What You Are Getting and What You Will Be Getting:

Testing Whether Verb Tense Affects Intertemporal Choices

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Abstract

Prior research has shown that language structure – specifically the form of verb tense in that language – can predict savings behaviors among speakers of different languages, consistent with some forms of the Whorfian hypothesis that language shapes thought. To test the role of language in financial decision-making, we investigate the effect of manipulating verb tense (within a single language) on intertemporal tradeoffs. We find that verb tense *can* significantly shift choices between options, due to tense-based inferences about timing. However, the spontaneous use of verb tense when making choices occurs only in the complete absence of other timing cues and is eliminated when even ambiguous or non-diagnostic time cues are present, even if prompted timing inferences persist. We test between multiple competing accounts for how verb tense impacts timing inferences but not choices, and find evidence for a cue-based account, in which the presence of other cues blocks the use of verb tense in making intertemporal-decisions.

Keywords: Judgment; Decision Making; Linguistic Priming; Intertemporal Choice; Inferences; Whorfian Hypothesis; Implicatures; Cue Competition.

Since the 19th century, philosophers, linguists and psychologists have wondered whether language has a causal impact on thought. Perhaps the best-known version of this idea, often called the Sapir-Whorf hypothesis, is that differences across languages determine, or at least influence, differences in thought. In this view, the structure of a given language can facilitate some ways of thinking and impede others, leading some cognitions to be more accessible and therefore more prevalent among speakers of that language, in ways that are empirically testable (see Hunt and Agnoli 1991 for a review).

In this paper, we investigate the potential for linguistic cues, identified in prior research, to affect decision-making. We focus on a well-motivated test case: whether differences in verb tense cues, within a single language, influence intertemporal choices between smaller-sooner and later-larger options. Research in linguistics, economics and psychology all raise the possibility that people's intertemporal tradeoffs are sensitive to linguistic cues in how those tradeoffs are expressed. At the same time, other research in each of these three areas has provided strong reasons to question the likelihood of such an influence of language on choice.

In linguistics, in particular, differences in the way languages structure and relate concepts have been posited to affect how people think about those concepts when using that language. Specifically, the Sapir-Whorf hypothesis states that people's thoughts can be influenced by the language they speak (Sapir, 1929; Whorf 1956; Koerner, 1992). Consistent with this view, Boroditsky (2001) argued that different spatial metaphors for expressing time in Chinese (vertical) and English (horizontal) affected people's performance in spatial cognition tasks. However, linguists have argued that human thought and action are determined by other factors than language (Berlin & Kay, 1991; Kay et al., 1991), and subsequent research has called the spatial metaphor finding into question (Chen 2007).

In psychology, research on priming has suggested that even subtle contextual cues can affect people's choices, including intertemporal choices (Shevorykin, et al., 2019; Sheffer et al., 2016; see Rung & Madden, 2018 for a review). That said, recent research has demonstrated that prior conclusions about

the pervasiveness of priming were premature, questioning the replicability of classic social priming findings (as discussed in Bower, 2012; Pashler & Wagenmakers, 2012, Cesario, 2014; Molden, 2014; Vadillo et al., 2016).

In economics, explaining levels and variation in household savings that are seemingly inconsistent with traditional economic principles has been a long-standing puzzle (Laibson 1997; Warner and Pleeter 2001; Sutter et al, 2018). For example, savings rates vary across countries in ways that are not well explained by having sufficient resources to save (Torvik, 2009; Boschini et al. 2013).

A recent influential paper (Chen 2013) has posited linguistic differences as a partial explanation for differences in savings rates, and has documented a correlational relationship between the structure of the future tense in the language used and consumer savings rates (as well as other presumably far-sighted behaviors), both across countries and among linguistic groups within a country. However, subsequent research argues that at least some of that relationship is explained by shared culture (Roberts, Winters, & Chen 2015). In fact, other research suggests that culture may even influence language formation (e.g., geographical origins influencing cultural norms and language development over time; Galor, et al., 2016).

Thus, across disciplines, how linguistic cues might or might not shape intertemporal preferences is an important and unresolved question, and research on these questions is limited by the fact that cross-language comparisons involve multiple confounds. In this paper, we investigate how variation in the verb tense used in describing choice options, within a single language (English), affects the choices that people make. Our goal is to test whether such an effect *can* reliably occur, and if so, to identify under what conditions verb tense would and would not affect intertemporal preferences. Our results suggest that while verb tense can impact choices, it does so via an inferential (rather than priming) mechanism. As a weak cue that competes with other cues, a syntactic structure such as verb tense will affect choices primarily when no other cues of timing are present, and therefore will have limited impact in realistic situations.

Across 9 studies, 3744 participants, and 114 unique choice questions, we find that present vs. future verb tense (e.g., "get" vs. "will get") predicts choice of an option only in the impoverished situation where no other timing information is presented. In the presence of either objective timing information or even ambiguous and non-informative timing cues, the impact of verb tense on choices is eliminated, consistent with a cue-based inference mechanism. Data, analysis code, and study materials are publicly available at https://osf.io/dmybj/.

Theoretical Development and Proposed Framework

Linguistic Determinism vs. Relativity.

Does the language we use to process information shape the way we think? This possibility, known as the Sapir-Whorf hypothesis in linguistics (Sapir 1929; Whorf 1956), can be thought of in terms of two possibilities. The strong version of the hypothesis suggests that language *determines* thought, in the sense that thoughts that are possible in one language may not even be conceivable in another. The weak version, on the other hand, posits a weaker relationship in which language *influences* thought, via what a person is likely to spontaneously perceive or remember (Tohidian, 2008; Chandler, 1994).

Carroll & Casagrande (1958) claimed early empirical backing for the strong Sapir-Whorf hypothesis. They documented that children speaking only Navajo were able to pick up form recognition more quickly than children speaking only English. They argued that this was consistent with linguistic determinism, because Navajo has verb conjugations that depend on form and shape, while English does not. However, their study also documented evidence inconsistent with the hypothesis, as bilingual children (speaking both Navajo and English) developed form recognition *later* than English speaking children.

Linguists have largely rejected the deterministic version of the Sapir-Whorf hypothesis for lack of clear evidence. For example, some researchers have suggested that the translation of the Native American languages to English in the original work by Sapir and Whorf was overly literal, rendering it too simplistic

(Garnham & Oakhill, 1994). It has also been pointed out that the Strong Hypothesis fails to account for reverse causality, where thought or culture can impact the development of language (Lenneberg & Roberts, 1956).

More recent research has instead focused on the Weak Hypothesis. Differences across languages in how colors are named provides an illustrative example of the mixed evidence for the Weak Hypothesis. Initial evidence from cross-language differences in color naming and color recognition suggested that language influences color recognition and perception (Lenneberg & Roberts, 1956; Brown & Lenneberg, 1954), lending support to the weak Sapir-Whorf hypothesis. However, subsequent research found that there were semantic universals in color naming schemes, with variation in people's color descriptions driven primarily by individual differences in visual physiology (Heider, 1972; Berlin & Kay, 1991; Kay et al., 1991). On the other hand, subsequent papers on color recognition provided additional support for the Weak Hypothesis – speakers of a language with fewer color categorizations grouped similar colors together than those with more color categories (Davies et al., 1998, Ozgen et al., 1998; Davidoff et al., 1999).

Linguists have continued to investigate the possibility that thought is influenced by language, perhaps via shifts in attention (see Levinson & Gumperz, 1996; Gumperz & Levinson, 1991 for more details). Relationships between language and thought could be bi-directional and also affected by social context – that is, language may affect thought but conversely, thought may also affect language use (Chandler, 1994). Lastly, it should be noted that research on the Sapir-Whorf hypothesis has largely focused on the effect of language structure on language usage and recognition (e.g., naming colors, recognizing patterns), but little has been done to test whether language structure influences decision-making. By contrast, in this paper, we focus on whether (and how) the linguistic feature of verb tense affects people's decisions in intertemporal choices.

Intertemporal Choices and Farsighted Behavior.

A large research literature has studied intertemporal choices (e.g., between a sooner-smaller and a later-larger option), to understand the discount rates implied by people's preferences. This research has established that people are more impatient than can be explained by normative economic standards, and that people's intertemporal preferences are sensitive to a variety of contextual factors (see Frederick, Loewenstein, & O'Donoghue, 2002 and Urminsky & Zauberman 2016 for detailed reviews).

Intertemporal preferences have long been viewed as one of the primary determinants of savings and investment decisions (Irving, 1930; Samuelson, 1937; Carroll, 1992; Laibson 1997; Gourinchas & Parker, 2002; Bernheim and Rangel 2007). Empirical work has documented that less extreme time discounting predicts prudent financial behaviors (Chabris et al 2008; Harrison, Lau, and Williams 2002; Johnson, Atlas and Payne 2011; Meier and Sprenger 2010) and farsighted health behaviors (see Urminsky & Zauberman 2017 for a review), although not necessarily savings (Chabris et al 2008; Chapman et al 2001).

People's intertemporal preferences depend specifically on how they process prospective time and perceive the future. The most widely documented behavioral anomaly is hyperbolic discounting, the tendency for people to be more patient when choosing between two options far in the future than when choosing between the same two options in a time perceived as the present (Ainslie 1975, Thaler 1980, Jang and Urminsky 2020). Prior work attempting to explain high discount rates and hyperbolic discounting has demonstrated that intertemporal preferences depend on people's subjective time perception (Zauberman et al., 2009), their assessment of their future self (Bartels & Urminsky 2011) and the salience of future opportunity cost (Read, Olivola and Hardisty 2017). Therefore, intertemporal preferences could be influenced by language, to the degree that linguistic cues affect relevant factors (such as subjective time perception) that contribute to preferences.

Linguistic cues and time perception.

Prior research has suggested that differences across languages can impact how people think about time. For example, time is often expressed in vertical terms ("up" vs. "down") in Mandarin and some researchers have therefore argued that Mandarin speakers also think of time more vertically than English speakers do (Miles et al., 2011; Boroditsky et al., 2011; Boroditsky, 2008). Differences in spatial representation of time by language has also been shown in comparisons between Hebrew and English (Fuhrman & Boroditsky, 2010), and between English and Greek/Spanish (Casasanto et al., 1994). This idea, while intuitive, has been quite controversial, however, and seemingly promising empirical demonstrations (Boroditsky 2001) have subsequently failed to prove robust (January and Kako 2006; Chen 2007).

In this paper, we focus on how temporal events are syntactically marked by verb forms (i.e., future time reference). In certain languages, considered "futureless," present and future timing is not conveyed by how verbs are expressed (*e.g.*, Finnish and Estonian; Dahl, 2000). However, most languages have future markers on the verb that distinguish present and future. For example, in English, a modal (e.g., "will") can be placed before another verb ("go") to form the futured pair ("will go"), to denote a future act of going (e.g. "I will go to the mall tomorrow") (Wekker, 1976). In languages with future markers, the presence of absence of such verb modifiers may convey timing information.

The relationship between language and farsightedness.

Chen (2013) proposes that the presence of future tense in a language relates to savings rates of speakers of that language, both across and within national boundaries. Specifically, he proposes that the existence of future tense markers to modify verbs in a language results in lower saving behaviors of native speakers, because the future is seen as more distinct from the present in languages with future tense markers. Conversely, using the same verb for both the present and future is proposed to bridge the psychological distance between the two times, hence inducing native speakers of such languages to exhibit

more farsighted behavior. His findings show that, on average, speakers of futureless languages save more, retire with more wealth, smoke less, practice safer sex, and are healthier.

The relationship between language and farsightedness still holds when accounting for the fact that languages are not independent of each other (i.e., share cultural norms), but the effect size does diminish (Roberts, Winters, & Chen 2015). In a sample of bilingual speakers of Estonian (futureless) and Russian (futured), those randomly assigned to complete a survey in Estonian were more patient and more supportive of future-oriented policies than those questioned in Russian (Perez & Tavits 2017), suggesting a causal effect of language. Extending these findings, firms located in countries with futureless languages had higher precautionary cash holdings (Chen, et al. 2017), and firms using less futured writing in their annual reports generated above-average positive returns (Karapandza 2011).

Similar differences have been documented for intertemporal choices. German-speaking (futureless language) children in a bilingual city were more likely to delay gratification in an intertemporal choice experiment than Italian-speaking (futured language) children (Sutter et al. 2015). However, another paper found has found the opposite relationship, with speakers of English and Spanish (futured) more patient than speakers of Danish, German, and Chinese (futureless; Thoma & Tytus 2017). More comprehensively, Falk et al (2018) replicated the relationship between futureless language and greater patience (on an index comprised of time discounting tasks and attitudinal measures) across 76 countries.

The interpretation of the relationship documented by Chen (2013) has been widely debated, however. In particular, linguists have objected to the inference that language strongly and causally affects thinking about time, especially when interpreted in terms of the strong Sapir-Whorf hypothesis (*e.g.,* Pullum 2012; McCulloch 2013; McCulloch 2014; Dahl, 2013). These objections are largely based on the long-standing debates over the Sapir-Whorf hypothesis in general, as summarized above, with conflicting

evidence regarding the weak form and very ambiguous evidence for the strong form (Pinker, 2003; Au 1983; Lenneberg & Roberts, 1956; Garnham & Oakhill, 1994).

Moreover, Fabb (2016) contends that Whorfian work in Economics has over-simplified the categorization of language. For example, English has been categorized as a no-pronoun-drop language (pronouns grammatically required as agents in sentences; as in Kashima & Kashima 1998) and also as a strong future-time-reference language (obligatory tense markers on verbs to distinguish future and present; as in Chen 2013). However, these categorizations may be too rigid because English, for example, exhibits instances of pronoun-drop (e.g., in newspaper headlines) and weak future time reference (using the same tense to depict both future and present.)

If, on the other hand, the proposed relationship between language and farsighted behaviors is robust and generalizable, why might it occur? Differences in both language and farsightedness between speakers of different languages could be caused by corresponding long-standing differences in cultural norms (Wang et al. 2016), which in turn could arise from geographical differences (Galor et al. 2016). Focusing on purely linguistic influences, we can also think of farsightedness as potentially shaped by long-term immersion in a language with a structure that promotes thinking of the future as a continuation of or distinct from the present (e.g., the associations formed between language structure and timing estimates; Casasanto 2008). In both the cultural hypothesis and the immersion hypothesis, we would expect language to predict differences in farsightedness across people, but we would expect a given person's farsightedness to be stable and we would not expect variation in language use or exposure, especially within a given language, to shift intertemporal preferences.

Alternatively, we can think of language as influencing intertemporal preferences directly in the moment, during stimulus processing and subsequent deliberation, in one of two ways. The first possibility is that linguistic elements activate specific associations, which impact intertemporal preferences via semantic priming (Neely 1991). For example, seeing a future outcome described using a

verb tense associated with the present could activate more near-term associations than would seeing a future-only verb tense. The second possibility is that people engage in inferential reasoning, treating linguistic elements as cues to meaning. In particular, people might infer a longer delay from the objectively equivalent timing information when expressed in a future-only verb tense.

