, & Macrae, 2005; Zahn et al., 2007), one goal of the current research was to examine whether the survival processing effect extends to social memory. Second, little research has examined whether survival processing influences other forms of cognition, notably judgments and decisions. One might expect, for instance, that if survival processing is truly adaptive, then it should improve judgments and decisions related to the memory context. Third and finally, as there have recently been alternative explanations offered for the survival processing effect, this proposal examined the validity of these different accounts in the novel context of social memory. The next section provides an overview of the survival processing effect research and core explanations for the effect.

**The Survival Processing Effect**

Our cognitive systems do not arbitrarily process information in our environment. Rather, our cognitive systems selectively attend to, encode, and recall information using particular cues and are impacted by motivations, emotions, and cognitive limitations. For example, a large literature has revealed that emotions can impact various forms of cognition (Darke, 1988; Elliman, Greene, Rogers, & Finch, 1997; Gray, 2001; Spies, Hesse, & Hummitzsch, 1996), including problem solving, working memory, and
attention (Cheng & Holyoak, 1985; Kensinger & Corkin, 2003; Spies et al., 1996). For purposes of this paper, I primarily focused on the role of one particular motive in impacting how people process and recall information. Specifically, I focus on the idea that bringing to mind survival-relevant information and motives can change how people process, recall, and utilize stimuli in their environments.

The so-called survival processing effect has now been examined in over two dozen investigations. The majority of these studies use the same basic paradigm. Specifically, participants are instructed to imagine being stranded in the grasslands of a foreign land without survival materials, and that they will need to find supplies and protect themselves from predators. Participants in other conditions are instructed to imagine something not related to survival (e.g., leading a bank robbery, moving to a foreign land) or do not imagine anything at all. Next, a word list is presented and participants rate the relevance of each word to the imagined scenario (Nairne, Thompson, & Pandeirada, 2007). After a distractor task, a surprise retention test is given. Across studies, survival processing repeatedly has the best retention performance compared to the control conditions (e.g., Kang, McDermott & Cohen, 2008; Nairne et al., 2008; Weinstein, Bugg & Roediger, 2008; Nairne & Pandeirada, 2011; Raymaekers, Otgaar, & Smeets, 2014). This effect has proven its replicability and robustness across numerous studies, manuscripts, and laboratories (for review see Nairne & Pandierada, 2007, 2008, and 2010, Schwartz, Howe, Toglia, & Otgaar, 2013). What are the possible explanations for this striking effect? Two broad classes of explanations have been provided for the survival processing effect: a motivated cognition account that I will call the ancestral
*challenge account* and a more pure cognition account that I will call the *congruency-incongruency processing account*.

**Ancestral Challenge Account.** In most research on the survival processing effect, the primary explanation revolves around our memory systems being “tuned” to processing information that has fitness-relevance—a motivated cognition perspective I refer to as the ancestral challenge account. The basic argument behind this account emerges from a consideration of evolutionary theory and natural selection. Natural selection is a process which begins with the principle of individual differences, which are caused by mutation, sexual reproduction and other forces. Darwin (1859) defines the concept of natural selection as the “principle by which each slight variation [of a trait], if useful, is preserved” (p. 61). Based on this definition, natural selection is a gradual process by which living organisms have traits that are better suited or more adapted to their environment to survive and reproduce than other living organisms. As a result, these adaptive living organisms with superior features have survived and increased in number with each generation, becoming typical of the species.

One feature that has been molded through natural selection is human brain structures and processes (Darwin, 1859; Jacob, 1977). The structure of the human cognitive architecture has been modified through the course of evolution, and improved the functional operations of the architecture to increase the successful rate of solving adaptive information-processing problems, especially on solving recurrent adaptive problems (e.g., Cosmides & Tooby, 1987; Klein, Cosmides, Tooby, & Chance, 2002; Sherry & Schacter, 1987). In relation to memory, it has been argued that nature has shaped our memory systems to process and recall fitness-relevant information, such as
characteristics that may signal threats to, or benefits for, survival (e.g., location of food, presence of predators). For instance, it has been suggested that people remember things in a functional way such that we tend to remember events that occur and recur in the environment, but forget events that are less likely to reoccur (Anderson & Schooler, 1991, 2000). For example, if a particular food source appears and reappears during certain times of the year, this would clearly be relevant to survival. Ultimately, memory systems that helped an organism selectively attend to fitness-relevant information were more likely to survive and pass on their genetic material to subsequent generations.

Given that the majority of our cognitive development occurred during the Pleistocene era (approximately from 1.8 million to 10,000 years ago), our memory processes, it is argued, are tuned to the problems faced by our ancestors during that time, such as basic survival needs (Tooby & Cosmides, 1992 and 2005). In a modern human context, it has been argued that people still possess the core features of the brain that enabled such survival processing. Thus, a byproduct of this design and architecture is that evoking contexts that are relevant to fitness concerns even today will change the way people process information. This ancestral challenge account has been the primary explanation for the so-called survival processing effect (e.g., Kroneisen & Erdfelder, 2011), where inducing problems or contexts often faced by our ancestors (e.g., basic survival concerns) should lead to enhanced psychological processing (e.g., attention, encoding, recall) relative to more modern problems or contexts (Weinstein et al., 2008).

**Criticisms of the Ancestral Challenge Account & Alternative Accounts.**

Although there is a now a wealth of research demonstrating the survival processing effect in the context of memory for word lists, more recent research has suggested boundary
conditions and alternative accounts for the findings that do not involve evolutionary motives. First, with respect to boundary conditions, some research has found that the survival processing effect is smaller when under cognitive load (Nouchi, 2012), when using scenarios that describe modern contexts rather than ancestral contexts (Nairne & Pandeirada, 2010; Weinstein et al., 2008; although see Soderstrom & McCabe, 2011), and when using more interactive imagery (Kroneisen et al., 2013). The fact that moderators exist suggests that other possible mechanisms may be important for understanding and interpreting the survival processing advantage findings.

Second, as stated above, early explanations for the survival processing effect—that is, the ancestral challenge account—focused on evolutionary explanations involving our memory systems being “tuned” to processing information that has fitness-relevance. However, more recent accounts have focused on cognitive-based explanations as opposed to motivated cognition stemming from ancestral challenge. Notably, some researchers have suggested that the results may not be due to being in a mindset that relates to concerns of the evolving brain and the challenges faced by our ancestors; rather, the results may reflect something about the words achieving deeper processing due to their consistency with preexisting and congruent knowledge structures in which the context facilitates encoding. In a similar vein, human memory is an active reconstruction process and can be influenced by pre-existing knowledge, past experiences and expectations (Barlett, 1932). In other words, social information we obtain daily is not processed equally but selectively drawn by our attention to the features of the environment as a function of qualities intrinsic to those features (e.g., light, movement) or as a function of our temporary motives (Taylor & Fiske, 1978). As a result of differential attention to
particular features, information about salient features may be encoded in more accessible form. When we have limited resources to process information and need to respond quickly to information, we tend to use the information which is most salient or available to us, that is, easily brought to mind (Tversky & Kahneman, 1974). Thus, previously learned, salient and extreme information is weighted more heavily than later learned, less salient and extreme information (e.g., Dreben, Fiske, & Hastie, 1979; Fiske, 1980; Kahneman, Slovic, & Tversky, 1982). Indeed, in a recent series of studies involving the survival processing effect (Nairne et al., 2007), researchers provided participants with either a survival context or a non-survival context (e.g., leading a bank robbery). Participants then read lists of words that were either congruent or incongruent with the context. Consistent with a pure (as opposed to motivated) cognition explanation, and inconsistent with evolutionary explanations like the ancestral challenge account, memory was not higher overall for the survival context. Rather, participants showed enhanced recall for words congruent with the context, regardless of whether it was related to survival or not (for related research and ideas, see Craik, 2002; Craik & Tulving, 1975; Schulman, 1974). In these studies, participants’ attention was drawn to process information that is useful for temporary motives (survive in a foreign land or robbing a bank). Thus, in the early studies on the survival processing effect, the results could have been due to the average congruency of the words differing between the survival processing task and control tasks. In other words, the survival processing effect could be due to a confound between survival processing and item congruency.

**Current Research Objective & Hypotheses**
Prior studies have revealed a survival processing advantage wherein information is recalled more when presented in the context of a fitness-relevant goal (e.g., survival). The current research builds on this prior research in a number of ways. First, all prior research on this topic has been conducted in the context of word lists; however, no study has examined the memory advantage for fitness-relevant content in the context of social stimuli. As will be described below, social stimuli may hold a unique position in memory for understanding the importance of fitness-relevant goals. Second, the current research examined the functional impact of this selective processing by examining not only recall of social information, but also whether survival processing affects judgments and decisions. Third, only a handful of studies has examined the alternative explanation offered for the survival processing effect involving congruency between the context and the stimuli; thus, I sought to provide another test of the validity of this account compared to the ancestral challenge account in the novel context of social memory.

**The Survival Processing Effect and Social Memory.** First, to date nearly all investigations on the survival processing effect have been conducted in the context of memory for word lists. The present study went beyond this prior research to examine whether the survival processing effect can be extended to social memory. The core arguments related to the survival processing effect center around the functionality of cognition toward survival-based content. Thus, it stands to reason that the survival processing effect should enhance attention and memory toward any stimuli in the environment, as being in the survival processing mode should impact how people attend to and encode stimuli more globally. Moreover, this may be especially true for socially-relevant information, given the importance of social groups for survival. That is, people
evolved in social groups due to what social groups offer in terms of protection, division of labor, and so on— to the point that human interaction has become practically unavoidable (e.g., Baumeister, & Leary, 1995; Brewer & Caporael, 2006; Caporael, 2007; Cosmides & Tooby, 1992). Thus, it is very likely that a person who is able to read social cues and utilize social information in an efficient and accurate manner would be more likely to survive and pass on their genes to subsequent generations (e.g., Brewer, 1988; Fiske & Neuberg, 1990; Macrae, Milne & Bodenhausen, 1994). Indeed, research has consistently shown that people are quite accurate using demographic cues to judge targets when they lack information about targets’ unique characteristics (Jussim, Crawford, & Rubinstein, 2015).

In support of the idea that social information is unique for cognition, some evidence suggests that social categorization is more complex than other types of categorization. For instance, neurological (Mitchell, Banaji, & Macrae, 2005; Mitchell, Macrae, & Banaji, 2004; Zahn et al., 2007), and associative-learning research (Gamond et al., 2012) indicates that the processing of social categorical information is different from the processing of non-social categorical information. Indeed, a series of fMRI studies demonstrate this difference by showing that different brain regions are involved when encoding social and non-social information. Specifically, processing non-social information is related to activity in the right hippocampus whereas processing social information is related to activity in the dorsomedial prefrontal cortex (Mitchell et al., 2005). In addition, the studies on human chemistry show that the brain chemical oxytocin facilitates learning and memory for some social information but it impairs non-social learning and memory function (de Oliveira, Camboim, Diehl, Consiglio, & Quillfeldt,
2007, Guastella, Mitchell, & Mathews, 2008, Rimele, Hediger, Heinrichs, & Klaver, 2009). Other studies claim that the stimuli that form the input for social categorization are more complex than for non-social categorization (e.g., food, money), particularly when social categorization invokes affective and motivational concerns (Bodenhausen, Todd, & Becker, 2007; Lingle, Altom, & Medin, 1984). Furthermore, a series of studies also showed that participants were more likely to have correct answers in social contract selection tasks than in abstract logical tasks (Barkow, Cosmides, & Tooby, 1992). Finally, in a similar vein, Sperber, Cara & Girotto (1995) found that socially relevant problems were answered correctly more often than socially irrelevant problems in Wason selection task. These studies suggest that humans are better at solving problems in a social context than in a descriptive rule context and they are consistent with the idea that human cognition has evolved to automatically and effortlessly solve adaptive social problems (Van Lier, Revlin, & De Neys, 2013).

In sum, no studies to date have examined the survival processing effect in the context of social memory and there is some evidence that social information and processing are unique from non-social information and processing. Although it is unclear precisely what this might mean for the current research, I anticipated that social information should receive as much or more general attention and encoding than non-social information. Overall, then, survival processing would be expected to generally enhance attention and encoding toward (any) environmental stimuli and, on top of that, people may be more likely to attend to and encode social information. Taken together, the expectation was that the survival processing effect should be quite strong for social stimuli.
The Survival Processing Effect and Judgment/Decision Making. Second, the current research went beyond recall and examined the importance of survival processing for judgments and decisions. If the survival processing advantage assists people in selectively attending to and recalling fitness-relevant information, then this should produce some additional benefits that extend to other phenomena beyond memory. Namely, survival processing should theoretically impact our judgments and decisions, which would presumably have behavioral consequences. Indeed, when trying to decide on a sensible course of action, people invariably search the environment and their own memories for information and cues. By focusing on the most relevant aspects in the information search, we are able to make reasonably good decisions and judgments that are necessary for survival, especially in situations where quick and impulsive actions are required. Ultimately it is the consequences bestowed by the survival memory advantage which are critical.

Therefore, it can be predicted that survival processing should aid in selectively attending to and encoding information which is relevant and important for people to make adaptive decisions and judgments. In the current study, this would emerge as a survival processing effect not only on memory but also on producing more beneficial judgments and decisions. Here I set up a decision problem not unlike some classic judgment and decision making contexts, where participants are exposed to a large amount of information that must be evaluated, organized, recalled, and utilized in order to make adaptive judgments and decisions (see also Burnkrant, 1978; Chung, & Byrne, 2008; Wiggin, Brouwers, Davies, & Loveday, 2014). As with other research, I anticipated that
people would be influenced by contextual cues, information, and mindsets—such as those provided by the processing context.

**Design & Hypotheses.** The purpose of this research was to test to what extent survival processing influences recall for social information and whether it impacts judgments and decisions in a social context. In the main study, participants were asked to imagine one of two scenarios. Based on prior research, one scenario involved a goal related to evolutionary fitness (i.e., surviving in a grasslands of a foreign land) and the other one did not (i.e., leading a bank robbery; see Kang et al., 2008). As part of the scenario, participants were told that achieving their goal requires them to join another social group. Participants then learned about different fictitious groups of people that had different combinations of goal-relevant (survival-relevant traits for the survival scenario and robbery-relevant traits for the robbery scenario) and goal-irrelevant traits (survival-relevant traits for the robbery scenario and robbery-relevant traits for the survival scenario). After a distractor task, participants were provided with a surprise recall and recognition task for the group traits. They were also asked to evaluate the groups and choose which group they would like to join. Finally, at the very end of the study, they were asked to recall the group traits a second time. The overall design was a 2 (scenario type: survival or robbery) X 2 (trait type: survival-relevant or robbery-relevant) mixed-design with the last factor as a within-participants factor. Based on the prior literature, a set of competing hypotheses was tendered:

**Hypothesis Set 1: Survival Processing Main Effect.**
Based on the ancestral challenge account, this hypothesis stated that a survival advantage would be detected overall, regardless of whether the traits are congruent or incongruent with the context (Nairne & Pandierada, 2011).

**H1a:** Participants who imagined themselves in a survival context would recall and recognize more traits overall than those who imagined themselves in a robbery context. Simultaneously, this account might also predict that participants would recall more survival-relevant traits than robbery-relevant traits in the survival condition but more robbery-relevant traits than survival-relevant traits in the robbery conditions; however, the discrepancy would be expected to be much larger for the survival than the robbery condition.

**H1b:** Participants who imagine themselves in a survival context will be more likely to select the “correct” group (i.e., the group with most goal-relevant characteristics) than those who imagined themselves in a robbery context.

**H1c:** Participants who imagine themselves in a survival context and a robbery context will have more favorable evaluations of groups that have the most goal-relevant characteristics for their scenario (e.g., 7 survival-relevant traits for the survival scenario but 7 robbery-relevant traits for the robbery scenario) vs. groups that have the fewest goal-relevant characteristics related to their scenario context. However, and importantly, the evaluation between the group that had the most characteristics and the
group that had the fewest characteristics would be expected to be much more polarized for the survival than the robbery condition.

**Hypothesis Set 2: Scenario X Congruency Interaction.**

Based on the congruency-incongruency account, this hypothesis stated that recall and recognition would be highest when the scenario and the traits to be processed were congruent rather than incongruent (Butler, Kang, & Roediger III, 2009; Röer, Bell, & Buchner, 2013).

**H2a:** Participants who imagined themselves in a survival context would recall and recognize more survival-relevant traits than robbery-relevant traits, whereas participants who imagined themselves in a robbery context would recall and recognize more robbery-relevant traits than survival-relevant traits. Note that this hypothesis has some overlap with Hypothesis 1a but that predicts equivalence in recall for congruent vs. incongruent traits across the two conditions.

**H2b:** Participants who imagine themselves in a survival context will not differ than those who imagined themselves in a robbery context in selecting the “correct” group. Rather, both groups are expected to select the “correct” group (i.e., the group with most goal-relevant characteristics) at greater-than-chance levels.

**H2c:** Participants who imagine themselves in a survival context and a robbery context will have more favorable evaluations of groups that have the most goal-relevant characteristics for their scenario (e.g., 7 survival-
relevant traits for the survival scenario but 7 robbery-relevant traits for the robbery scenario) vs. groups that have the fewest goal-relevant characteristics related to their scenario context. Unlike in hypothesis 1c above, however, the polarization between groups high and low in goal-relevant characteristics would be expected to be equivalent for the survival and robbery conditions.
Chapter 2

Pilot Study

In the main study of this research, participants were placed into either a survival scenario or a control (robbery) scenario. They were then provided with trait information about different social groups and later asked to recall/recognize, and make various judgments and decisions about, the provided information. A critical component of the main study was the trait information presented to participants about the social groups. Thus, the main purpose of this pilot study was to provide a quantitative evaluation of the characteristics that would be used for the main study. In particular, the goal was to confirm that the chosen characteristics were uniquely important and appropriate for the survival and robbery scenarios. Moreover, an additional goal was to obtain data relevant to properties other than relevance to the scenarios, such as their valence and imagineability. This was to ensure that relevance to the scenario and not some other dimension was important for any significant findings in the main study.

Method

Participants and Design. A total of 69 participants (12 men, 54 women, and 2 others, $M_{age} = 19.32, SD = 1.82$) were recruited from a large, Midwestern University in the U.S.. Participants signed up voluntarily through Sona Systems and received partial course credit for a psychology course. Two participants were eliminated due to leaving more than 50% of the questionnaire incomplete, leaving 67 participants (32 survival and 35 robbery). A between-participants design (scenario: survival or robbery) was applied because it helped to reduce carry-over effects.
**Scenarios.** The survival and robbery scenarios were drawn and modified from prior research (see Butler, Kang, & Roediger III, 2009; Kang, McDermott, & Cohen, 2008; Nairne & Pandeirada, 2011). In the survival scenario, participants were asked to imagine being stranded in the grasslands of an unfamiliar area, without any basic survival materials or skills. They were also told that they needed to meet local people who could help them to survive by finding food and water and providing protection from predators. In the robbery scenario, participants were asked to imagine leading a robbery of a well-guarded bank. They needed to find people who could help them make a plan, gather supplies, and conduct the robbery (see Appendix A). The robbery scenario was chosen for a couple reasons. First, prior research has revealed that the survival and robbery scenarios are equivalent on arousal, motivation, and engagement (Kang et al., 2008). Second, relative to some of the other scenarios used in the survival processing effect literature (e.g., moving to a foreign land), the robbery scenario involved a social component that matched the cover story and goal of investigating social memory.

**Scenario Characteristics.** A preliminary pilot study of undergraduate and graduate students from the same university described above was conducted ($n = 20$) in order to generate lists of social characteristics that were deemed to be important and relevant for survival and robbing a bank. In particular, participants in this initial pilot study imagined being in the scenarios described above and generated lists of characteristics they deemed to be most important or relevant for surviving in the grasslands of a foreign land or conducting a successful bank robbery (see Appendix A). Participants provided open-ended responses. A summative content analysis was then conducted to analyze the data (Hsieh & Shannon, 2005). First, a manifest content analytic
approach was applied by using Nvivo to count the frequency of specific words or content (Potter & Levine-Donnerstein, 1999). Then, a latent content analytic approach was used to discover the underlying meanings of the words or content (Babbie, 1992; Catanzaro, 1988; Holsti, 1969; Morse & Field, 1995). A narrow categorical approach was applied in order to reserve unique and distinct characteristics for each category (Dey, 1993). Then, an evaluator identified and merged the overlapping words or content as appropriate to reduce the amount of categories. For example, the evaluator merged “know environment”, “informative”, and “resourceful” into the category of “knowledgeable”.

Table 1 shows the frequency of typical characteristics for both the survival and robbery scenarios. As can be seen in Table 1, the survival scenario has 56 categories and the robbery scenario has 69 categories. There are some similarities in the scenario lists. For example, the categories of “physically fit/strong”, “intelligent”, and “agile/swift” appear in both scenarios, though in different rank orders. However, both scenarios also have some differences. In particular, although a number of traits/characteristics were mentioned in both scenarios, there were still a substantial number of traits/characteristics only listed for the survival scenario or the robbery scenario but not both. Overall, when accounting for traits/characteristics unique and shared across scenarios, the complete list could be reduced to 100 traits/characteristics (see Table 2). These were the ones included in the pilot study.

Table 1.
Traits for Survival and Robbery Scenario

<table>
<thead>
<tr>
<th>Survival Scenario</th>
<th>No.</th>
<th>Traits</th>
<th>Counts</th>
<th>Robbery Scenario</th>
<th>No.</th>
<th>Traits</th>
<th>Counts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Physically strong</td>
<td>28</td>
<td>1</td>
<td></td>
<td>Intelligent</td>
<td>17</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Intelligent</td>
<td>16</td>
<td>2</td>
<td></td>
<td>Physically fit</td>
<td>13</td>
</tr>
<tr>
<td>3</td>
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<td>Weapon expert</td>
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<td>Violent</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td>Tough</td>
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</table>

**Trait/Characteristics Ratings.** Participants in the main pilot study were asked to read one of the two scenarios described above and then examine the list of characteristics (see Table 2). For each characteristic, they were asked to provide the following judgments: “How relevant is the following characteristic/trait to the overall goal of surviving in a foreign grasslands after becoming stranded [successfully leading a robbery of a well-guarded bank]?”; “How positive or negative is the above characteristic/trait?”;
and “How easy is it to imagine someone having the above characteristic/trait?” In addition to attempting to match the final word lists on positivity and imaginability, I also attempted to match the traits/characteristics on other properties relevant to memory, including their word length and frequency (Coltheart, 1981; Kucera & Francis, 1967).