Priming far-sightedness.

According to theories of spreading activation, thinking about a concept activates a node that represents it, and temporarily increases activation of other nodes representing similar concepts (Anderson & Pirolli 1984). This process accounts for the phenomenon of priming, in which presenting the prime facilitates responses to a subsequent, related item—the target (McKoon & Ratcliff 1992).

A meta-analysis concludes that the literature provides evidence that some kinds of priming (of affect, mortality, timing, future thinking or construal) can reduce discounting in one-off choices (Rung & Madden, 2018). In particular, some recent work proposes that specifically semantic priming can impact time discounting (Shevorykin, et al. 2019; Sheffer et al. 2016), although other research has not found effects on time discounting from textual primes (Israel et al. 2014). Moreover, there have been many failures to replicate priming effects in general (as discussed in Bower 2012; Pashler & Wagenmakers 2012; Cesario 2014; Molden 2014; Vadillo et al. 2016). Therefore, despite the evidence suggesting that priming may impact time discounting, it is not currently understood how robust or generalizable such findings are.

Conversational Implicatures and Inference

Pragmatics, a sub-field of linguistics, offers a different perspective on how language can affect cognitions in the moment. Beyond the literal meaning of a semantic expression, people's understanding involves conversational implicatures, suggestive inferences about the meaning of the expression, in the context in which the information is encountered, by making assumptions about the information provider's intentions (Grice 1975; Horn 1984; Levinson 2000).

In typical theories of implicature, the information recipient assumes that the information provider intends to be truthful, succinct but complete, consistent with the general principle of least effort (Zipf 1949). Speakers economize their message by making their communication as brief as possible, and as relevant as possible. Listeners, knowing this, rely on all cues in the information given, in order to interpret the message (Grice 1975, Sperber & Wilson, 2002). One such cue, for inferring timing, can be the verb tense. To the degree that people infer timing from verb tense, the linguistic structure of how timing is expressed may affect intertemporal choices.

In this view, whether people make an inference is based on whether the needed information is available without the inference (i.e., literally stated), and whether the receiver believes the person has and intends to convey the information (for more discussion, see Horn & Ward 2004; Grundy 2013). For example, referring to the timing of two options using the same word might signal that the speaker does not know or does not intend to convey which occurs first. Conversely, using two different words for the timing of two options may signal that the speaker is conveying a difference in timing, prompting the recipient to engage in additional inference about which occurs first when that is not already clear.

Rescorla and Wagner (1972), building on prior work in animal behavior (Kamin 1969), showed that when a stimulus is known to be a predictor of the outcome, people perceive a second, additional, stimulus to have a minimal or negligible effect, and do not use it to predict outcomes. In particular, Dickinson et al. (1984) showed that, in humans, the effect of a stimulus on perceived outcome will be blocked (or attenuated) when it is presented along with another stimulus that has been previously identified as a predictor of the outcome. Therefore, when competing cues are present, which cues people rely on can determine the meaning they extract from the information given, and thereby what decision they make. Thus, contrary to the basic implicature account, cue-based inference suggests that people look for the most relevant cue(s) in a given information as opposed to using all the information based on the assumption that it has been expressed for a purpose.

The single-language approach to testing linguistic effects on intertemporal preferences.

In this paper, we test whether in-context linguistic differences (i.e., the verb tense used in the wording of choice options) influence intertemporal preferences in the moment, during stimulus processing and deliberation, via either semantic priming or pragmatic inference (either implicature or cue-based). This hypothesis is testable within any single language, as long as usage allows for sufficient flexibility that verb tense can be independently manipulated when conveying information. According to the distinction relied on by Chen (2013), English is a futured language and it has obligatory tense marking (i.e., separate tense forms must be used for present vs. future events; Dahl, 2000). While this assumption is prescriptively true (i.e., as suggested by textbook grammar rules), everyday usage of the English language is much more flexible, and future events can be referred to in multiple, acceptable forms (Copley 2009).

In particular, in conversational English, receiving a future amount of money can be conveyed in multiple ways:

1. You get $5 in a week.
2. You are getting $5 in a week.
3. You would get $5 in a week.
4. You will get $5 in a week.
5. You are going to get $5 in a week.

These sentences have the same meaning – the only difference is that (1) and (2) use the present-tense grammatical form, (3) uses a neutral form that ostensibly does not imply a timing, while (4) and (5) use a form reserved for discussing the future.

Our empirical approach will be to test the effect of manipulating verb tense on intertemporal preferences by presenting the same English-language choice options to English-speakers in different ways, as above. The advantage of testing the effect of linguistic cues on intertemporal choice within a single

language (e.g., as opposed to using two languages in a bilingual population), is that doing so reduces the potential confounds, particularly different cultural norms associated with different languages (Chen, Winters, & Roberts 2015).

Overview of hypotheses, explanatory accounts, and studies

Throughout the studies, we will test between two competing hypotheses – the priming hypothesis and the versions of the pragmatic inference hypothesis. If verb tense acts as a prime, activating concepts related to the associated timing of events, then we would expect an option with the present tense to be most attractive, followed by the neutral tense and then the future tense (holding constant other potential attributes, such as amount and objective delay), regardless of what other timing information is available. Thus, according to the priming hypothesis, we would expect the future amount expressed in the present tense, *e.g.*, in sentences (1) and (2) to be chosen more than the objectively equivalent offer expressed in the neutral tense (3), followed by the future tenses (4) and (5).

On the other hand, when objective timing information is available, there is no uncertainty to resolve and no need to draw inferences from cues such as verb tense. By contrast, according to the inference hypotheses, in the absence of any timing information (i.e., excluding "in a week" from the examples above), people would use an extractable cue, such as verb tense, to infer timing. If uncertain timing information is provided (e.g., "soon" instead of "in a week"), whether or not people are sensitive to verb tense will depend on how the cues are processed.

From a conversational implicature perspective (Grice 1975), receivers of a message will assume that every available cue has been communicated for a reason. If the sender uses the word "soon" for timing rather than an objective timeline, the receiver would assume that the sender could not or did not want to provide specific timing. However, the receiver would also assume that the tense used reflected a deliberate attempt to convey information. Thus, from the conversational implicature perspective, people

would spontaneously use verb tense when making choices to the degree that they perceive differences in tense to convey differences in timing, when prompted to make an inference.

However, other linguists have suggested that people instead engage in a "psycholinguistic guessing game" (Goodman 2014), attempting to use the fewest (but most informative) possible cues from the information provided to infer meaning beyond what is literally stated, when deemed necessary. This account is consistent with the notion of competition among cues (Kamin 1969; Rescorla and Wagner 1972; Dickinson et al. 1984), such that not all cues that are provided will be spontaneously incorporated into decision-making. From this perspective, even when people infer timing from a cue such as verb tense when prompted to do so, other more relevant-seeming cues may block the use of verb tense when making choices.

Across nine studies, we test the effect of verb tense framing of choice options on both direct inferences about timing (Studies 1a, 4a and 5a) and on intertemporal choices (Studies 1b, 2a, 2b, 3, 4b and 5b), varying the specificity of information about timing as well as the degree to which other diagnostic or relevant-seeming cues are present in the decision context. Studies 1a-b , and 3 presented options with no timing information (*e.g.*, "You will get $10"), Studies 2a, 2b, and 3 presented objective timing information ("You will get $10 in 6 days"), and Studies 3-5b presented ambiguous qualitative timing information ("You will get $10 soon"). Overall, we find that verb tense only impacts choices when other timing cues (diagnostic or not) are completely absent, supporting the cue-based version of the inference hypothesis.

Study 1a: Direct Inferences, absent timing information

In the first study, we test the inferences people draw from verb tense in the absence of any timing information, when prompted. In particular, identifying whether people see the present tense as conveying a sooner time than the future tense – a necessary condition for the inference hypothesis described earlier – is an untested question in pragmatics.

Method

Participants (N=248, after exclusions[1]) recruited from Amazon Mechanical Turk (AMT) were shown brief descriptions of two people receiving the same amount of money, described using different tenses. The participants then indicated which person they thought would be receiving the money sooner. For example, they were asked "Which do you think occurs earlier? – 'Bob gets $20' vs. 'John will get $20'." Across 10 such scenarios, we varied only the verb tense used in each option. We used two versions of the present tense ("get" and "is getting"), two versions of the future tense ("will get" and "is going to get"), and a neutral tense ("would get"). Our dependent variable was the proportion of times the description using each verb tense was chosen as the earlier outcome (compared to the baseline rate of 50% for each tense which would be expected if there was no effect of verb tense).

Throughout this paper, 'test' trials consist of questions in which the verb tense forms were *different* between the two options, and in 'filler' trials the verb tense was the same in both options. Since, in this study, the only thing that differed between options was the verb tense, there were no filler questions.

Using this design, we can predict choices between the two options as a function of tenses used, to test whether people infer the prescriptively earlier tense as occurring earlier than the prescriptively later tense. The two versions of present tense ("get" and "is getting") are prescriptively earlier than the neutral tense ("would get") which is prescriptively earlier than the two versions of the future tense ("will get" and "is going to get"). The empirical test is important because people's everyday usage may not align with grammatical prescriptions and people may not infer earliness from verb tense as grammatically prescribed.

Results and Discussion

As shown in Figure 1a, verb tense had a substantial and statistically significant effect on participants' judgments of relative timing of occurrence. For example, 86% of participants reported that

[1] In all studies, we excluded incomplete surveys, as well as surveys with duplicate IP addresses and failed attention checks.

"Bob gets $20" would occur sooner (on average, compared to options with other verb tense variations) but only 42% thought "John will get $20" would occur sooner than the other verb tense options.

As an initial overall test of differences by tense, we fit a linear regression with clustered standard errors, predicting which option was chosen as occurring sooner, based on the verb tense in each option. We created separate dummy codes for each tense (two present tenses, one neutral tense, and two future tenses): -1 if the tense was only used in the first option, +1 if it was only used in the second option, and 0 otherwise. For example, when people chose between "John will get $20" (Option 1) and "John gets $20" (Option 2), the tense "get" was scored as +1, and "will get" was scored as -1, and all other tenses were scored as 0.

Based on the combined regression analysis, present tense options ("get" and "is getting") were seen as occurring the earliest ("Get" : β=-.56, t(247)=-25.05, p<.001; "Is Getting" : β=-.46, t(247)=-21.78, p<.001), followed by future tense options ("will get" and "is going to get") ("Will get": β=-.21, t(247)=-12.28, p<.001; "Is going to get": β=-.15, t(247)=-8.40, p<.001), compared to the neutral tense ("would get").

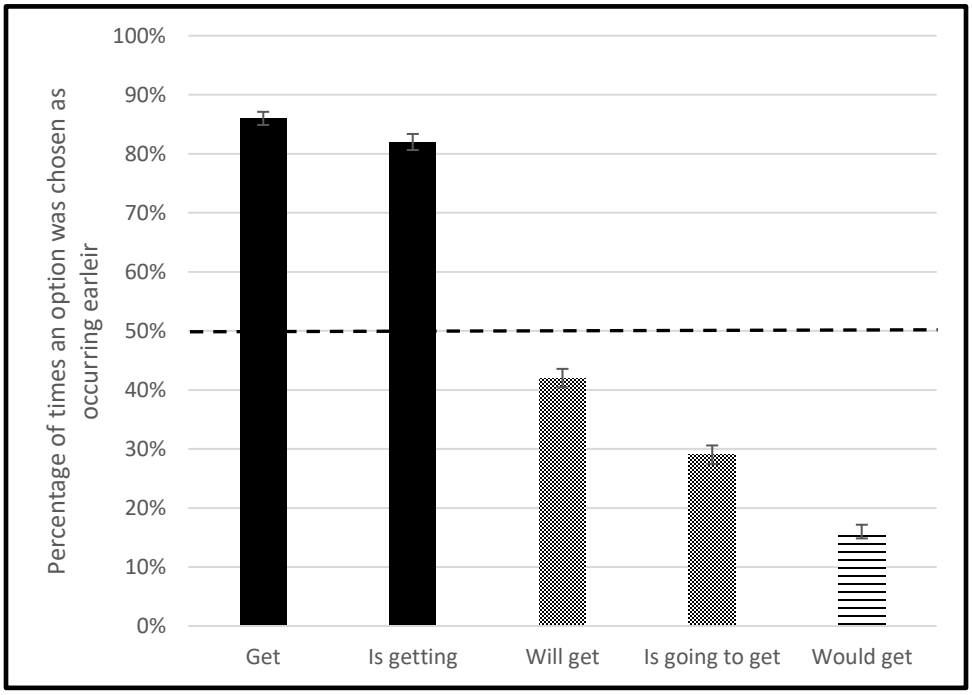

Fig 1a: The average percentage of times participants choose the option expressed in each verb tense as the earlier option. "Get" and "Is getting" are variants of the present tense; "Will get" and "Is going to get" are variants of the future tense; "Would get" is the neutral or nonspecific tense.

Utility-Model Estimation of the Verb Tense Effect

As a flexible framework to quantify the general effect of tense across the studies, we will use an additive-utility linear probability model[2]:

$$P(Option\ 1) = \alpha\ +\ U(o_1) - U(o_2) \quad \textbf{(1)}$$

Here, $U(o_1)$ is the utility from choosing the first option and $U(o_2)$ is the utility of the second option. The utility of an option is modeled in terms of the tense, such that β_1 and β_2 represent the subjective value implied by present and neutral tense, respectively, relative to the utility of future tense, which is set at 0:

$$U(o_i) = \beta_1\ Present_i\ +\ \beta_2\ Neutral_i \quad \textbf{(2)}$$

$Present_i$ is 1 if option *i* has present tense, 0 if not; and $Neutral_i$ is 1 if option *i* has neutral tense, 0 if not. Thus, the linear probability model in (1) can be re-written as:

$$P(Option\ 1) = \alpha + \beta_1(Present_1 - Present_2) + \beta_2(Neutral_1 - Neutral_2) \quad \textbf{(3)}$$

In this simplified regression model, α represents average preference for the first option when both options have the same tense variation (e.g., each is one of the forms of present tense).

The general model (4), which we will use subsequently, is an extension of the simplified regression model (3), controlling for the monetary amounts in the options and the objective delay between the options (when presented):

$$P(Option\ 1) = \alpha + \beta_1(Present_1 - Present_2) + \beta_2(Neutral_1 - Neutral_2) + \beta_3(Amount_1 - Amount_2) + \beta_4\ Delay \quad \textbf{(4)}$$

[2] We use the linear probability model for simplicity, since we are conducting significance testing but not generating predictions (for which a logit model would be more justified).

In this study, fitting the tense-only regression in (3) reveals that people were significantly more likely to choose the option with present tense as occurring earlier (β=.33, $t(248) = 23.34$, $p<.001$) and people were significantly less likely to choose the option with the neutral tense (β=-.18, $t(248) = -11.86$, $p<.001$), compared to the baseline of future tense.