Table 2.
The Master List of Traits

<table>
<thead>
<tr>
<th>Physically strong/fit</th>
<th>Physically strong/fit</th>
<th>Physically strong/fit</th>
<th>Physically strong/fit</th>
<th>Physically strong/fit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brave</td>
<td>Selfless</td>
<td>Adaptable</td>
<td>Attentive</td>
<td></td>
</tr>
<tr>
<td>Resourceful</td>
<td>Knowledgeable about banks</td>
<td>Secretive</td>
<td>Trustworthy</td>
<td>Skilled hunter</td>
</tr>
<tr>
<td>Sneaky</td>
<td>Builder</td>
<td>Knowledgeable</td>
<td>Friendly</td>
<td>Flexible</td>
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<tr>
<td>Agile/swift</td>
<td>Quick thinker</td>
<td>Strong Leader</td>
<td>Computer literate</td>
<td>Loyal</td>
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<tr>
<td>Optimistic</td>
<td>Uses common sense</td>
<td>Caring</td>
<td>Cooperative</td>
<td>Strong critical thinking skills</td>
</tr>
<tr>
<td>Follower</td>
<td>Good communicator</td>
<td>Good problem solver</td>
<td>Code breaker</td>
<td>Conscientious</td>
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<td>Fearless</td>
<td>Fast driver</td>
<td>Strong willed</td>
<td>Intimidating</td>
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<td>Low morality</td>
<td>Creative</td>
<td>Precise</td>
<td>Compassionate</td>
</tr>
<tr>
<td>Calm</td>
<td>Detail Oriented</td>
<td>Dedicated</td>
<td>Prior theft experience</td>
<td>Ruthless/Cruel</td>
</tr>
<tr>
<td>Not greedy</td>
<td>Organized</td>
<td>Responsible</td>
<td></td>
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<tr>
<td>Team player</td>
<td>Decisive</td>
<td>Able cook</td>
<td>Socially adept</td>
<td>Agreeable</td>
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<td>Empathetic/understands others</td>
<td>Ambitious</td>
<td>Access to/experience with weapons</td>
<td>Skilled clothes maker</td>
<td>Assertive</td>
</tr>
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<td>Concerned with communal goals</td>
<td>Aware of surroundings</td>
<td>Dependable</td>
<td>Charismatic</td>
<td>Skilled gatherer</td>
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<tr>
<td>Criminal background</td>
<td>Good teaching skills</td>
<td>Helpful</td>
<td>Cautious</td>
<td>Truthful/honorable</td>
</tr>
<tr>
<td>Disguise expert</td>
<td>Fast learner</td>
<td>Even-tempered</td>
<td>Experienced outdoorsman</td>
<td>Knowledgeable about explosives</td>
</tr>
<tr>
<td>Patient</td>
<td>Focused</td>
<td>People eat less food</td>
<td>Persistent</td>
<td>Knowledgeable about guns</td>
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</table>

21
<table>
<thead>
<tr>
<th>Productive</th>
<th>Knows other criminals</th>
<th>Good sense of direction</th>
<th>Good listener</th>
<th>Good story teller</th>
</tr>
</thead>
<tbody>
<tr>
<td>Looks normal</td>
<td>Weapon expert</td>
<td>Tolerant</td>
<td>Modest</td>
<td>Non drug user</td>
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<td>Not impulsive</td>
<td>Observant</td>
<td>Unforgettable mind</td>
<td>Knows police officers</td>
<td>Sensation-seeking</td>
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<td>Spontaneous</td>
<td>Violent</td>
<td>Wealthy</td>
<td>Witty</td>
<td>Tough</td>
</tr>
</tbody>
</table>

**Scenarios Evaluation Questions.** In addition to making ratings of the characteristics/traits, participants also made a series of judgments about the scenarios (derived from Nairne, & Pandeirada, 2010; Soderstrom, & McCabe, 2011). Specifically, participants were told to think back on the scenario they read involving surviving in a foreign grasslands (or leading a bank robbery) and answer the following questions: (1) “How did you feel when imagining being in the scenario involving surviving in the grasslands of a foreign land [leading a bank robbery]? (arousal: 1=very calm; 5=very excited; valence: 1= very sad; 5=very happy)”; (2) “How interesting and engaging was the scenario involving surviving in the grasslands of a foreign land [leading a bank robbery]? (1= not at all interesting nor engaging; 5 = very interesting and engaging)”; and (3) “How easy is it for you to create an “image” of the scenario involving surviving in the grasslands of a foreign land [leading a bank robbery] in your mind? (1 = extremely difficult; 5 = extremely easy)”.

**Procedure.** The main pilot study was conducted online. After reading the study description, participants clicked a website link and reached the survey webpage in PsychData. Upon signing the informed consent document, participants were randomly assigned to one of the two scenario conditions. After reading the scenario, the set of traits/characteristics were presented on the screen one at a time (in a random order). Participants made ratings of relevance, valence, and imaginability (in a random order) for
one trait/characteristic before moving onto the next trait/characteristic. Finally, participants completed the scenario evaluation questions before completing basic demographic questions. A debriefing statement was presented after they finished the survey.

Results

Characteristic/Trait Ratings. The overall goal of the analyses was to confirm the suitability of the set of traits/characteristics for the survival vs. robbery scenarios. Indeed, I found clear evidence for separate subsets of traits/characteristics that were rated high on survival relevance but low-to-moderate on robbery relevance, and traits/characteristics that were rated high on robbery relevance but low-to-moderate on survival relevance. This was accomplished by examining the difference in survival and robbery relevance ratings for each trait using a series of independent-samples \( t \)-tests. As this required numerous tests, type I error was an issue and, therefore, effect sizes (Cohen’s \( d \)) were deemed to be the more suitable mode of evaluation. Overall, I identified 16 survival traits and 16 robbery traits (see Table 3) that demonstrated medium-to-large effect size differences between the robbery and survival conditions. Moreover, in selecting these sets of traits, I also 1) attempted to maintain some balance in the ratings of valence, imaginability, and character length (less than 15) where feasible, and 2) included characteristics that were more general/trait-like (e.g., physically strong in the survival scenario and secretive in the robbery scenario) rather than specific (e.g., fast driver in robbery scenario and skilled hunter in survival scenario). Taken together, these approaches helped to determine and confirm the suitability of characteristics for the survival and robbery scenarios.
Table 3.
Final Set of Selected Traits for Survival and Robbery Scenarios

<table>
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<tr>
<th>Traits for Survival Scenario</th>
<th>Cohen’s $d$</th>
<th>Mean Relevance</th>
<th>Mean Valence</th>
<th>Mean Imaginability</th>
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<td>1. Physically Strong</td>
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<td>4. Optimistic</td>
<td>.91</td>
<td>3.19</td>
<td>3.98</td>
<td>3.37</td>
<td>10</td>
</tr>
<tr>
<td>5. Caring</td>
<td>.89</td>
<td>2.42</td>
<td>3.74</td>
<td>3.57</td>
<td>6</td>
</tr>
<tr>
<td>6. Helpful</td>
<td>.87</td>
<td>3.54</td>
<td>4.15</td>
<td>3.67</td>
<td>7</td>
</tr>
<tr>
<td>7. Patient</td>
<td>.79</td>
<td>3.60</td>
<td>3.99</td>
<td>3.15</td>
<td>7</td>
</tr>
<tr>
<td>8. Adaptable</td>
<td>.76</td>
<td>4.06</td>
<td>4.00</td>
<td>3.15</td>
<td>9</td>
</tr>
<tr>
<td>9. Productive</td>
<td>.75</td>
<td>3.94</td>
<td>4.12</td>
<td>3.55</td>
<td>10</td>
</tr>
<tr>
<td>10. Resourceful</td>
<td>.72</td>
<td>4.18</td>
<td>4.06</td>
<td>3.52</td>
<td>11</td>
</tr>
<tr>
<td>11. Protector</td>
<td>.72</td>
<td>3.46</td>
<td>3.87</td>
<td>3.42</td>
<td>9</td>
</tr>
<tr>
<td>12. Good Teaching Skills</td>
<td>.66</td>
<td>2.96</td>
<td>4.01</td>
<td>3.22</td>
<td>18</td>
</tr>
<tr>
<td>13. Understand Others</td>
<td>.60</td>
<td>2.73</td>
<td>3.96</td>
<td>3.15</td>
<td>15</td>
</tr>
<tr>
<td>14. Compassionate</td>
<td>.59</td>
<td>2.54</td>
<td>3.75</td>
<td>3.36</td>
<td>12</td>
</tr>
<tr>
<td>15. Responsible</td>
<td>.54</td>
<td>3.49</td>
<td>4.24</td>
<td>3.39</td>
<td>11</td>
</tr>
<tr>
<td>16. Fast Learner</td>
<td>.46</td>
<td>3.88</td>
<td>4.06</td>
<td>3.39</td>
<td>11</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Traits For Robbery Scenario</th>
<th>Cohen’s $d$</th>
<th>Mean Relevance</th>
<th>Mean Valence</th>
<th>Mean Imaginability</th>
<th>Character Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Secretive</td>
<td>-1.99</td>
<td>2.94</td>
<td>2.72</td>
<td>3.43</td>
<td>9</td>
</tr>
<tr>
<td>2. Sneaky</td>
<td>-1.24</td>
<td>3.27</td>
<td>2.72</td>
<td>3.46</td>
<td>6</td>
</tr>
<tr>
<td>3. Low Morality</td>
<td>-.97</td>
<td>2.88</td>
<td>2.30</td>
<td>3.39</td>
<td>11</td>
</tr>
<tr>
<td>4. Detail Oriented</td>
<td>-.80</td>
<td>3.55</td>
<td>3.90</td>
<td>3.44</td>
<td>14</td>
</tr>
<tr>
<td>5. Organized</td>
<td>-.80</td>
<td>3.69</td>
<td>4.10</td>
<td>3.52</td>
<td>9</td>
</tr>
<tr>
<td>6. Cruel</td>
<td>-.63</td>
<td>2.94</td>
<td>2.10</td>
<td>3.43</td>
<td>5</td>
</tr>
<tr>
<td>7. Precise</td>
<td>-.56</td>
<td>3.85</td>
<td>4.03</td>
<td>3.24</td>
<td>7</td>
</tr>
<tr>
<td>8. Trustworthy</td>
<td>-.49</td>
<td>3.70</td>
<td>4.03</td>
<td>3.30</td>
<td>11</td>
</tr>
<tr>
<td>9. Intimidating</td>
<td>-.48</td>
<td>2.84</td>
<td>2.93</td>
<td>3.54</td>
<td>12</td>
</tr>
<tr>
<td>10. Violent</td>
<td>-.42</td>
<td>2.64</td>
<td>2.11</td>
<td>3.48</td>
<td>7</td>
</tr>
<tr>
<td>11. Charismatic</td>
<td>-.34</td>
<td>2.78</td>
<td>3.79</td>
<td>3.61</td>
<td>11</td>
</tr>
<tr>
<td>12. Agile</td>
<td>-.33</td>
<td>3.61</td>
<td>3.78</td>
<td>3.25</td>
<td>5</td>
</tr>
<tr>
<td>13. Quick Thinker</td>
<td>-.32</td>
<td>4.50</td>
<td>4.39</td>
<td>3.24</td>
<td>12</td>
</tr>
<tr>
<td>14. Attentive</td>
<td>-.29</td>
<td>3.70</td>
<td>3.84</td>
<td>3.46</td>
<td>9</td>
</tr>
<tr>
<td>15. Not Impulsive</td>
<td>-.28</td>
<td>3.27</td>
<td>3.68</td>
<td>2.91</td>
<td>12</td>
</tr>
<tr>
<td>16. Spontaneous</td>
<td>-.20</td>
<td>2.55</td>
<td>3.20</td>
<td>3.24</td>
<td>11</td>
</tr>
</tbody>
</table>

**Scenario Evaluation.** To evaluate the different perceptions between the scenarios (in terms of engagement, imaginability, arousal, and emotion), a series of independent
samples $t$-tests (survival and control) were conducted and effect sizes computed. As expected based on prior research (Bulter, Kang & Roediger III, 2009; see Table 4), the survival and robbery scenarios were not significantly different in term of engagement ($t(65) = .61, p = .54$), imaginability ($t(65) = .69, p = .49$), arousal ($t(65) = .04, p = .97$), or emotion valence ($t(65) = -1.0, p = .32$). This set of analyses confirms that the scenarios are not different from each other in terms of engagement, imaginability, arousal, or emotion valence.

Table 4.

Results of $t$-tests and Descriptive Statistics for Engagement, Imaginability, and Emotional Arousal by Scenario

<table>
<thead>
<tr>
<th>Properties</th>
<th>Survival</th>
<th></th>
<th></th>
<th>Robbery</th>
<th></th>
<th></th>
<th>Cohen’s d</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>n</td>
<td>M</td>
<td>SD</td>
<td>n</td>
<td></td>
</tr>
<tr>
<td>Engagement</td>
<td>2.78</td>
<td>.98</td>
<td>32</td>
<td>2.63</td>
<td>1.06</td>
<td>35</td>
<td>.61</td>
</tr>
<tr>
<td>Imaginability</td>
<td>3.72</td>
<td>.81</td>
<td>32</td>
<td>3.54</td>
<td>1.22</td>
<td>35</td>
<td>.69</td>
</tr>
<tr>
<td>Calm/Excited</td>
<td>2.78</td>
<td>.83</td>
<td>32</td>
<td>2.77</td>
<td>1.00</td>
<td>35</td>
<td>.04</td>
</tr>
<tr>
<td>Sad/Happy</td>
<td>2.47</td>
<td>.76</td>
<td>32</td>
<td>2.66</td>
<td>.77</td>
<td>35</td>
<td>-1.00</td>
</tr>
</tbody>
</table>

* $p < .05$.

**Main Study**

The primary purpose of the main study was to test to what extent the survival processing effect would be related to the recall and use of social categorical knowledge, and to test between the competing hypotheses outlined above. The two scenarios (survival and robbery contexts) from the pilot study were used. First, participants were asked to read the assigned scenario. As part of this scenario, participants received information about several different groups of people that possessed varying levels of the characteristics associated with the goals of the scenarios. Participants then completed a distractor task before receiving surprise recall and recognition tests for the group characteristics. Participants also made judgments and decisions about the groups that
presumably reflected the extent to which they were viewed as useful and relevant for achieving the scenario goal and received a second surprise recall test at the very end of the study to assess memory decay.

As discussed before, two competing hypotheses were examined. First, one hypothesis, derived from an ancestral challenge account, suggested a main effect of scenario type along the lines of prior research showing a survival processing advantage (see Nairne & Pandeirada, 2011). That is, participants placed in a survival context would be expected to recall and recognize more traits and be more likely to select the “correct” group to join compared to participants who were placed in a non-survival (robbery) context. An additional component of this hypothesis was that there would be larger recall for goal-relevant traits than goal-irrelevant traits, but that this would be primarily driven by the survival condition.

Second, a competing hypothesis, derived from a congruency-incongruency account, was that memory would be dependent upon the congruency of the stimuli and that the survival and robbery conditions would not differ in this regard. Said differently, participants would be expected to have strong recall and recognition in both the survival and robbery contexts for traits congruent with the context (survival traits when in the survival context; robbery traits when in the robbery context), but poor recall for traits incongruent with the context (survival traits when in the robbery context; robbery traits when in the survival context). Critically, the extent to which participants would show this congruency-incongruency effect (unlike with hypothesis 1 above) was expected to be comparable across the survival and robbery scenario contexts. Additionally, participants in both the robbery and survival scenarios should demonstrate adaptive judgments and
decisions, such that they should select the “correct” choice of group at greater–than-chance levels and judge the social group with the most goal-relevant traits more favorably than the group with the least goal-relevant traits.

**Method**

**Participants and design.** A total of 145 participants (75 Males and 70 Females, \(M_{age} = 20.25\)) were recruited from a large, Midwestern University. Participants were randomly assigned to the survival context scenario or robbery context scenario. Sample size was determined based on a consideration of two sets of studies that relate to the competing hypotheses outlined in the introduction and the results of a G power analysis. First, numerous recall studies have been conducted using the aforementioned survival scenario in relation to various control conditions (e.g., robbery scenario, moving scenario, no context control; Abel, & Baum, 2013; Bell, Röer, & Buchner, 2013; Burns, Burns, & Hwang, 2011; Burns, Hart, Griffith, & Burns, 2013; Butler, Kang, & Roediger, 2009; Howe, & Derbish, 2010; Kang, McDermott, & Cohen, 2008; Kostic, McFarlan, & Cleary, 2012; Kroneisen, & Erdfelder, 2011; Kroneisen, Erdfelder, & Buchner, 2013; Nairne, & Pandeirada, 2008, 2010; Otgaar, & Smeets, 2010; Röer, Bell, & Buchner, 2013; Smeets, Otgaar, Raymaekers, Peters, & Merckelbach, 2012; Stillman, Coane, Profad, Howard Jr., & Howard, 2014; Weinstein, Bugg, & Roediger III, 2008). Based on an analysis of Cohen’s \(d\) values from these studies (average Cohen’s \(d = .69\)), 64 participants would be needed to have 80% power (alpha = .05 criterion of statistical significance; Cohen, 1992). Second, a handful of more recent studies have examined the congruency effect for the survival scenario compared to a control scenario (e.g., robbery scenario; Butler, Kang, & Roediger III, 2009, Nairne & Pandierada, 2011; Palmore,
Garcia, Bacon, Johnson, & Kelemen, 2012; Röer, Bell, & Buchner, 2013). These studies used comparable factorial designs as used here where they manipulated scenario type (survival vs. control) and target word (congruent or incongruent with scenario). Based on an analysis of the average eta-squared value for the interaction from this set of studies (eta-squared = .28), a power analysis revealed that 104 participants would be needed to have 80% power (alpha = .05 criterion of statistical significance). Based on the consideration of the two sets of studies, I took the higher of these sets of values for the sample size initially (i.e., 104). However, because this study used a novel social memory context and, thus, effect size estimates were unknown precisely, I collected more participants than 104 to yield approximately 70 participants per condition. The final sample size was 145.

Among these 145 participants, 70.3% of them were Caucasian, 15.2% were African American, 6.9% were Hispanic/Latino, 3.4% were Asian or Asian American, 5.5% were others. In term of religious beliefs, 62.8% of the participants were Christian or Catholic, 13.8% were Muslim and 9% of them were another religion (14.5% were unidentified).

Materials. Materials included two scenarios (survival and robbery), which were the same as those used in the pilot study (see Appendix B) and the groups’ traits/characteristics that were determined from the pilot study (see Table 4).

Scenarios. The survival and robbery scenarios were reused from the pilot study. The instructions at the end were modified slightly to reflect instructions relevant to the goal of selecting among groups of other people (See Appendix B).
Selection of Groups' Traits. As noted in the pilot study section, 32 traits were selected for use in the main study. The list of traits were allocated to the four groups and presented alongside arbitrary and novel-sounding names (generated from “Alien Species Name Generator”, http://fantasynamengenerators.com/alien-names.php#.Vmnj2fkrlIU) in order to enhance the cover story and engagement with the task. 16 traits were related to survival but not robbery, whereas 16 traits were related to robbery but not survival. The allocation of survival- or robbery-relevant traits across the four groups followed a subtle linear progression. For example, 7 survival-relevant traits and 1 robbery-relevant trait were allocated to one group; 5 survival-relevant traits and 3 robbery-relevant traits were allocated to a second group; 3 survival-relevant traits and 5 robbery-relevant traits were allocated to a third group; and finally 1 survival-relevant trait and 7 robbery-relevant traits were allocated to a fourth group. Overall, this approach allowed a group for each condition (robbery and survival) to be the most desirable to join based on their frequency of goal-relevant traits. Moreover, setting the allocation of traits using a subtle linear progression of greater or fewer goal-relevant traits was also deemed to be less likely to arouse subject biases or suspicion. Moreover, to ensure that the specific group name linked to a set of traits was not important for the results, the group names chosen (Subol, Fibir, Mere, Zipar) for the traits was counterbalanced. This counterbalancing factor was determined using a couple steps. First, I randomized the order of the lists of survival-

---

1 It is a common approach in past research to have some mixture of both congruent and incongruent content, rather than tip the balance toward all congruent or incongruent content (e.g., Dijksterhuis, Bos, Nordgren, & van Baaren, 2006, Thorsteinson & Withrow, 2009, Waroquier, Marchiori, Klein & Cleeremans, 2009).

2 A series of mixed-model ANOVAs were performed to check the order effect on the dependent variables which included recall, recognition, confidence, group judgment, and decisions. Although there were main effect differences on a couple variables, the more critical analyses revealed no significant interaction effects with our independent variable (all ps >= .06). In other words, this counterbalanced factor did not appear to have any systematic interactive impact on the core measures.
relevant and robbery-relevant traits. Second, I created two configurations for the group names as they applied to the 4 groups described above (i.e., 7 survival-relevant traits and 1 robbery-relevant trait; 5 survival-relevant traits and 3 robbery-relevant traits; 3 survival-relevant traits and 5 robbery-relevant traits; and 1 survival-relevant trait and 7 robbery-relevant trait). Table 5 displays the two configurations. For example, the name “Group Zipar” is used for the group with 7 survival-relevant traits and 1 robbery-relevant trait for order 1, but the group with 1 survival-relevant trait and 7 robbery-relevant traits in order 2.

Table 5.
The First and Second orders of the Allocation of Survival- and Robbery-relevant traits across the Four Groups.