The fact that participants treated present verb tense as indicating earlier timing than future verb tense is consistent with our prior discussion of prescriptive grammar. However, contrary to prescriptive grammar, "would get" was seen as occurring significantly *later* than either present or future tense. These results suggest that people make other inferences than neutral timing (perhaps uncertainty or conditionality) from the "would get" formulation, which makes it a poor test of the hypothesis. Accordingly, we will only present comparisons between present and future tense in the following studies, but the analyses will still control for neutral tense, when applicable.

Study 1b: Tense-Based Choices, absent timing information

Study 1a demonstrated that people infer timing information from present vs. future verb tense (i.e., perceive an outcome described as "get" as occurring sooner than an option described as "will get", absent objective timing information). Next, we test whether such linguistic framing affects choices between options.

Method

In this pre-registered study (https://aspredicted.org/v87s4.pdf), participants (N=296), recruited from AMT, made a series of 10 hypothetical test choices between two options. Each option specified only the amount (randomly determined, between $19 and $21) and verb tenses were randomized, from among the five forms tested in study 1a. No other cues as to timing were presented in the choice options. For example, a participant would be asked to choose between "You get $19" and "You will get $21". There were no filler trials (*i.e.,* the verb tense forms between the two options were never exactly the same).

Results and Discussion

Participants were significantly more likely to choose an option if it was described in present tense ("get" or "is getting") than if it was described in the future tense ("will get" or "is going to get"), as shown in Fig. 1b. Consistent with the inferences observed in Study 1a, options described using the neutral tense ("would get") were the least likely to be selected.

We fit the full linear utility model (4) to account for differences in monetary amounts, using a linear regression with clustered standard errors. Participants were more likely to choose options expressed in the present tense than in the future tense (β=.13, $t(295)$ =9.48 , $p<.001$) in the absence of other timing information, and were less likely to choose options in neutral tense than in future tense (β=-.09, $t(295)$ =-5.77, $p<.001$). Tense did not merely serve as a tie-breaker, but instead affected choices not only when monetary amounts were equal (β=.23, $t(288)$ =10.44, $p<.001$), but also when the monetary outcomes differed (β=.08, $t(295)$ =4.76, $p<.001$).

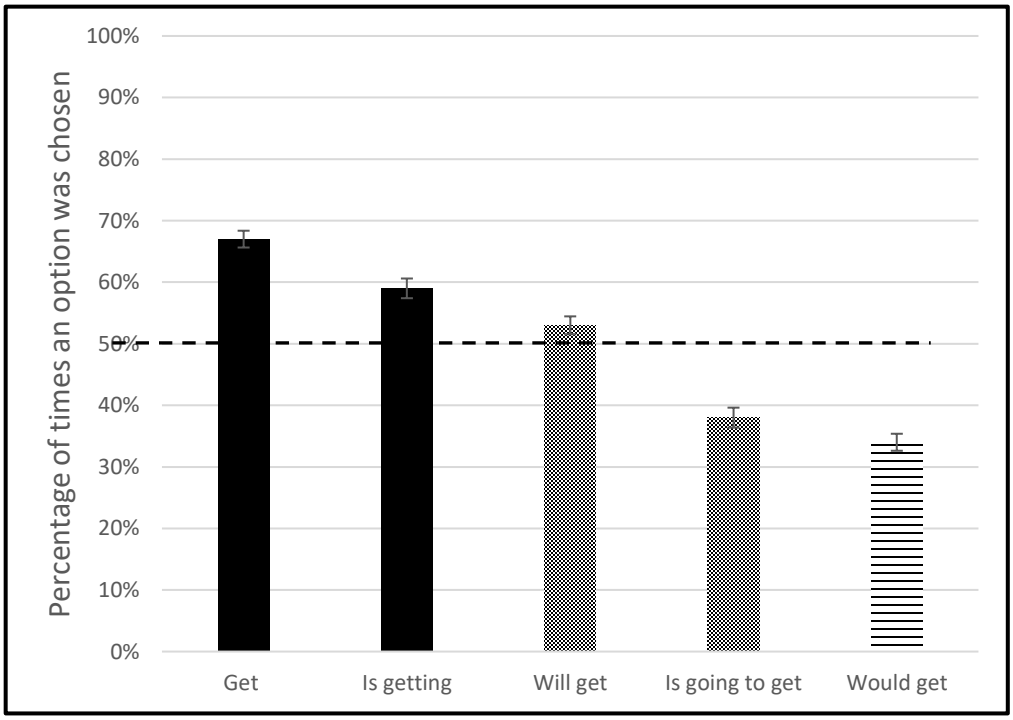

Fig 1b: The average percentage of times participants choose an option expressed in the present tense vs. future tense vs. neutral tense.

It is important to note, however, that the choice options used in this study included only small differences in magnitudes (i.e., no larger than $19 vs. $21). We ran a follow-up study (N=189), reported in Appendix A, which was identical to Study 1b except that the options ranged between $10 and $30, and no neutral tense was used. In this study, we found no significant sensitivity to present tense vs. future tense (β=.03, $t(188)$ =1.33, p=.184) and participants' choices were only predicted by the difference in monetary amounts between the two options (β=.04, $t(188)$=43.53, $p<.001$). This suggests that verb tense leads to relatively small or uncertain differences in inferred timing, that can be decisive when traded off against small magnitude differences but not relative to large differences in monetary amounts between options. We conduct further direct tests of amount magnitude as a moderator of sensitivity to verb tense in Studies 3 and 5b.

Study 2a: Intertemporal Choices

The stimuli in Studies 1a and 1b represent one extreme, in which the decision-maker has no timing information about the options whatsoever. In Study 2a, we test the opposite extreme, investigating the effect of verb tense when the objective timing of each option is provided. The inference and priming hypotheses provide differing predictions in this context. If verb tense is an effective prime to shift people's subjective sense of timing, then verb tense should continue to significantly predict choices, even when objective timing is presented. However, since there is no need for people to infer timing when the objective information is available, the inference hypothesis would predict no sensitivity to verb tense in this case.

Method

In this study (N=113), we administered a series of 18 intertemporal choices to AMT participants. Every participant made a series of choices between a sooner-smaller and a later-larger option, each specifying the (randomly determined) amount and the timing of each option. The sooner-smaller amounts occurred "today" and ranged between $10-$16. The later-larger amounts were between $3-6 more than the corresponding sooner-smaller option and occurred in 6-8 days, with amounts and delays randomized. The verb tense of both the sooner-smaller and later-larger option were independently and randomly varied within subjects, across questions. For example, participants would see questions like "Please choose between – 'You get $10 today' vs. 'You will get $15 in 6 days'." We also tested all the other verb tense variants, as in the previous studies. Out of these 18 intertemporal choices, 12 were test trials (with two options differing in verb tense), and 6 were filler trials (same verb tense for both options).

Results and Discussion

In this study, we found no effect of present vs. future tense (Fig 2a) on participants' choices. A regression analysis with clustered standard errors for the linear utility model (4) showed that choices were sensitive to differences in monetary magnitudes (β=.06, $t(111)$ =2.81, p=.006), but not to present vs. future tense (β=.01, $t(111)$ =1.11, p=.271) or differences in objective delay (β=.01, $t(111)$ =0.33, p=.739). The lack of sensitivity to tense in this study is consistent with the inferential hypothesis, but would not be predicted by the priming hypothesis. This result is also consistent with the results of Study 3 in Thoma & Tytus (2017), which found that the choice of a sooner-smaller option in an intertemporal question with objective delays did not differ by the tense of the option.

We also analyzed the results of the filler questions to check if choice of the later larger option was higher when both options are described in the future tense (vs. both in the present tense). We found no differences in the rate of choosing the later larger option (both options in present vs. both options in future: z=-.14, p=.889; both present vs. both neutral: z=-.5, p=.614; both future vs. both neutral: z=-.67,

p=.501). These results are consistent with a recent paper which showed that the inclusion of a future tense marker on both options (vs. on neither), had no effect on intertemporal choices in Chinese, when amounts and objective time were present (Chen et al. 2019).

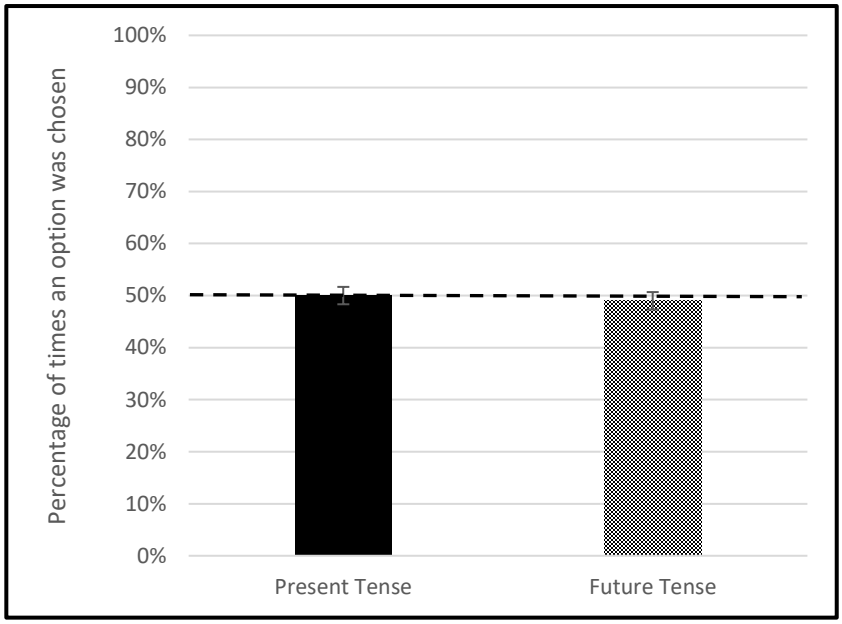

Fig 2a: The percentage of times participants choose an option expressed in present tense vs. future tense.

Study 2b: Testing Inattention

The difference in sensitivity to timing between Study 1b and Study 2a suggests that tense provides people with an approximate sense of timing, helping them choose when timing information is not available, but not influencing the use of objective timing information. However, an alternative interpretation is that people don't pay sufficient attention to any contextual cues when the choice options specify both amount and timing. To distinguish selective sensitivity to tense from general inattention, we contrasted tense with other contextual cues in the next study.

Method

In this study (N=1460), participants from AMT made two intertemporal choices: (1) between $30 today and $50 in 6 weeks and (2) between $30 in 6 weeks and $50 in 12 weeks.

Participants were randomly assigned to one of five between-subjects tense-display conditions: (1) both options in present tense, (2) both options in future tense, (3) the first option in present tense and the second in future tense, (4) the first option in future tense and the second in present tense, or (5) no tense information provided ("$30 today"). In this study, we used only one form of present tense ("is getting") and one form of future tense ("is going to get").

In addition, we tested two subtle cues that have been shown to impact intertemporal choices in prior research, "hidden-zeros" and "date-delay" framing. We varied whether the choice options specified the non-payments or not (e.g., "$30 today" or "$30 today and $0 in six weeks"). Highlighting these "hidden zeros" has been shown to increase choices of the later-larger option (Magen, Dweck & Gross 2008; Read, Olivola & Hardisty 2016). We also varied whether the timing was presented as a delay or a date (e.g., "in 6 weeks" or "on September 2d"). Prior research has found greater patience when the date is presented rather than the delay (Read et al 2005; LeBoeuf 2006). In all, the study included 20 conditions in a 5(tense-display) x 2(date vs. delay format) x 2(standard vs. hidden zero highlighted) between-subjects design (see Appendix B for question wording). Varying these other aspects of how the options are communicated provides a basis of comparison for assessing whether participants are sensitive to contextual cues in general, that will be useful as a baseline in interpreting the sensitivity to tense.

Results and Discussion

We found similar rates of choosing an option displayed in present tense or future tense (Fig 2b). We fit a linear utility regression analysis model with clustered standard errors, including additional terms for the other experimental treatments (date/delay and hidden zero) and the timing of the sooner-smaller option (today or in 6 weeks) as controls. Consistent with the results of Study 2a, we again found no

significant effect of present tense on intertemporal preferences, despite high statistical power (β=.02, t(1459) =1.40, p=.163).

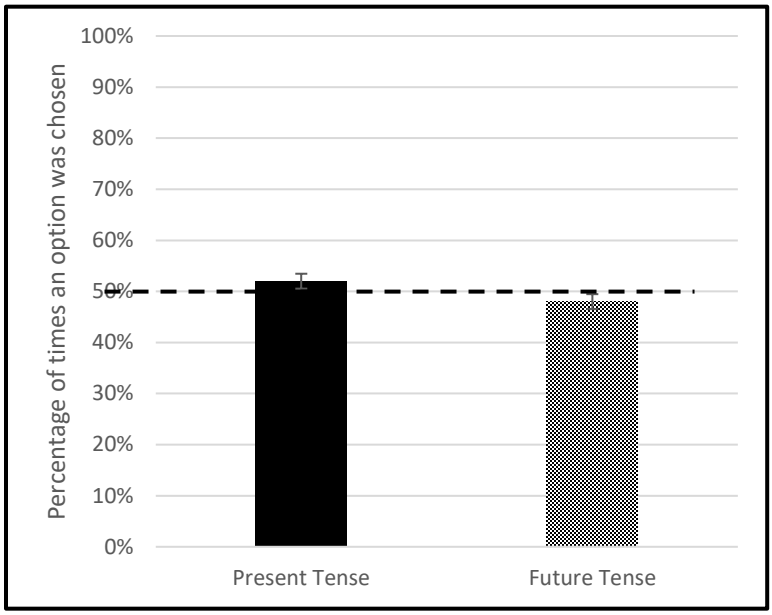

Fig 2b: The average percentage of times participants choose an option expressed in present vs. future tense, overall

By contrast, we found that participants were sensitive to the other subtle cues tested, strongly replicating findings from the prior literature. Consistent with the date-delay effect, people were less likely to choose the sooner-smaller option when the delays were presented as the length of delay rather than the date of the payment (β=.14, t(1459)=7.87, p<.001). Likewise, we replicated the hidden zero effect, with more patient choices when the hidden zeros were shown (β=-.17, t(1459)=-9.19, p<.001). We did not find a difference based on the timing of the sooner-smaller option, although recent research indicates that present-bias is only detectable with a sufficiently long common delay (Jang and Urminsky 2020).

The lack of sensitivity to verb tense was robust to differences in presentation format (date vs. delay, hidden-zero present vs. absent, sooner-smaller today or in 6 weeks; see Appendix A). Since participants were highly sensitive to other contextual framing cues, these results suggest that people specifically neglect tense when the exact timing is presented, and rule out general inattention. In the next

study, we systematically test whether the absence vs. availability of objective timing information moderates sensitivity to verb tense.