<table>
<thead>
<tr>
<th>Order 1</th>
<th>Group Subol</th>
<th>Group Fibir</th>
<th>Group Mere</th>
<th>Group Zipar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traits</td>
<td>Traits</td>
<td>Traits</td>
<td>Traits</td>
<td>Traits</td>
</tr>
<tr>
<td>Fast Learner</td>
<td>Compassionate</td>
<td>Resourceful</td>
<td>Responsible</td>
<td></td>
</tr>
<tr>
<td>Kind</td>
<td>Physically Strong</td>
<td>Protector</td>
<td>Secretive</td>
<td></td>
</tr>
<tr>
<td>Creative</td>
<td>Optimistic</td>
<td>Understand Others</td>
<td>Spontaneous</td>
<td></td>
</tr>
<tr>
<td>Caring</td>
<td>Patient</td>
<td>Low Morality</td>
<td>Not Impulsive</td>
<td></td>
</tr>
<tr>
<td>Helpful</td>
<td>Productive</td>
<td>Charismatic</td>
<td>Sneaky</td>
<td></td>
</tr>
<tr>
<td>Adaptable</td>
<td>Cruel</td>
<td>Agile</td>
<td>Quick Thinker</td>
<td></td>
</tr>
<tr>
<td>Good Teaching Skills</td>
<td>Intimidating</td>
<td>Precise</td>
<td>Violent</td>
<td></td>
</tr>
<tr>
<td>Attentive</td>
<td>Detail Oriented</td>
<td>Organized</td>
<td>Trustworthy</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Order 2</th>
<th>Group Zipar</th>
<th>Group Mere</th>
<th>Group Fibir</th>
<th>Group Subol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traits</td>
<td>Traits</td>
<td>Traits</td>
<td>Traits</td>
<td>Traits</td>
</tr>
<tr>
<td>Fast Learner</td>
<td>Compassionate</td>
<td>Resourceful</td>
<td>Responsible</td>
<td></td>
</tr>
<tr>
<td>Kind</td>
<td>Physically Strong</td>
<td>Protector</td>
<td>Secretive</td>
<td></td>
</tr>
</tbody>
</table>

3 To evaluate whether the fixed sequence of the traits in the order 1 and 2 at Table 4 was a confound issue, I examined the relevancy ratings for the set of robbery and survival traits used when there were 1, 3, 5, and 7 traits. Two repeated-measure ANOVAs (one with survival and one with the robbery-relevant traits) were conducted and effect sizes were computed. The results revealed that the set of 1-, 3-, 5-, and 7- of goal-relevant traits for survival ($F = .66, p > .05, \eta^2 = .02$) and robbery ($F = 1.57, p > .05, \eta^2 = .04$) were not significantly rated more relevant than among each other respectively. This result suggests that something about the specific traits chosen for the different groups of 1, 3, 5, and 7 traits likely did not contribute to the findings.
<table>
<thead>
<tr>
<th>Creative</th>
<th>Optimistic</th>
<th>Understand Others</th>
<th>Spontaneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caring</td>
<td>Patient</td>
<td>Low Morality</td>
<td>Not Impulsive</td>
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<tr>
<td>Helpful</td>
<td>Productive</td>
<td>Charismatic</td>
<td>Sneaky</td>
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<td>Adaptable</td>
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<td>Agile</td>
<td>Quick Thinker</td>
</tr>
<tr>
<td>Good Teaching</td>
<td>Intimidating</td>
<td>Precise</td>
<td>Violent</td>
</tr>
<tr>
<td>Skills</td>
<td>Detail Oriented</td>
<td>Organized</td>
<td>Trustworthy</td>
</tr>
</tbody>
</table>

Note. Survival-relevant trait = no shading & robbery-relevant trait = light shading

**Dependent Measures.** The following measures were used in the main study.

Recall and Recognition. To assess social memory, two different measures were used: a free-recall and a recognition task. First, for the free recall task, participants were asked to write down anything they had learned for each group. Each group name randomly appeared on the screen sequentially; participants were prompted to type anything that came to mind about that group before moving onto the next one. To examine if memory changed over time, recall was assessed twice: once immediately following the distractor task (Time 1) and once at the very end of the experimental session (Time 2).

In the recognition task, participants were asked to identify whether a given characteristic belonged to a particular group. In responding to each item, participants first made a dichotomous judgment (yes or no) as to whether the item was among those originally presented. Equal numbers of distractor traits (8) were used for each group for a total of 64 items (note that I used left-over items from the pilot test for distractor traits). Right afterwards, participants judged the confidence in their response from 50% (“complete guess”) to 100% (“completely certain”) as an exploratory measure.

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4 Two different tests were used because recall and recognition performance can yield different results. One important difference between the two was that recall performance is sensitive to variations in conceptual encoding, but was not sensitive to perceptual encoding whereas recognition performance, which can discriminate old from new information, is benefited by retrieving both conceptual and perceptual encoding (Johnston, Hawley, & Elliott, 1991).
Participants were given as much time as needed to complete the free-recall and recognition tests.

*Group Judgments and Decisions.* In order to examine the adaptive use of the social group information, participants were first asked to choose one of the four groups to join. For this measure, the names of the groups were displayed on the screen and participants were asked to select which of the four groups they would like to join. Second, participants provided judgments for each group. For these items, the group name appeared at the top of the screen followed by a series of questions: “How relevant did the traits of this group seem to the goal of survival (leading a bank robbery)?” (1 = *traits were not at all relevant*; 5 = *traits were very relevant*); “How motivated would you be to join this group?” (1 = *not at all motivated*; 5 = *very motivated*); “How desirable would it be to join this group?” (1 = *Not at all desirable*; 5 = *very desirable*); and “How favorably would you rate this group in terms of their overall ability to help you reach your goal of survival (leading a bank robbery)?” (1 = *not at all favorably*; 5 = *very favorably*).

**Procedure.** Participants signed up in groups of 1-4 on SONA Systems. Upon arrival in the laboratory, participants were seated in front of a computer. All stimuli and questions were presented on Medialab software. Participants were randomly assigned to one of the two scenario conditions. Before reading the scenarios, participants were provided with a cover story indicating that they were actually participating in two different experiments: a scenario story evaluation experiment and a cognitive skill experiment. First, with regard to the scenario evaluation, participants were told to evaluate and think about the story as if it could actually happen to them. Moreover, participants were told that they would later answer questions about how they might be
able to handle the situation. Next, participants were told to imagine that, in order to reach the goal stated in the scenario (i.e., survival or leading a bank robbery), they must rely on other people to help. Specifically, participants were told to imagine that there are four different groups of people with whom they must choose to join up with in order to facilitate reaching their goal. Then, one group at a time (in a random order), participants were exposed to information about the general characteristics of each group. Specifically, the name of the group (“Group Subol”) appeared at the top of the screen and 8 different trait terms per group were flashed on the screen, one at a time. The traits appeared in the center of the screen for 3 seconds each (with an interstimulus interval of 1 second; see Bulter et al., 2009; Jackson & Rose, 2012; Kang et al., 2008; Nairne & Pandierada, 2010). Next, after learning about the group characteristics, participants engaged in a “cognitive skill” task (i.e. Tetris online game) for 5 minutes as a distractor task (see Butler, Kang, & Roediger III, 2009; Kang, McDermott, & Cohen, 2008; Otgaar & Smeets, 2010; Raymeakers, Otgaar, & Smeets, 2014). Next, participants went onto the main dependent measures (recall at Time 1, recognition test, judgment and decisions, recall at Time 2). Finally, some basic demographic indicators were assessed before participants were debriefed and thanked.

Results

Recall Scoring. Recall was scored according to a gist criterion (Srull, 1981; Srull & Brand, 1983). That is, a response was scored as correct if it conveyed the same idea as that of one of the characteristics presented, regardless of wording. Hypothetically, imagine that “physically attractive” was one of the traits. The words “pretty” and “beautiful” or the phrase “very good looking” would be counted as correct under this
system. The proportion of characteristics correctly recalled served as the dependent variable (Green, Sedikides, & Gregg, 2008).

Two raters were trained and worked separately to code the recall responses according to the coding strategy described above. Kappa interrater reliability was computed to assess the inter-judge reliability. The results revealed that there was a substantial agreement between the two raters (Kappa = .72, p < .001; Landis & Koch, 1977) and any coding discrepancies between the raters were resolved through discussion to create a single coding variable.

**Free Recall Analysis.** To evaluate how many characteristics were correctly recalled, recall rates (proportion of traits recalled) were submitted to a 2 (scenario: survival context or robbery context) X 2 (trait type: survival traits or robbery traits) X 2 (recall time point: Time 1 or Time 2) mixed-model ANOVA, with the last two factors as within-participants factors. First, in terms of the main effects, there was an effect of recall time point showing that, perhaps not surprisingly, recall accuracy was better at Time 1 (M=.18; SD = .12) than Time 2 (M=.15; SD=.13), F(time) (1, 143) = 17.05, p = .001, \( \eta^2_p = .11, d = .28 \). The main effects of scenario and trait type were not significant, F(scenario) (1, 143) = .03, p = .87, \( \eta^2_p = .00 \) & F(trait) (1, 143) = .06, p = .80, \( \eta^2_p = .00 \). Importantly, the fact that the scenario main effect was not significant provides evidence against one prediction from hypothesis 1a derived from the ancestral challenge account.

Second, there was a significant scenario X trait type interaction, F(1, 143) = 11.68, p < .001, \( \eta^2_p = .078 \). As can be seen in Figure 1, the nature of this interaction was such that participants in survival scenario condition recalled a greater proportion of survival traits (M = .19, SD = .15) than robbery traits (M = .15, SD = .11), t = 2.46, p = .01,
Cohen’s $d = .36$, 95% confidence interval for mean difference = .006 to .062. On the other hand, participants in the robbery scenario condition recalled a greater proportion of robbery traits ($M = .18$, $SD = .13$) than survival traits ($M = .15$, $SD = .11$), $t = -2.37$ $p = .02$, Cohen’s $d = .28$, 95% confidence interval for mean difference = -.055 to -.005 (see Table 6). Importantly, it did not appear that the magnitude of mean difference (in terms of effect size) was any larger for the survival condition than the robbery condition, which provides evidence against the other prediction from hypothesis 1a derived from the ancestral challenge account. Rather, the pattern of results more clearly supported Hypothesis 2a that recall would be higher when the traits were congruent with the scenario context (survival traits with the survival context, robbery traits with the robbery context) and lower when the traits were incongruent (survival traits with the robbery context, robbery traits with the survival context), and that the magnitude of these differences would be equivalent across survival and robbery contexts. All other interactions were not significant ($Fs < 1.40$, $ps > .20$, $\eta^2 < .01$).
Figure 1. Mean Free Recall Proportions (Time 1 & Time 2 Combined) as a Function of Trait Type and Scenario Type.

Table 6. Mean Proportion of Recall (%) and Recognition on Trait Types in Survival and Robbery Scenario

<table>
<thead>
<tr>
<th></th>
<th>Survival Scenario</th>
<th></th>
<th>Robbery Scenario</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Survival Traits</td>
<td>Robbery Traits</td>
<td>Survival Traits</td>
<td>Robbery Traits</td>
</tr>
<tr>
<td>Free Recall Time 1</td>
<td>.20 (.15)</td>
<td>.16 (.12)</td>
<td>.18 (.13)</td>
<td>.20 (.15)</td>
</tr>
<tr>
<td>Free Recall Time 2</td>
<td>.17 (.17)</td>
<td>.12 (.12)</td>
<td>.14 (.13)</td>
<td>.16 (.14)</td>
</tr>
<tr>
<td>Free Recall (T1 &amp; T2)</td>
<td>.19 (.15)</td>
<td>.15 (.11)</td>
<td>.15 (.11)</td>
<td>.18 (.13)</td>
</tr>
</tbody>
</table>

Note. Standard Deviations appear in parentheses. All numbers for free recall are the proportion correction.

Recognition Scoring. Recognition responses were analyzed using signal detection theory (Banaji & Greenwald, 1995; Green, Sedikides, & Gregg, 2008; Stainslaw & Todorovc, 1999; Swets, 1996). Participants were asked to identify whether each characteristic belonged to the specified group (“yes” or “no”). Briefly, the theory assumes that participants detect a signal (i.e., a “yes”) against a background of noise (i.e., “no”). For yes-no recognition, two normal curves of equal variance would be used to model participants’ judgments of signal and noise, respectively. Four types of answers are possible: a learned item can be correctly identified as “yes” (a hit); a distractor item can be identified as “no” (a correct rejection); a learned item can be mistakenly identified as “no” (a miss); and a distractor item can be mistakenly identified as “yes” (a false alarm). Accuracy of discrimination (sensitivity) is typically analyzed using the normalized hit rate minus the normalized false alarm rate, known as d-prime. High positive values would indicate that more traits were correctly recognized whereas low
negative values would indicate that less traits were correctly recognized. I computed d-prime for the set of survival traits and the set of robbery traits separately\(^5\).

**Recognition Analyses.** To evaluate discrimination (sensitivity) for the recognition task, the d-prime values were submitted to a 2 (scenario: survival context or robbery context) X 2 (trait type: survival traits or robbery traits) mixed-model ANOVA, with the last factor as a within-participants factor. As with the recall measure described above, the main effects of scenario and trait type were not significant, \(F_{\text{scenario}} (1, 141) = 1.74, p = .19, \eta_p^2 = .012\) & \(F_{\text{trait}} (1, 141) = 3.01, p = .085, \eta_p^2 = .021\). As with recall, the fact that the scenario main effect was not significant provides evidence against one prediction from Hypothesis 1a derived from the ancestral challenge account.

Furthermore, unlike with recall, no interaction was found, \(F(1, 141) = 0.1, p > .05, \eta_p^2 = .001\) (see Figure 2). The lack of an interaction demonstrates evidence against one prediction of the ancestral challenge account for Hypothesis 1a and also the congruency-incongruency account for Hypothesis 2a. This result is particularly interesting in light of the evidence supporting the congruency-incongruency account for recall (see General Discussion for more information).

<table>
<thead>
<tr>
<th>d-Prime Values as a Function of Trait Types and Scenario Type</th>
<th>Survival Scenario</th>
<th>Robbery Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survival Traits</td>
<td>.0095 (.9983)</td>
<td>-.2044 (.9155)</td>
</tr>
<tr>
<td>Robbery Traits</td>
<td>-.092 (1.003)</td>
<td>-.2746 (.8709)</td>
</tr>
</tbody>
</table>

\(^5\) A common transformation was used to compute the signal detection measures for the cases where hit rate or false alarm rate was equal to zero or one (see MacMillan & Creelman, 2005). For each case where hit rate or false alarm rate equal to zero, the following formula was used to calculate a new hit rate or false alarm rate: \(1/(2N)\) where \(N\) is equal to the number of items presented. For each case where the hit rate or false alarm rate equaled one, the following formula was used to calculate a new hit rate or false alarm rate: \(1 - (1/(2N))\).
Note. Standard Deviations appear in parentheses. A value of 0 indicates in inability to recognize an old (learned) trait from a new (distractor) trait. A positive value indicates a greater ability to recognize an old trait from a new trait whereas a negative value indicates to responding yes when intending to respond no, and vice versa.

Confidence Judgments. To evaluate participants’ confidence in their judgments on the recognition task, confidence judgments were submitted to a 2 (scenario: survival context or robbery context) X 3 (trait type: survival traits, robbery traits or distractor trait) mixed-model ANOVA\(^6\), with the last factor as a within-participants factor. First, there was a main effect of trait type, \(F_{\text{trait}} (2, 1.799) = 3.24, p < .05, \eta^2_p = .03\). Perhaps unsurprisingly, participants reported more confidence in responses to robbery traits (\(M = 72.84, SD = 14.47\)) and survival traits (\(M = 71.17, SD = 13.70\)) compared to distractor traits (\(M = 70.59, SD = 14.46\)), \(t > 2.13, ps < .04\). However, confidence estimates did not differ overall for survival traits compared to robbery traits, \(t = .59, p > .05\). Second, there was no main effect of scenario, \(F_{\text{scenario}} (1, 104) = .12, p > .05, \eta^2_p = .001\), nor was there a significant scenario X trait type interaction, \(F(2, 187.11) = 1.52, p > .05, \eta^2_p = .014\).

Judgments and Decisions. Recall that there were two core measures related to judgments and decisions about the social groups. First, participants selected which group (out of the four) they would like to join. For this measure, I examined whether participants selected the appropriate group based on the scenario context. That is, I examined whether participants in the survival (robbery) condition opted to join the group that had the greatest number of survival-relevant (robbery-relevant) traits. To do this, I

---

\(^6\) Mauchly's Test of Sphericity indicated that the assumption of sphericity had been violated, \(\chi^2(2) = 12.19, p < .05\), and therefore, a Greenhouse-Geisser correction was used.
created a new variable in which participants received a score of “1” for selecting the group with the most characteristics relevant to the scenario they read (i.e., the group with 7 survival-relevant traits in the survival scenario condition and the group with 7 robbery-relevant traits in the robbery scenario) and a “0” if they selected any other group. Then, a chi-square test was performed to indicate whether selecting the appropriate group depended upon scenario condition. The results revealed that there was not a significant relationship between scenario type and group choice, $\chi^2 (1, N=145) = .08, p > 0.05$ (See Table 8). Instead, the results revealed that approximately 31% of the participants in the survival condition and 29% of the participants in the robbery condition selected the “correct” group. Importantly and in support of Hypothesis 2b, participants in both the survival and robbery condition appeared to select the “correct” group at equivalent levels that were slightly higher than chance (25%). Moreover, the result does not support Hypothesis 1b that participants in the survival scenario condition would be more likely to select the “correct” group.

Table 8.

<table>
<thead>
<tr>
<th>Group Choice</th>
<th>Correct</th>
<th>Incorrect</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survival Scenario</td>
<td>22</td>
<td>48</td>
<td>.08</td>
</tr>
<tr>
<td>Robbery Scenario</td>
<td>22</td>
<td>53</td>
<td></td>
</tr>
</tbody>
</table>

Note. * $p < .05$.

Additionally, instead of only examining whether participants selected the “correct” group, another way to examine participants’ group selection is based on the groups’ number of goal-relevant traits. That is, I could examine the number of participants who selected the group with the most goal-relevant traits, the second-most
goal relevant traits, the third-most goal relevant traits, and the least goal relevant traits. After recoding, a chi-square test was performed to indicate whether selecting between these 4 types of groups depended upon scenario condition. As with the analysis described above, the results revealed that there was not a significant relationship between scenario type and group choice, $\chi^2 (3, N = 145) = 3.41, p > .05$ (See Table 9). Though there were subtle shifts, overall it appeared that the selection of groups was relatively comparable across the survival and robbery conditions, with slightly more participants selecting the correct group across conditions than any of the other groups.

Table 9. 
Crosstabulation of Social Groups and Scenario Type

<table>
<thead>
<tr>
<th></th>
<th>Survival Scenario</th>
<th>Robbery Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Most goal-relevant traits</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>2nd most goal-relevant traits</td>
<td>19</td>
<td>14</td>
</tr>
<tr>
<td>3rd most goal relevant traits</td>
<td>19</td>
<td>20</td>
</tr>
<tr>
<td>4th most goal-relevant traits</td>
<td>10</td>
<td>19</td>
</tr>
</tbody>
</table>

Note. * = correct group choice

A point-biserial correlation was also computed to determine the relationship between participant’s choice of group (First best, second best, third best and fourth best) and scenario type (survival or robbery scenario). The results continued to reveal that there was no relationship between choice and scenario type ($r_{pb} = .07, p > .05$).

Second, recall that participants also made ratings of the extent to which each group had traits that were relevant to the scenario, how motivated they would be to join the group, how desirable it would be to join the group, and how favorably they rated the group. Responses to these measures were aggregated ($\alpha = .87$) to form a composite for each group. The means were then submitted to a 2 (scenario: survival context or robbery context) X 4 (social group: 7 goal-relevant traits; 5 goal-relevant traits; 3 goal-relevant
traits; 1 goal-relevant trait) mixed-model ANOVA, with the last factor as a within-participants factor. The main effects of scenario and social group were not significant, $F_{\text{scenario}}(1, 143) = 1.32, p = .25, \eta_p^2 = .009$ & $F_{\text{social group}}(3, 429) = .71, p = .55, \eta_p^2 = .005$.

However, there was an interaction effect between scenario and social group, $F(3, 429) = 3.12, p = .03, \eta_p^2 = .02$ (See Figure 2).

Table 10.

<table>
<thead>
<tr>
<th>Social Groups</th>
<th>Survival Scenario</th>
<th>Robbery Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 survival_1 robbery traits</td>
<td>3.16 (.85)</td>
<td>2.87 (.87)</td>
</tr>
<tr>
<td>5 survival_3 robbery traits</td>
<td>3.12 (.91)</td>
<td>2.93 (.87)</td>
</tr>
<tr>
<td>3 survival_5 robbery traits</td>
<td>3.20 (.88)</td>
<td>3.10 (.91)</td>
</tr>
<tr>
<td>1 survival_7 robbery traits</td>
<td>2.88 (.84)</td>
<td>3.15 (.94)</td>
</tr>
</tbody>
</table>

*Note*. Standard Deviations appear in parentheses.

![Figure 2. Mean Judgments as a Function of Social Group and Scenario Type](image-url)
There were several ways to follow-up on this finding. First, one important pattern I had a priori interest in examining was whether participants rated the group with 7 goal-relevant traits higher than the group with 1 goal-relevant trait. Indeed, when in the survival condition, participants had higher mean ratings for the group that had 7 survival-relevant traits ($M=3.16; SD=.85$) compared to the group that only had 1 survival-relevant trait ($M=2.88; SD=.84$), $t=2.15, p = .04$, Cohen’s $d = .25$; 95% confidence interval for mean difference = .021 to .551. Likewise, when in the robbery condition, the opposite pattern was evident in terms of groups with robbery- or survival-relevant traits: participants had higher mean ratings for the group that had 7 robbery-relevant traits ($M=3.15; SD=.87$) compared to the group that only had 1 robbery-relevant trait ($M=2.87; SD=.93$), $t=-2.02, p = .047$, Cohen’s $d = .24$; 95% confidence interval for mean difference = -.06 to -.004. In sum, this finding supports the congruency-incongruency account that participants would have more favorable evaluations of groups that had characteristics that were congruent (rather than incongruent) with the scenario context goal.