Study 3: Different type of timing information

Thus far, across studies, we have found that presenting a choice option in present tense increases preferences for that option (vs. an alternative option in future tense), but only when no timing information is present and when the magnitude difference between options is small, consistent with the inferential hypothesis. However, the studies thus far have only tested the two extremes: timing information that is either objective or completely absent. In everyday conversation, however, objective timing information may be lacking because people use ambiguous time words instead. A friend might promise to return money they had loaned "soon" rather than "in 2 days", for example. Ambiguous temporal words such as "soon" and "later" are informative but require interpretation as to the timing of an outcome. Since ambiguous timing words are consistent with a range of timing values, inference from the verb tense may be used to reduce the uncertainty (e.g., based on the conversational implicature assumption that relevant information is being conveyed). On the other hand, people making an intertemporal choice may treat even ambiguous timing words (along with other cues, like amounts) as sufficiently informative, and may either overlook or choose not to rely on verb tense in making their choices. .

In this study, we vary the timing information between-subjects, presenting either no timing information, ambiguous timing words, or objective quantitative timing for the intertemporal choice options.

Method

Participants (N=660) from AMT were randomly assigned to one of four timing-information conditions: (1) both options had *no timing* information ("You get $30" vs. "You will get $35") , (2) both options had *objective timing* ("You get $30 in 1 day" vs. "You will get $35 in 7 days"), and two

ambiguous timing conditions, in which (3) the sooner-smaller option was described as "soon" and the later-larger option was described as "later" ("You get $30 soon" vs. "You will get $35 later"), or (4) the sooner-smaller option was described as "now" and the later-larger option was described as "at some point" ("You get $30 now" vs. "You will get $35 at some point"). The first condition, with no timing information, had a larger sample size than the other conditions, because we planned to compare it to the other conditions as our primary analysis. Conditions 1 and 2 are replication tests of our prior studies, while Conditions 3 and 4 extend our investigation to ambiguous timing words.

Each participant made 15 intertemporal choices. Across these choices, we randomized the verb tense (across two present-tense forms, two future tense forms and the neutral tense). Out of these 15 questions, 10 were test questions (different tense forms in both options) and 5 were filler questions (the same tense form in both options). We also varied (within subjects) the difference in magnitude between the sooner-smaller amounts (between $30 and $35) and the later-larger amounts (between $1 and $30 more than the sooner-smaller). This design allows us to test whether the effect of tense on intertemporal preferences depends on the available timing information or on the magnitude differences between the options.

Results and Discussion

No Timing information

In the no-timing-information condition, we replicated the results of Study 1a. The linear utility model regression analysis with clustered standard errors revealed higher subjective utility for options in the present tense than in future tense (β=.04, $t(254)$= 5.28, $p<.001$). In addition, the effect of present vs. future tense on intertemporal preferences was significantly moderated by the magnitude of difference in amounts between the two options (interaction β=.003, $t(254)$=2.20, p=.029; Figure 3a).

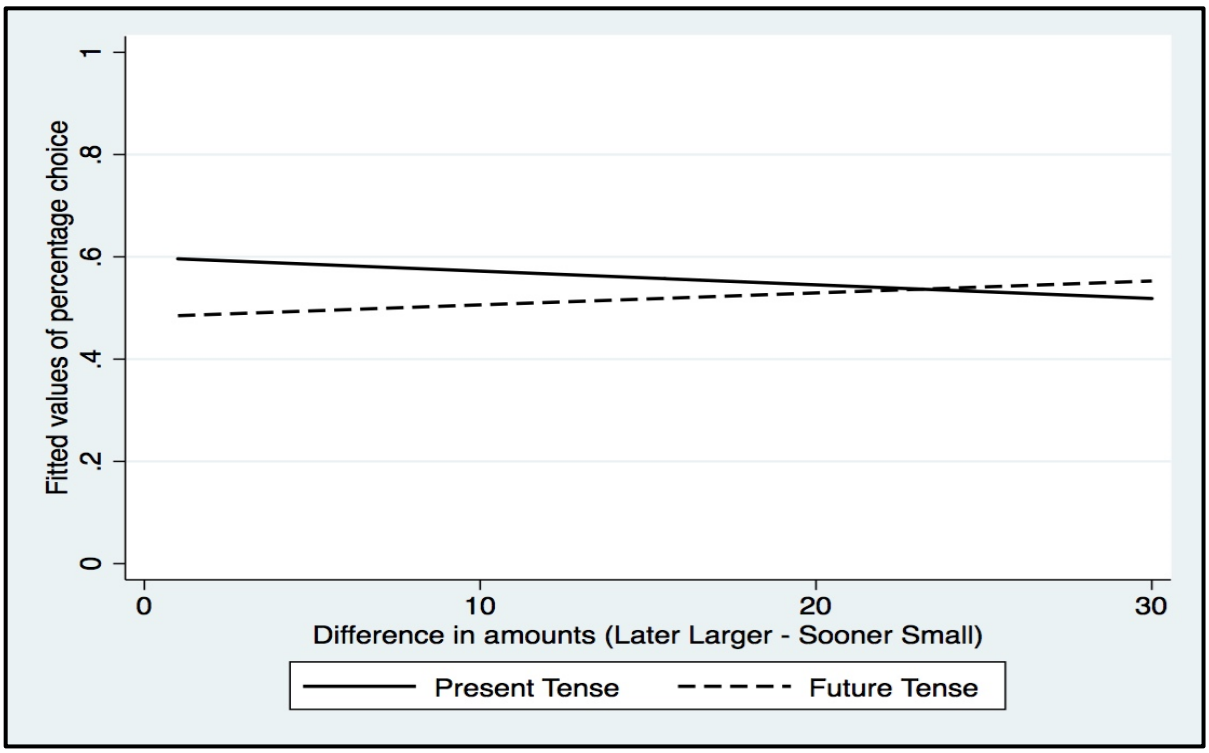

Fig 3a: The fitted values of percentage of times an option with present tense is chosen compared to an option with future tense, as a function of the difference in the amounts between the two options, when no timing information was present.

Objective Timing Information

By contrast, in the objective timing information condition present vs. future tense had no significant effect on choice overall in the linear utility regression analysis with clustered standard errors, replicating Studies 2a and 2b (β=.003, $t(130)$= 0.31, p=.755). This result was not moderated by the magnitude of difference in the amounts between the two options (interaction β=.002, $t(130)$=1.34, p=.184; Fig 3b).

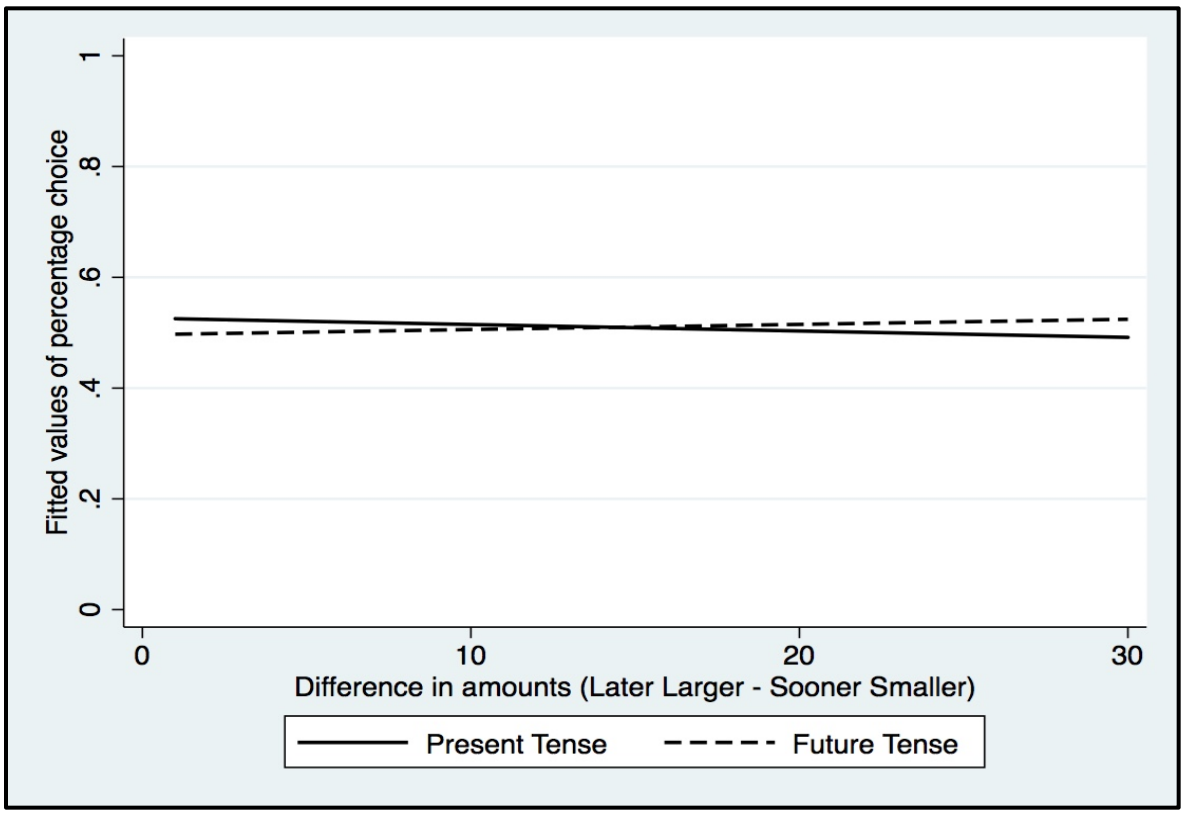

Fig 3b: The fitted values of percentage of times an option with present tense is chosen compared to an option with future tense, as a function of the difference in the amounts between the two options, when objective timing information was present.

Next, we investigate whether people rely on tense when choosing between options characterized by ambiguous timing words (e.g., “soon” vs. “later” or “now” vs. “at some point”) that do not specify the exact timing of the options.

Ambiguous timing information

Based on a linear utility regression analysis with clustered standard errors, in Condition 3, when the SS option was described as “soon” and the LL option as “later”, tense did not significantly impact choice (β=.02, t(126)=1.27, p=.206), and this was not moderated by magnitude (interaction β=.001, t(126)=0.79, p=.432; Fig 3c).

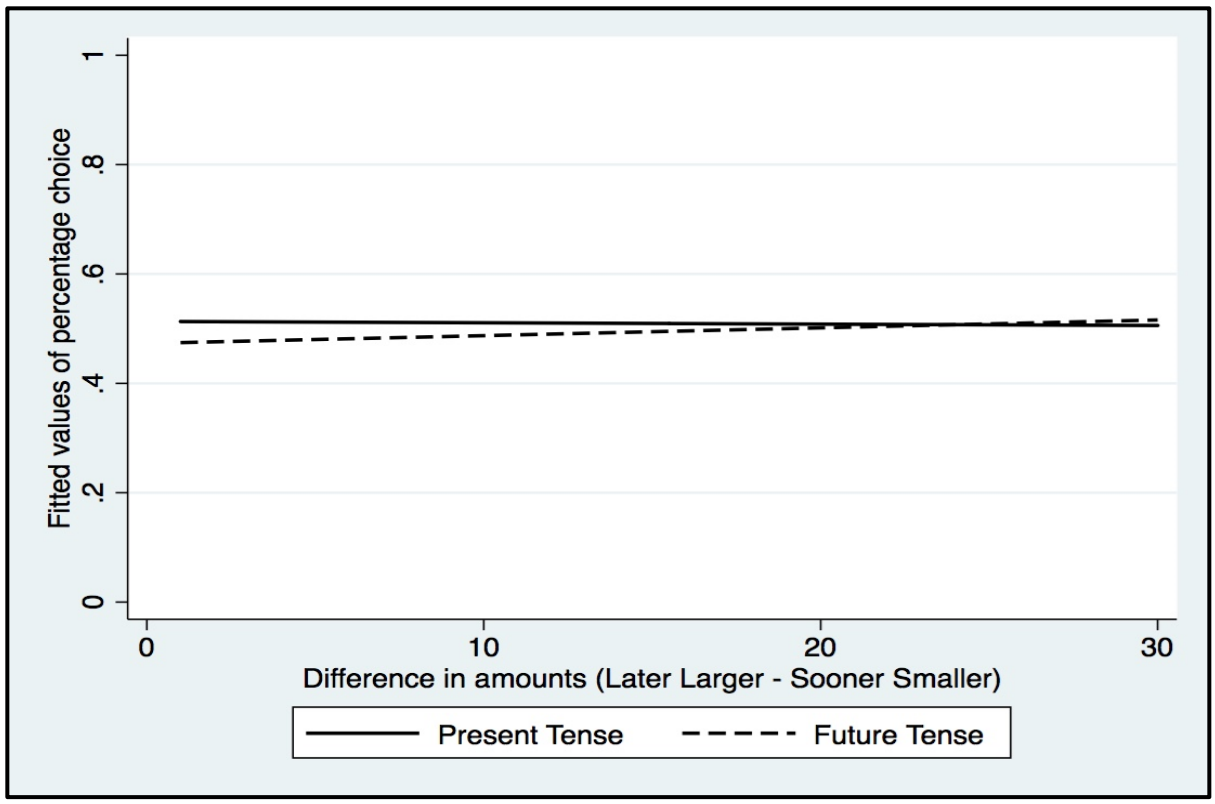

Fig 3c: The fitted values of percentage of times an option with present tense is chosen compared to an option with future tense, as a function of the difference in the amounts between the two options, when ambiguous timing information ("soon" vs. "later") was present.

Finally, based on the linear utility regression analysis with clustered standard errors, in Condition 4, where the SS option occurred "now" and the LL would be "at some point", the pattern of results was similar. Present tense was not a significant predictor of choice (β=-.001, t(146)=-.19, p=.847), however the interaction between magnitude and tense was borderline significant (β=.002, t(146)=1.98, p=.050), as depicted in Fig 3d.