Second, I examined linear trends in the survival and robbery conditions such that I would expect higher ratings for groups as they possessed greater numbers of goal-relevant traits. There was some overall support for this pattern. Indeed, in the robbery condition, a linear trend analysis revealed that participants provided higher ratings for groups as the number of robbery-relevant (i.e., goal-relevant) traits increased, $\beta = .98$, $t(3) = 6.18, p = .03$. For the survival condition, the linear trend was in the opposite (and hypothesized) direction, although the evidence of a linear trend with increasing amounts of survival-relevant traits was clearly not as dramatic, $\beta = -.68$, $t(3) = -1.32, p = .32$ (do note that inferential statistics are less meaningful here due to the low degrees of freedom
for this type of analysis). Indeed, an inspection of Figure 2 reveals that, at least nominally, participants in the survival condition provided high ratings for groups when they had at least 3 survival-relevant traits, but lower ratings if the group only had 1 survival-relevant trait.

In sum, the collective pattern across the decision and judgment variables most clearly supports the congruency-incongruency account. First, participants in the robbery and survival conditions chose the “correct” group at equivalent and greater-than-chance levels, suggesting they were attuned to the context when attending to trait information about the groups. Second, participants in both the robbery and survival conditions judged groups with the most goal-relevant traits more favorably than groups with the least goal-relevant traits (although the overall linear pattern across all groups was more evident in the robbery condition).
Chapter 3

General Discussion

Dozens of studies have examined and found evidence for a so-called survival processing effect in memory, wherein people tend to recall information better when evaluating it in a survival context. These findings have mostly been interpreted from a motivated cognition perspective such that people have evolved to process information in terms of its survival value (e.g., Nairne et al., 2007, 2008). However, more recent research focusing on pure cognitive explanations have challenged this explanation for the survival processing effect by showing that even non-survival contextual cues can enhance memory (Butler et al., 2009; Roer et al., 2013). The current research built upon this prior research in a number of ways. First, instead of using a non-social domain, the current study examined the survival processing effect for social traits. Second, the current study tested whether such effects would extend to functional judgments and decisions. Third, the current study tested between competing accounts for the results. Several important results were found.

Results Overview and Explanations

Recall that there were several core variables examined in the current study, and a two competing hypotheses for the results. Specifically, the first account—the ancestral challenge account—stated that a survival advantage would be detected overall, regardless of whether the traits are congruent or incongruent with the context (Nairne & Pandierada, 2011). That is, participants who imagined themselves in a survival context would recall and recognize more traits overall than those who imagined themselves in a robbery context and make more adaptive judgments/decisions. The second account—the
congruency-incongruency account—stated that recall and recognition would be highest when the scenario and the traits to be processed were congruent rather than incongruent (Butler, Kang, & Roediger III, 2009; Röer, Bell, & Buchner, 2013). Moreover, the congruency-incongruency account also predicted that judgments and decisions would not be any more adaptive in the context of the survival than the robbery scenario. Taken together, the results mostly supported the congruency-incongruency account.

First, performance on the free recall test was higher when the traits were congruent with the scenario context (i.e., the survival processing – survival list and robbery processing – robbery list) and lower when the traits were incongruent (i.e., the survival processing – robbery list and robbery processing – survival list). The results on this variable most cleanly fit within the literature of the survival processing effect due to the use of a similar dependent variable. The results bolster recent studies that have uncovered the mnemonic power of congruity (Butler et al., 2009; Ceo & Nairne, 2007) and are inconsistent with the traditional interpretations of the survival processing effect (e.g., Nairne et al., 2008, 2011). Indeed, this result provides further support that it is not the word set per se that enhances memory performance but the congruency between the content and its relevance to the respective processing scenario. Overall, this and other findings suggest that a good fit between the processing task and the target word provides more elaborate and deeper encoding which benefits later retrieval (Craik, 1973, Craik & Tulving, 1975; Lockhart & Craik, 1990; Moscovitch & Craik, 1976; Schulman, 1974). Indeed, in line with the encoding specificity principle (Tulving & Thomson, 1973), information is encoded into a rich memory representation that includes the context during encoding. Additionally, a number of studies have shown that stereotype-inconsistent
information is recalled more than stereotype-consistent information under normal encoding conditions, but it is recalled less than stereotype-consistent information under limited cognitive capacity (e.g., Bodenhausen & Lichtenstein, 1987; Macrae et al., 1993; Stangor & Duan, 1991; Stangor & McMillan, 1992). These studies can be understood in terms of schematic principles of memory, which suggest that stereotypes facilitate the encoding and representation of consistent rather than inconsistent information (e.g., Bodenhausen, Macrae, & Garst, 1997; Hamilton & Sherman, 1994; Macrae, Stangor, & Milne, 1994; Taylor & Crocker, 1981). This schematic filtering proposes that stereotype-consistent information is easier to comprehend than stereotype-inconsistent information, and therefore more likely to be encoded in memory (e.g., Bodenhausen & Lichtenstein, 1987; Macrae et al., 1993; Stangor & Duan, 1991; Stangor & McMillan, 1992). The logic behind this principle is consistent with a congruency-incongruency account that information which is consistent with situational characteristics would be more likely to be comprehended and remembered.

Second, participants in both the survival and robbery scenario conditions selected the “correct” group at equivalent levels that were slightly higher than chance (25%). Moreover, participants reported higher favorability ratings for groups when they possessed the greater number of goal-relevant traits than the fewest number. This result extends prior research on this effect by demonstrating that recall in these contexts can directly translate into adaptive judgments and decisions. Consistent with prior research in the field of judgment and decision making, participants clearly used contextual information to functionally guide judgments and decisions.
Third, and inconsistent with the prior two measures, performance on the recognition test did not show any survival processing effect nor support the congruency-incongruency account. Although it is unclear precisely why recall and recognition results differed, it is not unprecedented in the broader literature. Indeed, it is often found that recognition tests produce better retrieval results than do recall tests, presumably because recall is more difficult (Haist, Shimamura, & Squire, 1992) and seems to be sensitive to only conceptual encoding whereas recognition involves both conceptual and perceptual encoding (Johnston, Hawley, & Elliott, 1991). One possibility for the mixed results across recognition and recall may emerge from Fuzzy-Trace Theory (FTT; Brainerd & Reyna, 2002). Fuzzy-Trace theory posits two types of memory traces: verbatim and gist. Verbatim memory involves representations of exact words, numbers and pictures whereas gist memory involves essential meanings rather than surface details. It might be possible that recall and recognition are pulling differently on memory traces, such that recall involves more gist representation whereas recognition involves more verbatim representations. Ultimately, gist processing may be more impacted by contextual cues such as the scenario details and match between the traits and the scenarios. Further, judgments and decisions are also informed more by gist processes and information (e.g., Reyna & Brainerd, 1995, 2011), which may explain why the results here were more consistent with recall than recognition. Further, it is also worth noting that in all examinations of the survival processing effect, recall has been the variable under examination whereas recognition is not evaluated. This focus on recall is partly due to the procedure underlying survival processing studies, but it may also indicate something about how memory operates in these types of situations by relying more on gist-based
information (Otgaar, Howe, Smeets, and Garner, 2014). Moreover, it also worth noting that d-prime scores were quite poor overall, despite participants’ apparent confidence in their responses. Since participants performed the recognition task after the recall task, it is possible that both their motivation and memories suffered as a consequence.

**Limitations and Future Directions**

Some possible limitations are present in the current study. First, due to convenience, college students from the United States were sampled in the current study. Although college student samples have been used almost exclusively to examine the survival processing effect, future research should include more diverse participants (e.g., representative adults, non-Western, etc.). Moreover, it is possible that this is not a trivial matter. For example, perhaps participants from relatively affluent and educated countries might be less affected by survival contexts than participants who are from less educated and affluent countries.

Second, this research was conducted in an artificial laboratory environment and relied on a scenario-based approach. These approaches are clearly useful in terms of experimental control and results interpretation but it may be possible that the lab environment using scenarios might be less engaging and may not be able to immerse participants fully into a desired context (i.e., survival mode). Although the ease of creating an “image” in participants’ minds did not differ between the survival ($M = 3.72, SD = .81$) and robbery scenarios ($M = 3.54, SD = 1.22$), $t(65) = .69, p > .05$, Cohen’s $d = .17$, this does not eliminate criticisms of using a scenario method more broadly. Future research should consider using more engaging scenarios or methods that better simulate real-world conditions.
Third, there were several other methodological details and decisions that may be important for the interpretation of the results and for future research. For instance, prior studies on the survival processing effect have varied in the size of the recall list. Our choice of 32 bits of information to be recalled was approximately average compared to prior studies. It is possible that the amount of information is important for the results, though it is notable that our amount fell closer to the original studies showing a survival processing effect (e.g., Nairne et al). Another detail involves the procedures for the survival processing effect. In most prior studies, participants rated a list of (somewhat) ambiguous words in terms of their relevance to the scenario. Our participants viewed the trait words, but did not rate their relevance to the scenario. It is unclear what difference this would make for the results, but this procedural difference could change the amount of processing and encoding in our participants compared to those in other studies. Moreover, participants in here learned the groups’ names associated with social word lists but they did not rate the relevance of the word lists to the processing tasks (e.g., Butler et al.; Nairne et al.). In short, there may be some critical differences between the paradigm used here and what has commonly been used in the literature. Future studies might modify these methodological and procedural details to develop a more well-rounded view of the validity of the survival processing effect.

Fourth, although several arguments are made about differences between social and non-social stimuli in the introduction, the research never manipulates social and non-social content. Thus, I cannot speak directly to the similarities and differences between social and non-social memory in the context of the survival processing effect. What I can say is that the results with social stimuli do mirror prior research demonstrating the
efficacy of a congruency-incongruency account in non-social stimuli (Butler et al., 2009; Röer et al., 2013), albeit with a smaller overall effect size for the critical congruency X scenario context interaction (medium effect size for our study, $\eta^2_p = .078$; large effect size, $\eta^2_p = .38$, in Butler et al.’s Experiment 3).

Fifth, another potential limitation is the characteristics of the traits used in both survival and robbery scenarios. As can be seen in Table 4, the survival-relevant traits (e.g., helpful) seems to be more positive than the robbery-relevant traits (e.g., sneaky). Indeed, a paired samples t-test conducted revealed that survival-relevant traits ($M = 3.99, SD = .51$) were rated more positively than robbery-relevant traits ($M = 3.35, SD = .38$), $t(66) = 8.89, p < .001$. Although both traits are on the positive side of the Likert Scale (1 = very negative; 5 = very positive), it is clear that that survival-relevant traits were more positive than the robbery-relevant traits overall. Though such differences across condition clearly complicate the interpretation of the results, this difference is unlikely to fully account for the present results. One reason is because, according to the negativity effect, negative information is typically more heavily weighted when people form impression or evaluate judgments of other target individuals (Kanouse, & Hanson, 1972). Based on this, robbery-relevant traits should have a higher proportion recalled rate than survival-relevant traits but this is not the case in the current study.