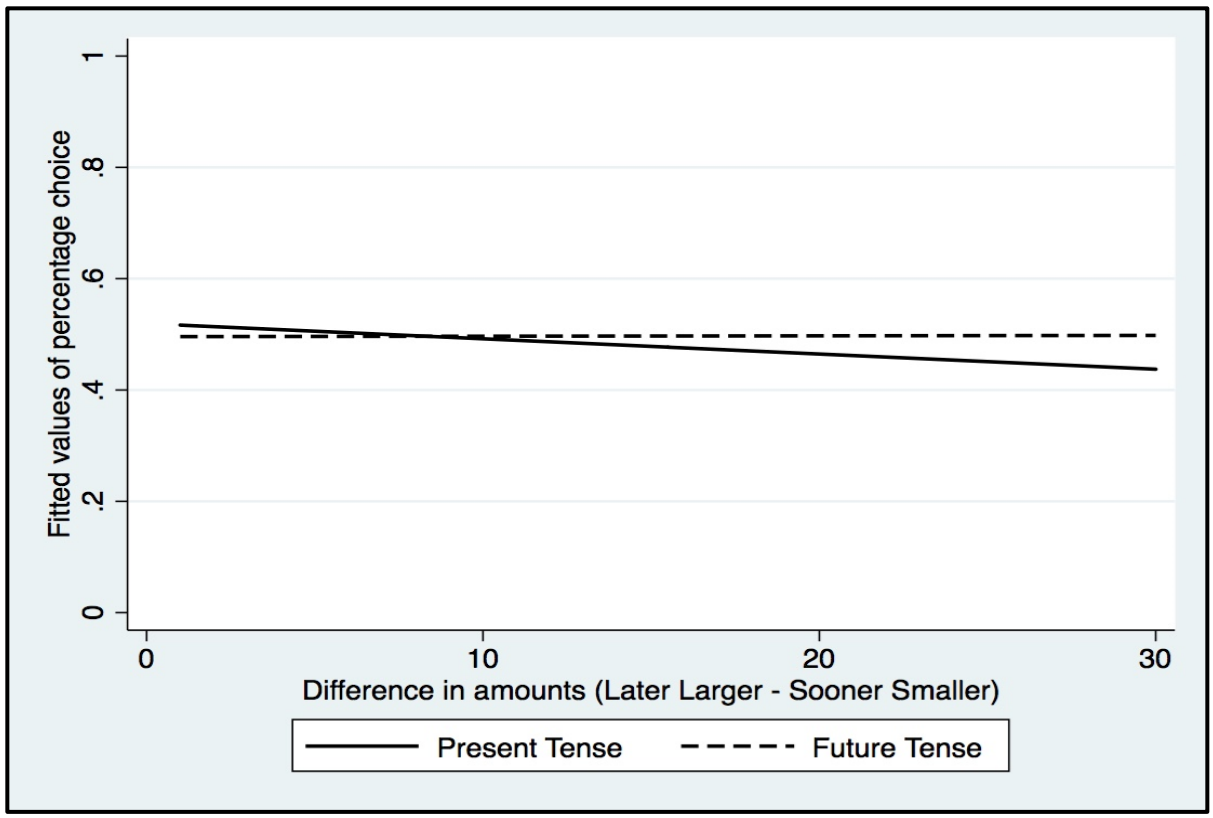

Fig 3d: The fitted values of percentage of times an option with present tense is chosen compared to an option with future tense, as a function of the difference in the amounts between the two options, when ambiguous timing information ("now" vs. "at some point") was present.

Overall, pooling across the conditions (no timing, objective timing, and ambiguous timing), we find that the available information is a moderator of sensitivity to tense. Tense predicts choice when the timing information is absent, but not when objective timing information is present (interaction β=-.08, $t(659)$=-6.94, $p<.001$). Similarly, the impact of tense is eliminated when even ambiguous timing information is present (β=-.08, $t(659)$=-7.38, $p<.001$). This suggests that introduction of *any* timing information to the choice options attenuates the impact of tense on choice that is observed in the absence of timing information.

Discussion

We again confirm that people prefer options described in present tense significantly more than options described in future tense when no other timing information is available and the difference in

amounts is small. However, no effect of verb tense was found when any other type of timing information (either objective or ambiguous) was provided to the participants.

There are multiple possible explanations for why people neglected verb tense when ambiguous timing information was available. It may be that the ambiguous timing words provided enough information for participants to make their decision. In this study, the ambiguous words clearly distinguished between the earlier ("now" or "soon") and more delayed ("at some point" or "later") options. To the degree that participants did not engage in tradeoff-based reasoning, simply identifying the earlier option may have provided all the information they needed to make a decision. If this is the case, we would expect people to be sensitive to verb tense when ambiguous timing information does not clearly identify which option occurs earlier.

The lack of sensitivity to verb tense when even ambiguous timing information is present is inconsistent with the priming hypothesis but is potentially compatible with an inference hypothesis. From the perspective of conversational implicature, participants may have concluded that although the ambiguous timing words did not provide sufficient information to decide, no more precise information (i.e., as communicated by verb tense) could be or was intended to be conveyed.

Alternatively, participants may have focused on the more salient ambiguous timing words and neglected to spontaneously incorporate verb tense. Thus, the lack of sensitivity to verb tense when ambiguous timing information is available can be understood in terms of cue competition (Kamin, 1969; Rescorla and Wagner, 1972; Dickinson et al., 1984), in which people ignore less salient cues that they otherwise find informative (verb tense) when another more salient cue (timing information) is available. In the next two studies, we investigate these three competing accounts (informativeness, implicature and cue competition), by testing the effects of verb tense on people's reasoning when provided with ambiguous timing information that does *not* identify which of the options will occur first.

Study 4a: Inferences with the same ambiguous timing information

In this study, we test the effect of verb tense on people's prompted inferences about timing (as in Study 1a), but in this case both options are characterized by the *same* ambiguous timing word. We saw in Study 1a that people inferred earliness from verb tense when no timing information was present. In this study, we tested whether presenting the same ambiguous timing information in both options (and therefore providing no information about which occurs earlier) would also lead people to rely on tense to infer earliness.

Method

AMT Participants (N=230) were asked to judge which of two options occurred earlier. Across the 9 questions, we varied both the tense ("get" or "will get" or "would get") of each option and the ambiguous timing word used to characterize both options. For example, participants were asked "Which do you think occurs earlier? – 'John gets $20 soon' or 'Bob will get $20 soon'." Only the verb tense varied between the two options, as the amount was fixed at $20 and the vague word presented was either "soon" for both options, "later" for both options, or "at some point" for both options. Verb tense was the only varying factor across questions in this study, so there were no filler questions and all 9 questions were test trials.

Results and Discussion

As shown in Fig 4a, participants were more likely to identify an option in present tense as earlier than an option in future tense, regardless of the ambiguous word used to characterize both options. Based on a linear utility regression analysis with clustered standard errors, participants inferred that an option described with an ambiguous temporal word in present tense would occur earlier than the same option described in the future tense, regardless of which ambiguous timing word characterized both options (for

"soon": β=.48, t(229)=9.15, p<.001; for "later": β=.27, t(229)=4.66, p<.001; for "at some point": β=.24, t(229)=4.02, p<.001) .

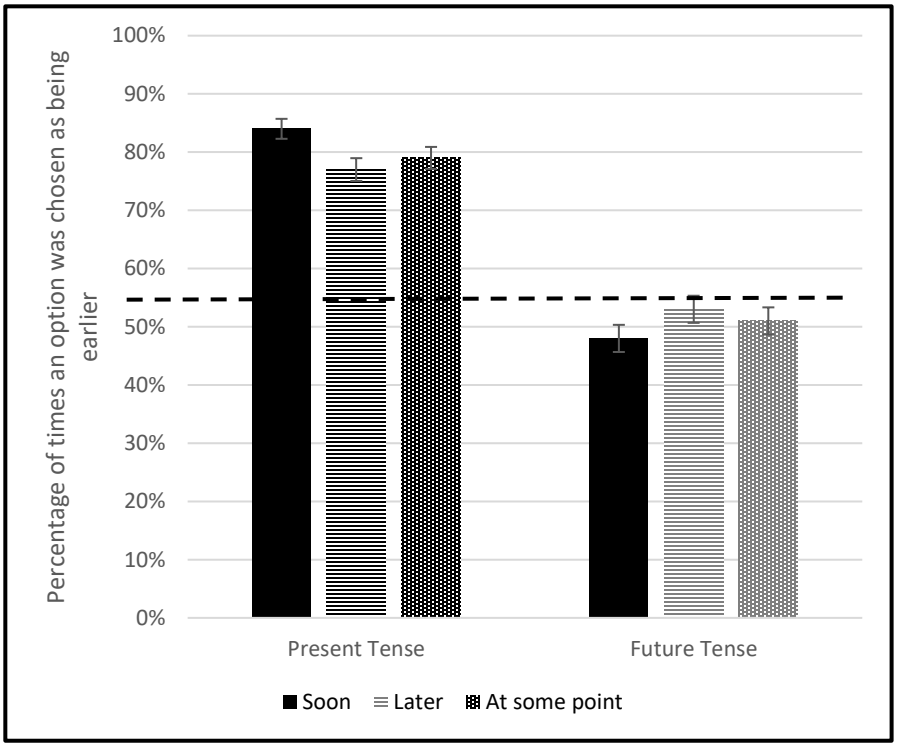

Fig 4a: The average percentage of times participants chose the option expressed in the present tense vs. future tense, split by ambiguous word

The results of this study reveal that participants consistently infer timing from verb tense, when prompted to do so, even in the presence of non-diagnostic ambiguous timing information.

Study 4b: Choices with the same ambiguous timing information

Given that people can make inferences from verb tense, even when uninformative ambiguous timing words are displayed, we next tested whether tense would impact choices when the same ambiguous timing words characterize both options. If, in Study 3, people only ignored tense because they could infer order of timing without tense, then when people see the same uninformative ambiguous timing word characterizing both options, they should rely on tense for making choices.

Method

Participants (N=221) from AMT made 10 choices between two options, varying the monetary amount and verb tense but using the same ambiguous-word characterization (either "soon" or "later", depending on the question) for both options. For example, participants were asked questions like "Please choose between: 'You get $19 soon' vs. 'You will get $20 soon'." The amounts ranged between $19 and $21, as in Study 1b. We used both forms of present tense ("get" and "is getting"), both forms of future tense ("will get" and "is going to get"), as well as neutral tense ("would get"). There were no filler questions in this study.

Results and Discussion

Even though the same ambiguous word was used to characterize both the options in each question, and therefore the timing words did not identify the order of the outcomes, the verb tense had no detectable effect on choices (Fig 4b). Based on a linear utility regression analysis with clustered standard errors, options described in present tense were not significantly more likely to be chosen than options described in future tense, either when both options were presented as "soon" (β=-.005, t(220)=-0.23, p=.818) or as "later" (β=-.018, t(220)=-0.73, p=.468).

These results suggest that the mere presence of non-informative ambiguous timing words prevented people from spontaneously incorporating tense into their decisions, even though they did rely on verb tense when prompted to make inferences in Study 4a. This cannot be explained by people having sufficient information about the order of outcome timing, as could have been the case in Study 3, to decide. The results are instead consistent with a cue-based inference account, in which the presence of the ambiguous timing cue distracted people from processing the tense cue when making choices (Study 4b), unless explicitly prompted to search for more cues by the direction to make a timing inference (in Study 4a). However, the findings could also be consistent with an implicature interpretation, if the use of the

same ambiguous timing word in both choice options was interpreted as signaling that no additional timing information was being conveyed (which may not have been the case when people were explicitly prompted to make an inference in Study 4a).

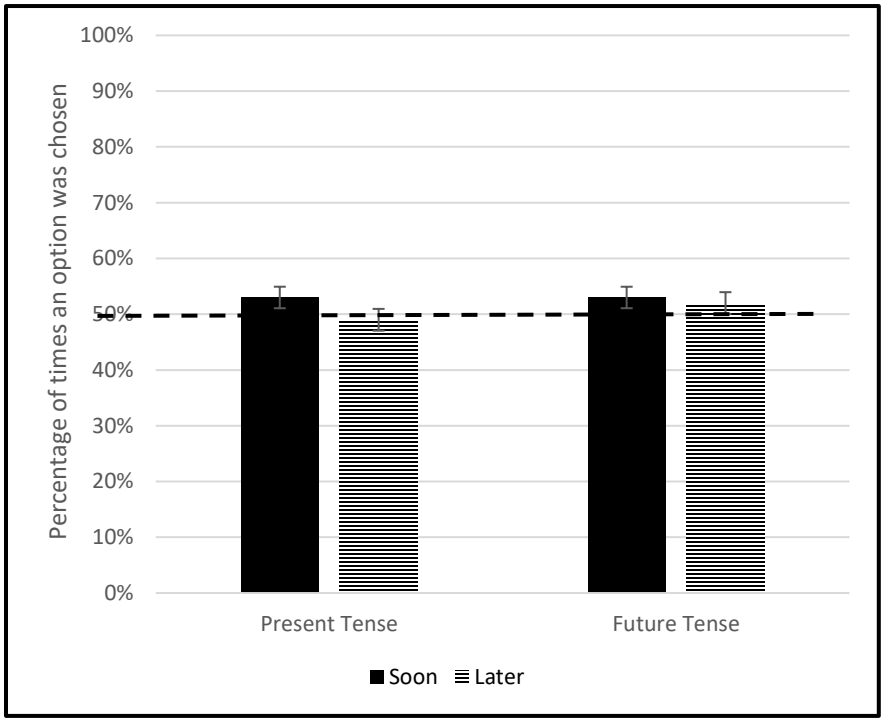

Fig 4b: The average percentage of times participants chose the option expressed in present vs. future tense, split by ambiguous word

Study 5a: Inferences with distinct qualitative timing information

To test between the two remaining possibilities (implicature and cue-based inference), we first identified pairs of distinct ambiguous timing words that nevertheless convey the same timing. This allowed us to present people with choice options described using different ambiguous timing words that have a similar meaning. This was done so as not to signal that both options will occur at the same time, allowing tense to potentially be used to infer which was earlier, per the implicature account. We conducted two pre-tests (see Appendix B) which identified two pairs of words as yielding very similar estimates of

which occurred earlier: ‘someday’ (47%) vs. ‘eventually’ (53%, $t(46)=-0.43$, $p=.67$); and ‘promptly’ (52%) vs. ‘quickly’ (48% , $t(76)=-0.34$, $p=.73$).

We used these two pairs of ambiguous words because we wanted one pair to indicate a more immediate timeframe (‘promptly’ and ‘quickly’), and another to indicate a more delayed timeframe (‘someday’ and ‘eventually’) in order to test the range of timing words. In another pre-test, we confirmed that ‘promptly’ and ‘quickly’ were both inferred as occurring earlier (by approximately 80% of people) than ‘someday’ and ‘eventually’ (by approximately 8% of people, all p’s<.001; see Appendix B).

We saw in Studies 1a and 4a that people inferred earliness from verb tense either when no timing information was presented, or when the same ambiguous timing word was present in both options. In this study, we tested whether presenting options characterized by distinct (but similar-meaning) ambiguous timing information (and therefore not signaling that both options may occur at *exactly* the same time) would also lead people to rely on tense to infer earliness when prompted.

Method

AMT Participants (N=113) were asked to judge which of two options occurred earlier. Across the 24 questions, we varied both the tense (“get” or “will get” or “would get”) of each option and the pair of ambiguous timing words used to characterize both options (counterbalanced). For example, participants were asked “Which do you think occurs earlier? – ‘John gets $20 promptly’ or ‘Bob will get $20 quickly.” Across the questions, only the verb tense and the ambiguous word varied between the two options, as the amount was fixed at $20. Each choice pair used either immediate or delayed words -- people always saw ‘promptly’ only paired with ‘quickly’, and ‘someday’ only paired with ‘eventually’. There were no filler questions in this study.