The last potential limitation involves the selection of the control scenario, particularly the robbery scenario. In the current study, it might be the case that robbery scenarios contain an element of survival in that it involves competition of resources. The

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7 Although the concept of robbery is negative and less moral in today’s sense, according to Darwinian theory (1859), robbery is one of many ways for people to survive (e.g., stealing resources) and struggle for existence in the ancient time.
purpose of having the robbery scenario in past research was to create a scenario that was
equivalent to the survival scenario on qualities such as excitement and novelty, but
unique in terms of the emphasis on survival challenges (Kang, McDermott, & Cohen,
2008). Importantly, a survival processing effect was found in these past studies when
comparing the survival and robbery scenarios, suggesting that they are not equivalent in
terms of their emphases on survival. Of course, in addition to basic survival differences,
another possible difference is past emphasis on ancestral vs. modern settings. In past
studies (Nairne & Pandeirada, 2010a, Experiment 1; Weinstein et al., 2008, Experiment
2), memory was better in ancestral survival processing conditions than in a modern
ancestral conditions. Although the robbery scenario in the current study might contain a
survival element, this scenario was set in a modern situation (i.e., robbing a bank) instead
of in an ancestral situation (e.g., raiding a neighbor territory). Based on the collection of
evidence from past research, the survival processing effect appears robust across settings
(Kostic, McFarlan, & Cleary, 2012) and is distinguishable from a variety of control
conditions, including the robbery scenario.

Conclusions and Implications

Previous research using the survival processing paradigm has shown that
processing information in term of its survival value improves retention relative to
survival-irrelevant processing (e.g., Nairne et al., 2007, 2008, and 2011). Given the
robustness and replicability of the survival processing effect, many have suggested that
our memory systems are evolved or tuned to help us remember fitness-relevant
information. Although this effect is robust, there is some mixed evidence regarding the
proximate mechanisms that produce the survival processing advantage in memory.
Furthermore, little research on the survival processing effect has been conducted outside of the domain of word list memory. Thus, it is unknown whether this survival processing benefit emerges in other domains, such as those involving social information.

Building from the past research, the present study represented an initial attempt to investigate two competing explanations for the survival processing effect in a new domain (social memory) and on several types of conceptual dependent variables (memory and judgments and decision). Overall, the findings of the present study have several theoretical and practical implications.

First, the present study provides evidence to further support the congruency-incongruency theoretical account for how contextual cues such as survival can influence recall. Additionally, the results simultaneously cast doubt on the ancestral challenge account as it applies to the survival processing effect finding and paradigm (although ancestral challenge accounts more broadly appear to be valid in other contexts and domains). To date, there has only been a handful of studies on the congruency-incongruency explanation for the findings compared to the much richer set of evidence examining the survival processing effect from a motivational/evolutionary explanation. Although only one study was conducted, the study was well-powered and showed a remarkably similar pattern to prior research supporting the congruency-incongruency perspective. Moreover, by using social stimuli instead of non-social stimuli and including non-memory dependent measures, this further broadens and strengthens some of the arguments against the survival processing effect. Finally, the results also fit well within the cognitive memory literature by further supporting that contextual cues can facilitate
memory. Overall, then the results are well-situated within the literatures of evolutionary psychology, social cognition, and memory.

Finally, from a practical perspective, the results shed light on how people learn about, remember, and judge social groups. In particular, this research provides further support that people tend to remember information better when the information is congruent with the context. This result fits well within the framework of understanding how people form, maintain, and utilize stereotypes about various social groups. For instance, these results suggest that new groups or individuals from groups (e.g., other students, co-workers) will be viewed differently depending upon the activation of contextual cues and whether the traits displayed might match or mismatch the context. Ultimately, this type of research could help us to gain a better understanding of person and group perception and impact intergroup relations and conflict resolution.
References


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Appendix A

Questionnaire for Pilot Study (Survival/Control)

INSTRUCTIONS:

Today you will be asked to rate to a list of typical characteristics after you read a scenario. There is no “right” or “wrong” answer. Please read the scenario carefully and write down your answers. Thank you!

Part 1: Scenarios

- Survival Context Scenario:
  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 people that can help you find steady supplies of food and water and protect yourself from predators.

- Robbery Context Scenario:
  In this task, we would like you to imagine that you are leading a heist of a well-guarded bank. Over the next few months, you’ll need to find people that can help you make a plan, gather any supplies you might need, and conduct the heist.

Part 2:

“On the following screens, you will see a number of traits/characteristics. You will be asked to rate each trait/characteristic on a number of questions. Please pay attention to what the question is asking and also which trait/characteristic is being asked about”

1) How relevant is the following characteristic/trait to the overall goal of surviving in a foreign grasslands after becoming stranded?

1 2 3 4 5
Not at all relevant Very relevant
2) How positive or negative is the above characteristic/trait?

1  2  3  4  5
Very Negative  Very positive

3) How easy is it to imagine someone having the above characteristic/trait?

1  2  3  4  5
Very difficult  Very easy

Part 3:

“Earlier in the study, you read a scenario that involved surviving in the grasslands of a foreign land [leading the heist of a bank]. You will now answer a few questions about your thoughts and feelings about these scenarios.”

1) How did you feel when imagining being in the scenario involving surviving in the grasslands of a foreign land [leading a bank heist]?

1  2  3  4  5
Very calm  Very excited

2) How did you feel when imagining being in the scenario involving surviving in the grasslands of a foreign land [leading a bank heist]?

1  2  3  4  5
Very sad  Very happy

3) How interesting and engaging was the scenario involving surviving in the grasslands of a foreign land [leading a bank heist]?
4) How easy is it for you to create an “image” of the scenario involving surviving in the grasslands of a foreign land [leading a bank heist] in your mind?

1 2 3 4 5
Extremely difficult Very interesting and engaging

Part 4: Demographics:

1. Age: _____

2. Sex (please circle): Male   Female   Other ___________

3. Marital Status (please circle): Single  Dating  Married  Other ___________
   a. To what extent would you like your status in the future?

1 2 3 4 5 6 7 8 9 10
Single committed Married/long term

4. Do you have any children (please circle): Yes   No
   a. If yes, how many children do you have? _________
   b. If no, how many children do you want to have? _________

5. Ethnicity (please circle): Caucasian/White  African American  Hispanic/Latino  Asian/Asian American  Native American  Other ___________
6. Sexual orientation (please circle): Heterosexual  Homosexual
   Other________

7. Education Level (please circle): High school College  Graduate
   Other________

   Atheist  Other________

9. Employment status (please circle all that apply): student  self-employed
   Employed  Other_____________
Appendix B

Questionnaire for Main Study

Part 1: Scenarios (10 minutes):

- Survival Context Scenario:

  *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 other people that can help you find steady supplies of food and water and protect yourself from predators. We are going to show you a list of traits associated with different groups of hypothetical people. We would like you to think about how valuable the traits would in helping you accomplish your task of surviving. Some of the traits may be relevant and others may not…it’s up to you to decide.*

- Robbery Context Scenario:

  *In this task, we would like you to imagine that you are leading a robbery of a well-guarded bank. Over the next few months, you’ll need to find people that can help you make a plan, gather any supplies you might need, and conduct the heist. We are going to show you a list of traits associated with different groups of hypothetical people. We would like you to think about how valuable the traits would in helping you accomplish your task of leading a bank robbery. Some of the traits may be relevant and others may not…it’s up to you to decide.*
Part 2: Learning about characteristics of the groups

Example of one group order and the type of group characteristics presented.

<table>
<thead>
<tr>
<th>Group Subol</th>
<th>Group Fibir</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 survival-relevant</td>
<td>5 survival-relevant</td>
</tr>
<tr>
<td>1 robbery-irrelevant</td>
<td>3 robbery-relevant</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group Mere</th>
<th>Group Zipar</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 survival-relevant</td>
<td>1 survival-relevant</td>
</tr>
<tr>
<td>5 robbery-relevant</td>
<td>7 robbery-relevant</td>
</tr>
</tbody>
</table>

Part 3: Distractor Task

Please play the tetris game for 5 minutes.

Part 4: Free Recall

Instructions

“Earlier in the study, you read a scenario in which you imagined that your task was to survive (lead a bank heist). You also learned that you needed the help of another group of people to reach your goal and were then provided with information that described the typical traits of those groups. We want you to try to remember as many of those traits associated with each group as you can. We will present the names of each group at the top of the screen and you should write down as much information as you can recall about each group. You can take as much time as needed.
Part 5: Recognition Test

“Earlier in the study, you read a scenario in which you imagined that your task was to survive (lead a bank heist). You also learned that you needed the help of another group of people to reach your goal and were then provided with information that described the typical traits of those groups. We want you to try to remember as many of those traits associated with each group as you can. We will present you with the names of each group at the top of the screen and a trait/characteristic that either was or was not presented for each group. You will indicate whether or not each characteristic/trait appeared along with the group and also rate how confident you are in your guess.”

Example Recognition Item

1a. Did you see the trait listed below among the [Group name]?

   Yes__________  No __________

1b. How confident are you in your response? Provide any value between 50% (complete guess) and 100% (complete certainty).

   ________ % confident

Part 5: Judgments and Decisions
“Earlier in the study, you read a scenario in which you imagined that your task was to survive (lead a bank heist). You also learned that you needed the help of another group of people to reach your goal and were then provided with information that described the typical traits of those groups.

1. If you had the choice to join just one group, which group do you think you would join?
   ──────── Group Subol
   ──────── Group Fibir
   ──────── Group Mere
   ──────── Group Zipar

2) How relevant did the traits of this group seem to the goal of survival (leading a bank heist)?

   1  2  3  4  5
   Not at all relevant  Very relevant

3) How motivated would you be to join this group?

   1  2  3  4  5
   Not at all motivated  Very motivated

4) How desirable would it be to join this group?

   1  2  3  4  5
   Not at all desirable  Very desirable

5) How would you rate this group overall?

   1  2  3  4  5
Part 6: Demographics

1. Age: ___

2. Sex (please circle): Male   Female   Other _________

3. Marital Status (please circle): Single  Dating  Married  Other _________
   a. To what extent would like your status in the future?
      1             2            3            4             5            6              7           8    9            10 Married/long-term committed

4. Do you have any children (please circle): Yes       No
   a. If yes, how many children do you have? _________
   b. If no, how many children do you want to have? _________

5. Ethnicity (please circle): Caucasian/White  African American
   Hispanic/Latino  Asian/Asian American  Native American
   Other___________

6. Sexual orientation (please circle): Heterosexual  Homosexual
   Other________

7. Education Level (please circle): High school  College  Graduate
   Other________

   Atheist       Other_________
9. Employment status (please circle all that apply): student self-employed

Employed Other_____________

10. How well can you remember more than 7 words at a time?

1 2 3 4 5

Not very well Very well

11. Do you have experience in traveling foreign land [leading people to do a project]? Yes No
Appendix C

Funnel Debriefing

1. Were all the directions clear and easy to understand?  Yes  No
   If no, what was confusing?
   ________________________________
   ________________________________

2. Did a friend or classmate tell you anything about this study?  Yes  No
   If yes, what did they tell you?
   ________________________________
   ________________________________

3. Was there anything you think might have altered your responses in some way?
   Yes  No
   If yes, what do you think may have influenced your responses and in what way?
   __________________________________________________________
   __________________________________________________________