Results and Discussion

As shown in Fig 5a, participants were more likely to identify an option in present tense as earlier than an option in future tense, regardless of the ambiguous word pair used to characterize both options. Overall, based on a linear utility regression analysis with clustered standard errors, participants inferred that an option described with an ambiguous temporal word in present tense would occur earlier than the corresponding option described with the other ambiguous temporal word in the future tense, regardless of which ambiguous timing word pair characterized both options (for the immediate pair 'promptly' vs. 'quickly': β=.09, $t(112)$=4.51, p<.001; for the delayed pair 'someday' vs. 'eventually': β=.07, $t(112)$=3.91, p<.001) .

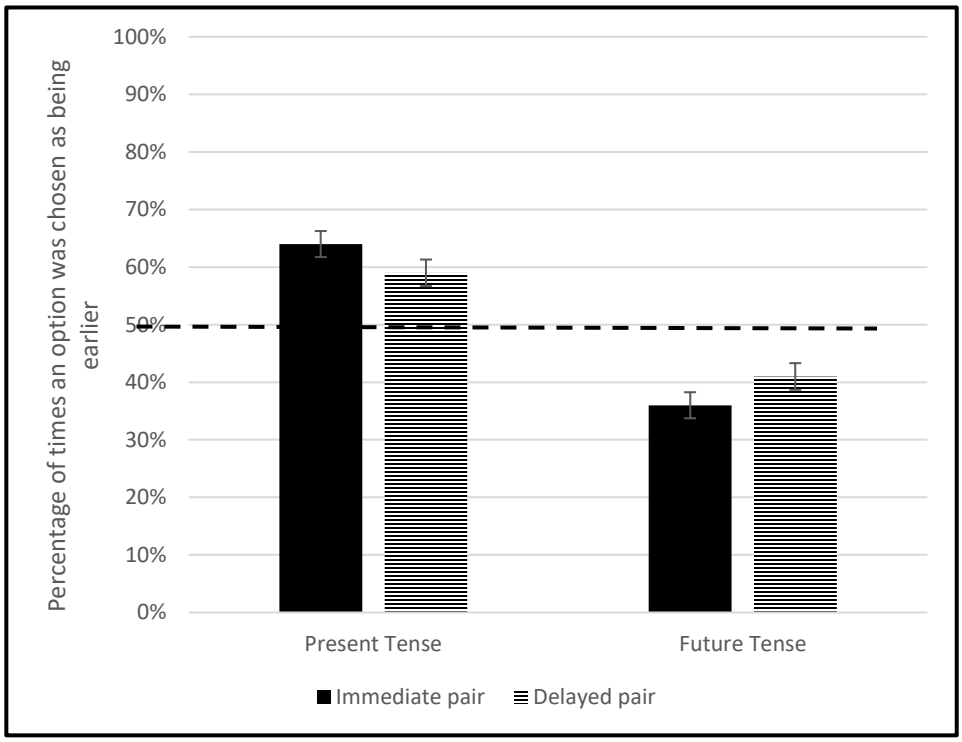

Fig 5a: The average percentage of times participants chose the option expressed in the present tense vs. future tense, split by ambiguous word pair

The results of this study reveal that when people encounter distinct ambiguous words which indicate similar timing (but which do not clearly indicate which is first as in Study 3), they rely on a secondary cue, verb tense, when prompted to infer timing.

Study 5b: Choices with distinct qualitative timing information

The inferences observed in Study 5a were consistent with both the implicature and cue-based versions of the inference hypothesis. In this study, we tested between the two accounts by testing choices using the same pairs of distinct ambiguous timing words as in Study 5a. If the implicature version is correct, then people will rely on tense to make choices between options involving distinct ambiguous timing words. On the other hand, if the cue-based account is right, then tense will not impact choices, because the presence of the ambiguous timing words would block spontaneous incorporation of the verb tense.

Method

Participants (N=403) from AMT were randomly assigned to two conditions. In the sooner-timing condition, participants were shown choice options with the immediate pair of words ('promptly' vs. 'quickly'), while in the later-timing condition they were shown options with the delayed pair of words ('someday' vs. 'eventually'). Participants then made a series of 16 choices between two options that varied in verb tense (each option in either present or future tense), with the order of the ambiguous timing words counterbalanced.

We also varied the differences in option amounts within-subjects, such that participants made choices both between options with small differences in one block (values for both options ranging from \$19-21) and between options with large differences in another block (values for both options ranging from \$10-30). In this study, we use only one form of present tense ("get"), and one form of future tense ("will get"). Out of these 16 questions, 8 were test trials, with participants choosing between two options using different tenses, and 8 were filler trials, with participants choosing between two options expressed in the same tense.

Results and Discussion

Once again, based on a linear utility regression analysis with clustered standard errors, we found that people were not sensitive to present vs. future verb tense, even when choosing between two options described with different but similar-meaning ambiguous timing words. For the immediate timing words, the insensitivity to present tense held both when tested overall (β=.02, t(200)=1.30, p=.194), and whether the options had small (β=.03, t(200)=1.34, p=.183) or large (β=-.001, t(200)=-0.03, p=.980) monetary differences (.interaction between tense and monetary difference: β=-.0003, t(200)=-.14, p=.887). This suggests that people did not spontaneously use present tense as a cue for resolving their uncertainty about which of two options described in immediate terms (e.g., as promptly vs. quickly) would occur earlier when making choices between the two options (Fig 5b.1). Consistent with the pre-test results, respondents did not prefer options described with one ambiguous timing word over the other (β=-.05, t(200)=-1.05, p=.294).

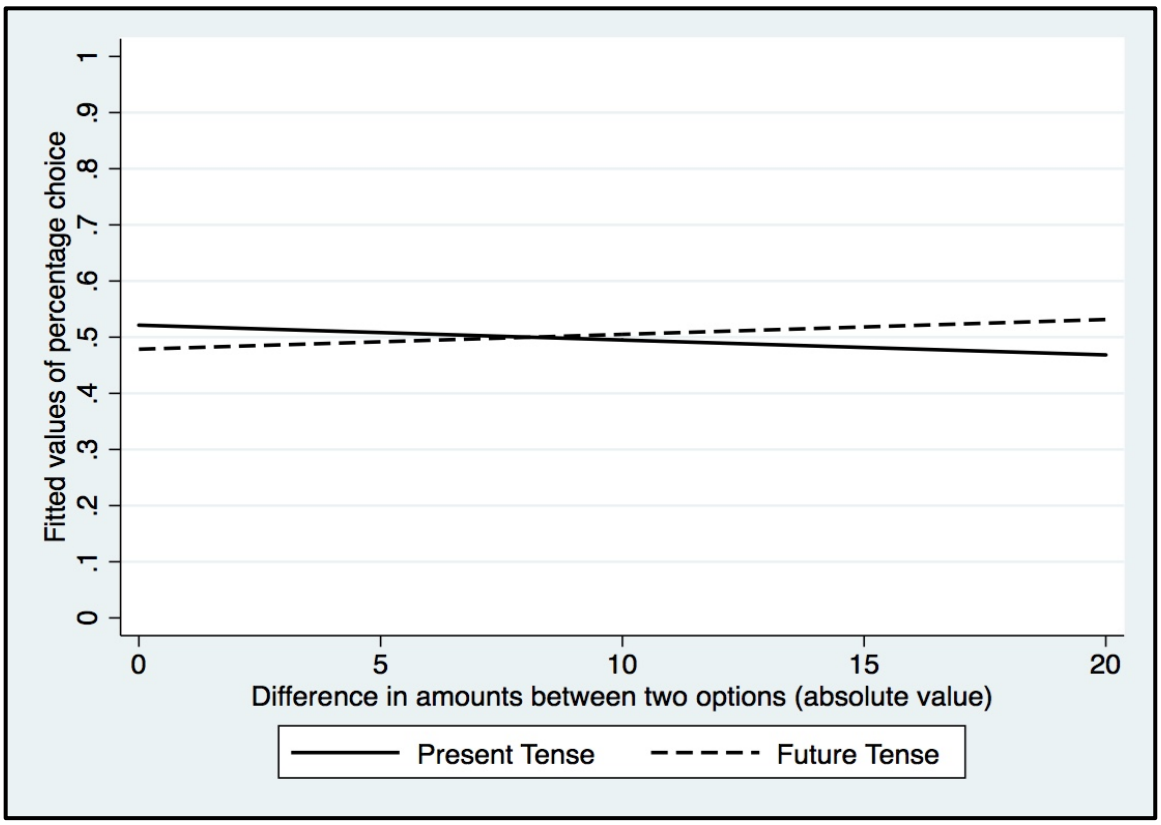

Fig 5b.1: The fitted values of percentage of times participants chose the option expressed in the present tense vs. the future tense over the absolute value of differences in monetary amounts between options (promptly vs. quickly)

Among people who saw the delayed pair of timing words ('someday' vs. 'eventually'), there was an unexpected preference for the option described in the *future* tense ('will get'), both overall (β=-.02, t(201)=-2.08, p=.039), and specifically when differences in amounts were small (β=-.05, t(201)=-2.72, p=.007). However, no difference was found when the amounts were large (β=.004, t(201)=-.23, p=.821) and the interaction between tense and monetary difference between the two amounts was also not significant (β=-.003, t(201)=-1.21, p=.226). Fig 5b.2 depicts these differences. Again, consistent with the pre-test results, respondents did not prefer options described with one ambiguous timing word over the other (β=-.08, t(200)=-1.81, p=.071).

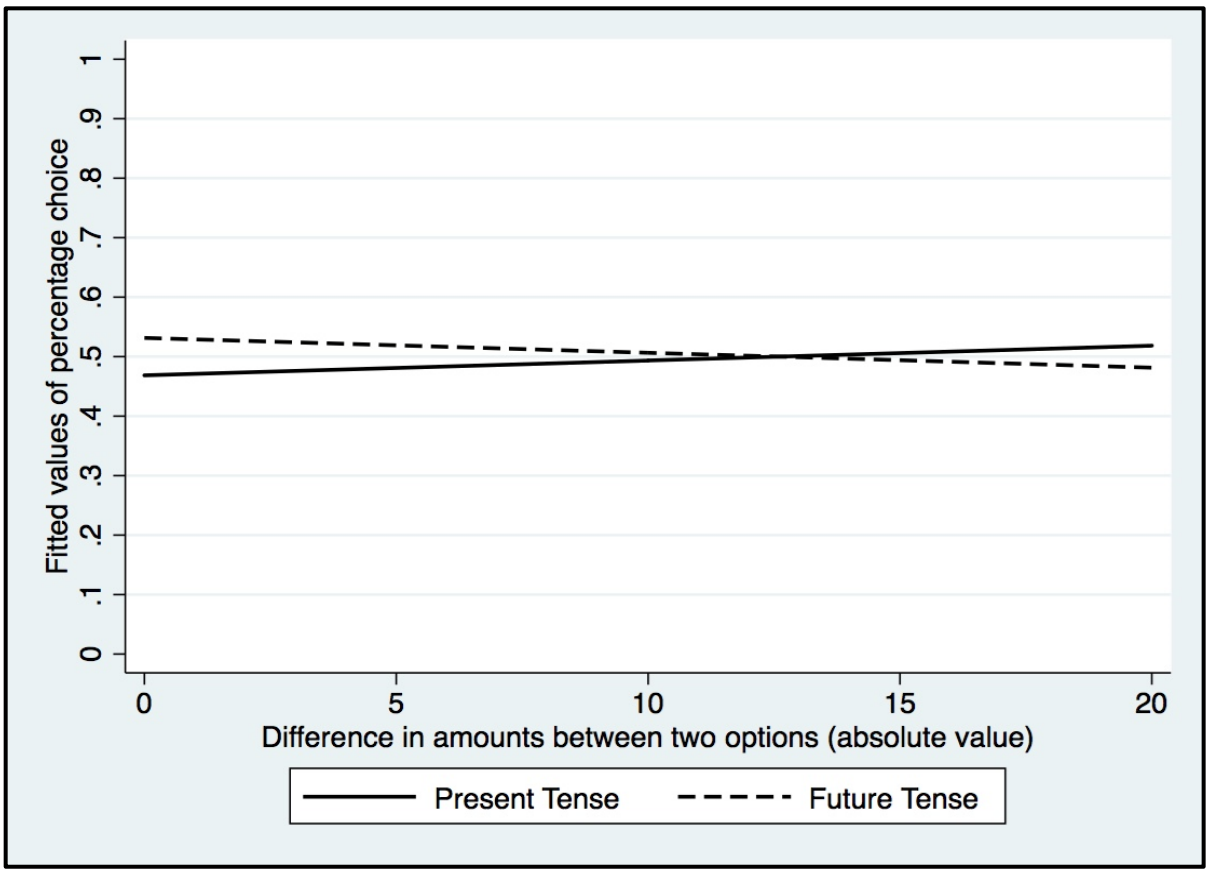

Fig 5b.2: The fitted values of percentage of times participants chose the option expressed in the present tense vs. the future tense over the absolute value of differences in monetary amounts between options (someday vs. eventually)

The significantly higher preference for the future tense option when the amounts are small is unlikely to have occurred because people preferred to receive a *later* outcome (as implied by the inferences in Study 5a). Instead, this result suggests that participants may have spontaneously used tense to draw *non-timing* inferences favoring the future tense option (e.g., such as potentially seeing the future tense "will get" as more likely to occur than the present tense "get", as supported by a post-test, see Appendix B). In any case, neither of the conditions in Study 5b provide evidence that people making choices spontaneously used tense to infer timing when the options were presented using two different ambiguous timing terms.

These findings are therefore not consistent with the predictions of an implicature account in which participants infer from the use of two different words that the timing of the options differs and then use tense to infer which is earlier. When explicitly asked to make inferences about earliness, people rely on multiple cues, including verb tense, not just the ambiguous timing words, which are insufficient to resolve the question. By contrast, when people make choices, the presence of ambiguous timing word cues block reliance on verb tense as a timing cue. Overall, these results are most consistent with the cue-based version of the inference hypothesis and suggest that the process of multiple-cue inference may be more complex and context-dependent than previously identified.

General Discussion

In this paper, across nine studies, we tested the role of verb tense in intertemporal judgments and decision-making. We find that people do make consistent earliness inferences from verb tense, when prompted to do so, with events described in the present tense perceived as occurring sooner than events described in the future or neutral tense. A meta-analysis of all the studies summarizes the earliness inferences in Fig 6 below. Present tense is seen as occurring earlier than future tense either when no timing information is provided (β=.33, $t(247)$=23.34, $p<.001$) or when ambiguous timing information is presented (β=.1, $t(342)$=6.77, $p<.001$). The presence of ambiguous timing words significantly reduces the reliance on verb tense in prompted timing inferences (interaction between tense and timing information: β=-.24, $t(590)$=-11.12, $p<.001$).

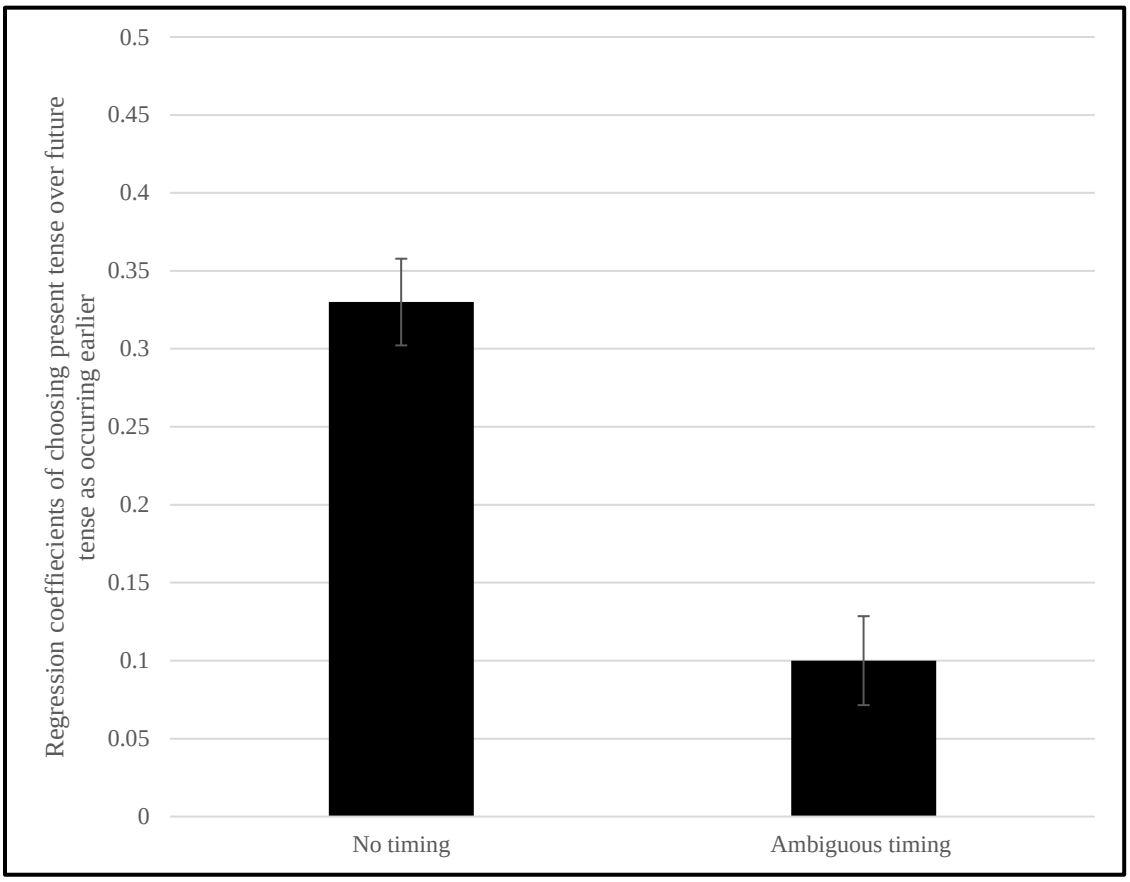

Fig 6: The regression coefficients of present tense (compared to future tense) impacting earliness inferences, by no timing and ambiguous timing conditions.

Even though we found a consistent impact of tense on prompted earliness inferences, the evidence for a spontaneous effect of verb tense on intertemporal choices was much more limited. Specifically, verb tense only impacted choices in the highly impoverished situation when no timing information of any kind (informative or not) was present. Furthermore, as shown in Figure 7, a meta-analysis of all the intertemporal choice studies in this paper reveal that even when no timing information was presented, tense only impacted choices when the magnitude of differences between the amounts was small (β=.1, $t(711)=9.32$, $p<.001$), but not when the differences were large (β=.01, $t(327)=1.18$, $p=.240$), a significant interaction (β=.09, $t(739)=9.01$, $p=.001$). Tense did not significantly impact choices when either ambiguous or objective timing information was presented (all *p*s>.1), and this was not moderated by differences in amounts (*p*s > .1; see Tables in Appendix A).

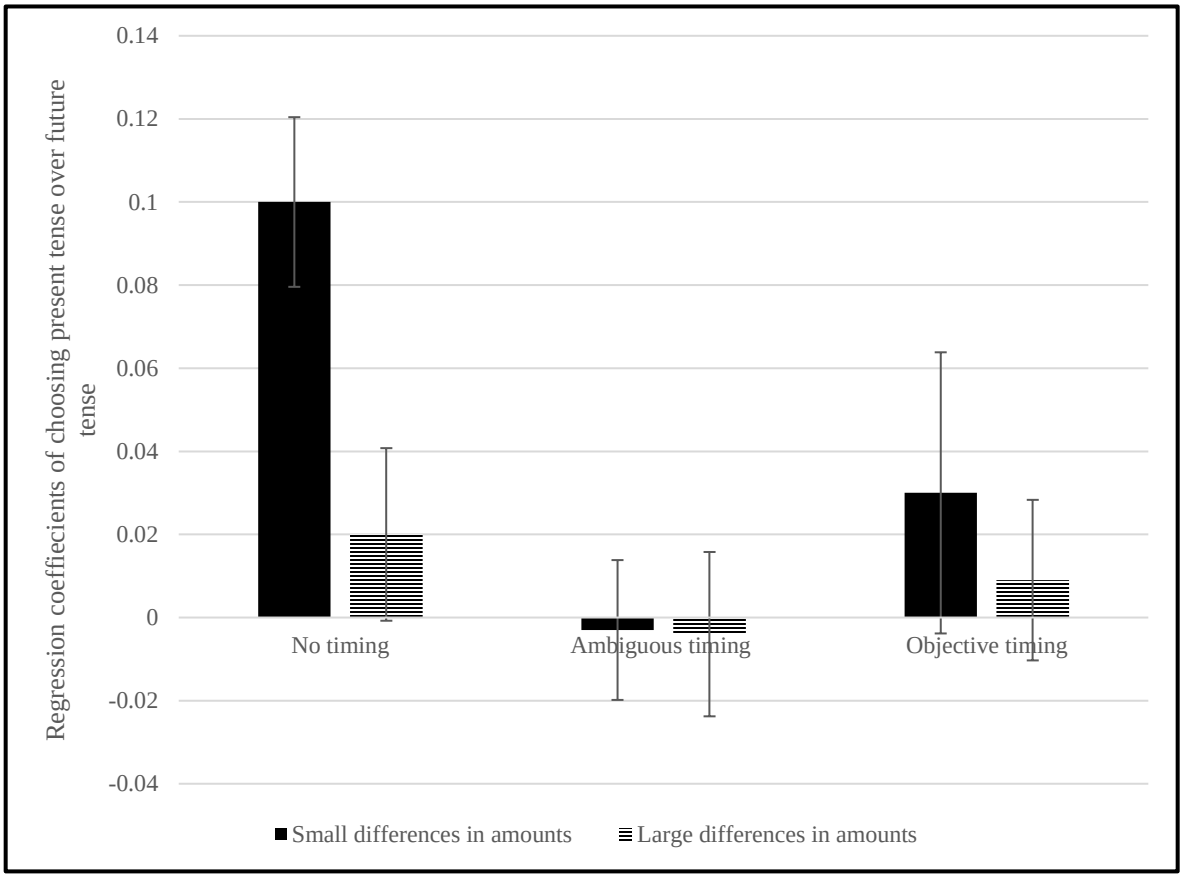

Fig 7: The regression coefficients of present tense (compared to future tense) on intertemporal choices, by timing conditions and size of magnitude differences in amount.

Our studies were designed to test under what conditions verb tense influences intertemporal preferences, with a focus on three possibilities: priming and two types of inference – implicature and cue-based. The priming hypothesis proved inconsistent with the results, since tense did not have a significant effect on choices when the options specified either objective timing (Studies 2a, 2b, 3 and meta-analysis) or ambiguous timing information (Studies 3, 4b, 5b, and meta-analysis). The results, for both judgments and choices, were instead best explained by an inference hypothesis. In particular, the results of Studies 4 and 5 point to a cue-based inference account, instead of implicature-based inference. Faced with outcomes described with ambiguous timing words, people used verb tense to judge relative timing when prompted, but did not spontaneously use verb tense to disambiguate timing when making

choices, contrary to the implicature account and consistent with cue-competition between timing words and verb tense.

Across the studies, we rule out alternative accounts. The lack of sensitivity to verb tense when timing words are present cannot be explained by inattention, since participants were influenced by other subtle cues previously identified in the literature (Study 2b). The results also cannot be explained by timing words providing sufficient information for respondents to make decisions, as the insensitivity to verb tense occurred in choices but not judgments, when both options were described with the same timing word (Study 4) or with different but similar-meaning timing words (Study 5). Overall, we conclude that verb tense is used as a cue for timing in intertemporal choices only when no other timing cue blocks its usage, even though verb tense is consistently used to make prompted relative timing inferences.

While we find that verb tense can impact how people make intertemporal choices, ultimately, this mechanism is insufficient to explain the relationship between language and explicit intertemporal choices demonstrated by Falk et al (2018) or, more broadly, between language and savings demonstrated by Chen (2013). On the one hand, our results show that people consistently use verb tense as a cue for making judgments specifically about timing. However, when making decisions involving timing, the verb tense of the options only impacts choices in the complete absence of any timing information, and only for relatively small differences in amounts between options. Given that everyday decision-making generally involves at least ambiguous information about timing, it is highly unlikely that verb tense shapes general intertemporal preferences and savings behavior, contrary to at least some interpretations of the Whorfian hypothesis motivating Chen (2013). However, as we discussed earlier, language may affect decision-making via a long-term mechanism, such as immersion in a language-culture, instead of via a transient influence on decision-making in the moment.

The distinction between transient and long-term linguistic influences on decision-making has been underappreciated in the prior literature. Most research has looked across languages, rather than

within a given language. However, if linguistic differences influence thought in the moment, during the processing of the language present in the decision context, then the effects of linguistic factors should be observable within a given language. This is important because testing a causal effect is both more feasible and less prone to confounds when conducted within a single language.

Prior research about the role of linguistic factors on decision-making has primarily focused on either framing or priming. Our approach illustrates the benefit of also considering concepts and distinctions identified in the pragmatics literature. We were able to not only test between priming and inferential processes, but to distinguish between different forms of linguistic inference. We found that that intertemporal decision-making is more akin to a psycholinguistic guessing game (Goodman 2014), where some cues block the impact of other cues, than inference based on implicatures, since people do not treat all the given information as relevant. Our key test, in Study 5, was based on the notion of scalar implicatures, in which the use of distinct words (especially of the same scale) conveys a distinction (i.e., if one candidate is described as "poor" and the other as "weak" then they have distinct defects; Grundy 2013). Future research on linguistic factors in decision-making could benefit from taking a similar approach, informed by pragmatics and focused on identifying boundary conditions of phenomena, to theory development and testing.

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Appendix A: Supplemental Statistical Results

Variable List used in Regressions:

Variable	Description
dP	Present1-Present2. This depicts the difference in occurrence of present tense in either options. If the first option had present tense and the second did not then Present1=1 and Present2=0. Therefore, dP=Present1- Present2=1-0=1. Conversely, if the second option had present tense and not the first option, dP=0-1=-1.
dN	Neutral1-Neutral2. This depicts the difference in occurrence of neutral tense in either options. If the first option had neutral tense and the second did not then Neutral1=1 and Neutral2=0. Therefore, dN=Neutral1- Neutral2=1-0=1. Conversely, if the second option had neutral tense and not the first option, dN=0-1=-1.
dMoney	Monetary amount in first option - Monetary amount in second option.
D	Objective Delay. Eg., 6 weeks for the timing information in an option.
Delay	Date/Delay dummy. Delay=1 means the objective time was expressed as a delay like 'in 2 weeks'. Delay=0 means the objective time was expressed as a date like 'on August 28'.
Hidden Zero	Hidden Zero dummy. Hidden Zero=1 means hidden zero was mentioned in intertemporal choice options, like '$20 today and $0 in a week'. Hidden Zero=0 means hidden zero was not mentioned in intertemporal choice options, like '$20 today'.
Earlier	Dummy for whether an option used the earlier ambiguous timing word when the ambiguous word pairs were distinct and different-meaning from each other like 'soon' vs. 'later'. In this example, if an option was depicted as 'soon' then the corresponding earlier dummy was Earlier=1 and 0 if it was 'later'.
Objective Time	Dummy for whether an option had objective time (objective time=1) or not (objective time=0).
Ambiguous Time	Dummy for whether an option had ambiguous time (ambiguous time=1) or not (ambiguous time=0).
Size	Dummy for whether the difference in monetary amounts between the two options was small (size=1) or large (size=2)
promptly_first	Dummy for whether the first option was described as "promptly" (=1) or not(=0)
quickly_first	Dummy for whether the first option was described as "quickly" (=1) or not(=0)
someday_first	Dummy for whether the first option was described as "someday" (=1) or not(=0)
eventually_first	Dummy for whether the first option was described as "eventually" (=1) or not(=0)
Timing Info	Dummy for whether the question had no timing information (Timing info=1), ambiguous timing information (Timing info=2), objective timing information (Timing info=3)
dpXdMoney	Interaction of dP and dMoney
DXdMoney	Interaction of D and dMoney
earlierXdMoney	Interaction of Earlier and dMoney
dpXobjective	Interaction of dP and Objective Time
dpXambiguous	Interaction of dP and Ambiguous Time
dpXtime	Interaction of dP and Timing info

Study 1A

Table 1A: Regression of choice of the first option in an earliness inference task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense).

	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
dP	0.3310484	0.0141823	23.34	0.000	0.3031147	0.358982
dN	-0.1762097	0.0148567	-11.86	0.000	- 0.2054717	-0.1469477
constant	0.5229839	0.0085735	61	0.000	0.5060974	0.5398704

Study 1B

Table 1B.1: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), and the difference in amounts between the two options.

	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
dP	0.1313126	0.0138443	9.48	0.000	0.1040664	0.1585587
dN	-0.0898723	0.0155695	-5.77	0.000	-0.1205136	-0.0592309
dMoney	0.0072897	0.0148225	0.49	0.623	-0.0218814	0.0364609
constant	0.4820995	0.0113559	42.45	0.000	0.4597507	0.5044484

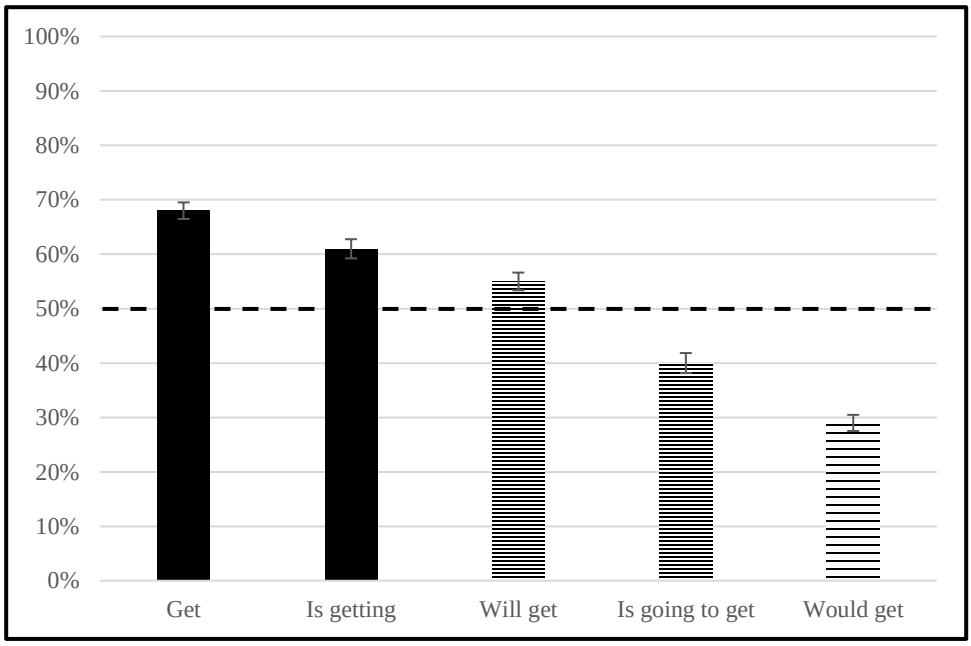
Table 1B.2: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), when the amounts in both options is equal.

	Coef.	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
dP	0.2284378	0.021889	10.44	0.000	0.1853552	0.2715204
dN	-0.1025122	0.0259069	-3.96	0.000	-0.1535031	-0.0515212
constant	0.4865283	0.0180311	26.98	0.000	0.4510388	0.5220178

Table 1B.3: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), when the amounts in both options are unequal.

	Coef.	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
dP	0.0781425	0.0164297	4.76	0.000	0.0458083	0.1104768
dN	-0.0849833	0.019018	-4.47	0.000	-0.1224114	-0.0475552
constant	0.4796191	0.0122714	39.08	0.000	0.4554686	0.5037696

Full graph: Percentage of people choosing an option described by each tense (an expanded version of Fig 1b):



Replication of 1B with larger difference in amounts

Table 1B.4: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense in the two options (compared against future tense), and the difference in amounts between the two options.

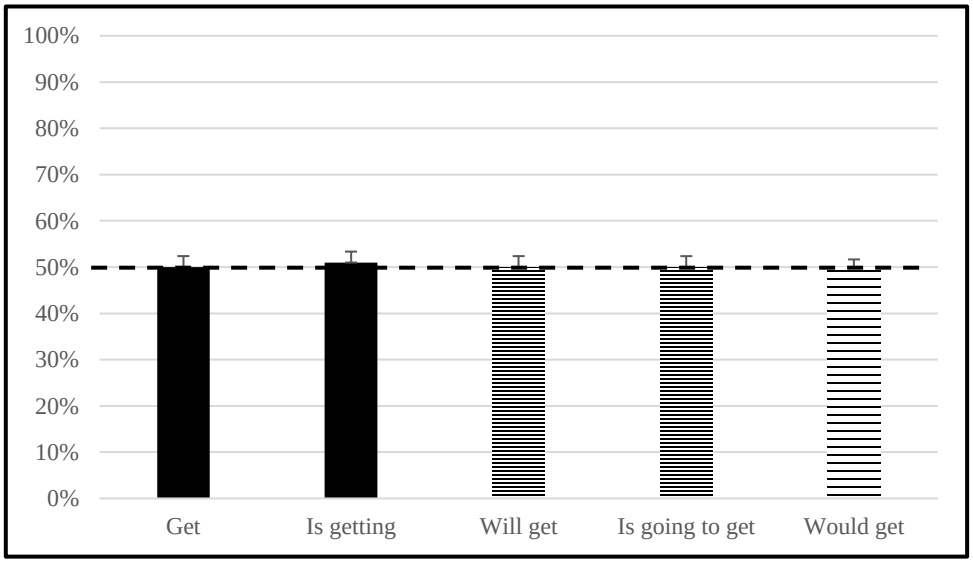
	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dP	0.0245332	0.0183941	1.33	0.184	-0.0117521	0.0608186
dMoney	0.0437223	0.0010043	43.53	0.000	0.0417412	0.0457035
constant	0.5194009	0.0106739	48.66	0.000	0.4983448	0.540457

Study 2A

Table 2A: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), the difference in amounts between the two options, and the objective delay.

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dP	0.0103935	0.0094033	1.11	0.271	-0.0082398	0.0290268
dN	0.0090324	0.0077696	1.16	0.248	-0.0063636	0.0244284
dMoney	0.0609779	0.0216842	2.81	0.006	0.0180092	0.1039467
D	0.0058131	0.0174092	0.33	0.739	-0.0286843	0.0403105
constant	0.624793	0.1535518	4.07	0.000	0.3205198	0.9290662

Full graph: Percentage of people choosing an option described by each tense (an expanded version of Fig 2a):



Study 2B

Table 2B.1: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense in the two options (compared against future tense), the presence or absence of Delay timing (as opposed to Date timing), and Hidden Zero (present or absent).

	Coef.	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
dP	0.020514	0.0146835	1.4	0.163	-0.008289	0.0493171
Delay	0.1449767	0.0184163	7.87	0.000	0.1088514	0.181102
Hidden Zero	-0.1689475	0.0183926	-9.19	0.000	-0.2050263	-0.1328687
constant	0.2330158	0.016185	14.4	0.000	0.2012675	0.2647641

Table 2B.2: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense in the two options (compared against future tense), and Hidden Zero (present or absent), when the timing is expressed as delay (instead of as a date).

	Coef.	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
dP	0.0204763	0.0225996	0.91	0.365	-0.0238921	0.0648447
Hidden Zero	-0.2148287	0.0289106	-7.43	0.000	-0.2715871	-0.1580704
constant	0.4007123	0.0224446	17.85	0.000	0.3566483	0.4447763

Table 2B.3: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense in the two options (compared against future tense), and Hidden Zero (present or absent), when the timing is expressed as date (instead of as a delay).

	Coef.	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
dP	0.0210994	0.0188104	1.12	0.262	-0.0158293	0.0580282
Hidden Zero	-0.1234432	0.0227141	-5.43	0.000	-0.1680357	-0.0788507
constant	0.2101069	0.018793	11.18	0.000	0.1732123	0.2470014

Table 2B.4: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense in the two options (compared against future tense), the presence or absence of Delay timing (as opposed to Date timing), when Hidden Zero is present.

	Coef.	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
dP	0.0330047	0.0187629	1.76	0.079	-0.0038311	0.0698406
Delay	0.099113	0.0222385	4.46	0.000	0.0554537	0.1427723
constant	0.0866314	0.0127408	6.8	0.000	0.0616184	0.1116444

Table 2B.5: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense in the two options (compared against future tense), the presence or absence of Delay timing (as opposed to Date timing), when Hidden Zero is absent.

	Coef.	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
dP	0.0085332	0.0225918	0.38	0.706	-0.0358194	0.0528859
Delay	0.1904733	0.029262	6.51	0.000	0.1330255	0.2479211
constant	0.2101414	0.0187885	11.18	0.000	0.1732554	0.2470274

Table 2B.6: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense in the two options (compared against future tense), the presence or absence of Delay timing (as opposed to Date timing), and Hidden Zero (present or absent), when sooner-smaller amount is realized "today".

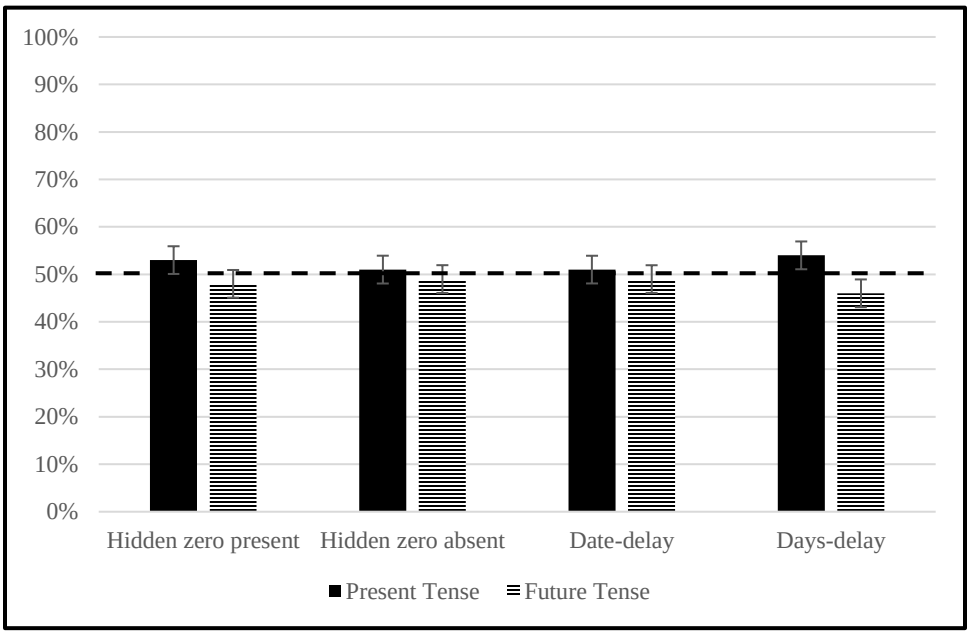
	Coef.	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
dP	0.025798	0.0164848	1.56	0.118	-0.0065385	0.0581344
Delay	0.1221279	0.0205275	5.95	0.000	0.0818613	0.1623945
Hidden Zero	-0.1890783	0.0204935	-9.23	0.000	-0.2292781	-0.1488785
constant	0.2438176	0.0186542	13.07	0.000	0.2072256	0.2804095

Table 2B.7: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense in the two options (compared against future tense), the presence or absence of Delay timing (as opposed to Date timing), and Hidden Zero (present or absent), when sooner-smaller amount is realized "in 6 weeks".

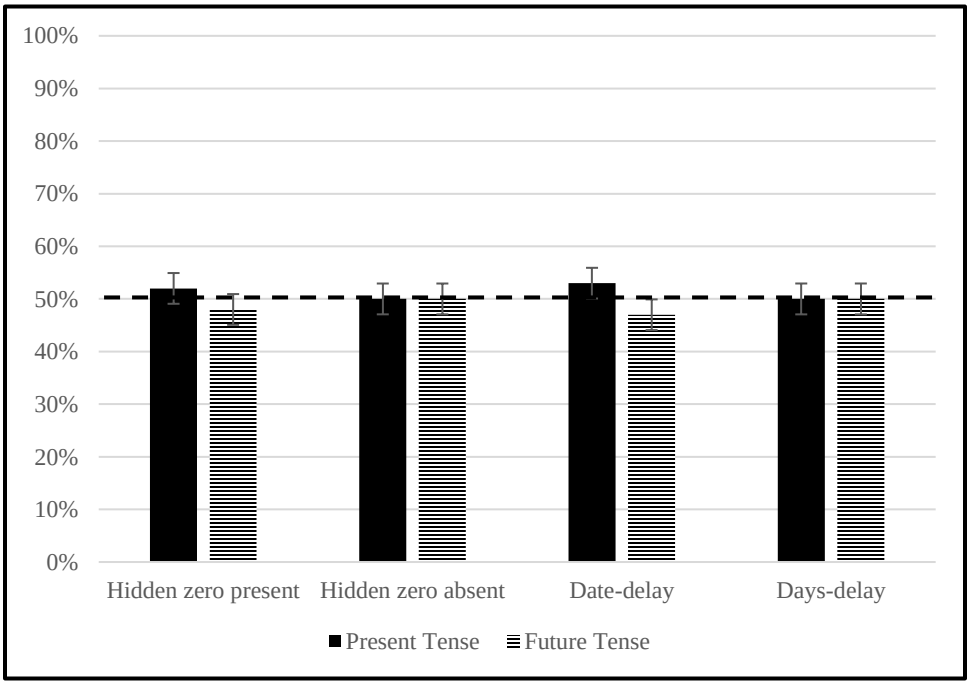
	Coef.	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
dP	0.0152301	0.0171289	0.89	0.374	-0.0183698	0.04883
Delay	0.1678255	0.0213186	7.87	0.000	0.1260071	0.209644
Hidden Zero	-0.1488167	0.0212854	-6.99	0.000	-0.1905699	-0.1070636
constant	0.2222141	0.0181343	12.25	0.000	0.1866421	0.2577861

Full graph: Percentage of people choosing an option described by each tense (an expanded version of Fig 2b), by each question:

(1) First Question



(2) Second Question



Study 3

Table 3.1: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), the difference in amounts between the two options, when no timing information is provided.

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dP	0.0427338	0.0081003	5.28	0.000	0.0267815	0.0586861
dN	-0.1286055	0.0129352	-9.94	0.000	-0.1540795	-0.1031316
dMoney	-0.0001644	0.0007452	-0.22	0.826	-0.001632	0.0013032
constant	0.4962379	0.0092856	53.44	0.000	0.4779514	0.5145244

Table 3.2: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), the difference in amounts between the two options, and the interaction between present tense and difference in amounts, when no timing information is provided.

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dP	0.0714985	0.0164278	4.35	0.000	0.0391464	0.1038506
dN	-0.1277668	0.0129158	-9.89	0.000	-0.1532024	-0.1023312
dMoney	-0.0001806	0.0007489	-0.24	0.81	-0.0016554	0.0012943
dpXdMoney	0.0026239	0.0011937	2.2	0.029	0.000273	0.0049748
constant	0.4962385	0.0092884	53.43	0.000	0.4779465	0.5145305

Table 3.3: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), the difference in amounts between the two options, the objective delay, when objective information is provided.

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dP	0.0029714	0.0094896	0.31	0.755	-0.0158026	0.0217454
dN	0.0012031	0.0152891	0.08	0.937	-0.0290446	0.0314509
D	0.0066717	0.0122604	0.54	0.587	-0.0175841	0.0309274
dMoney	0.0001642	0.0008843	0.19	0.853	-0.0015852	0.0019136
constant	0.4364496	0.1115307	3.91	0.000	0.2157994	0.6570998

Table 3.4: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), the difference in amounts between the two options, the objective delay, the interaction between present tense and difference in amounts, and the interaction between difference in amounts and objective delay, when objective information is provided.

	Coef.	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
dP	0.0223393	0.0146826	1.52	0.131	-0.0067085	0.0513871
dN	0.0015954	0.0151332	0.11	0.916	-0.0283438	0.0315346
D	0.0188123	0.0180338	1.04	0.299	-0.0168653	0.05449
dMoney	-0.0088362	0.0102637	-0.86	0.391	-0.0291417	0.0114693
dpXdMoney	0.0017096	0.0012796	1.34	0.184	-0.0008219	0.0042412
DXdMoney	0.0010047	0.0011588	0.87	0.388	-0.0012879	0.0032973
constant	0.3272502	0.1606581	2.04	0.044	0.0094074	0.645093

Table 3.5: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), the difference in amounts between the two options, the presence of the earlier ambiguous word for the option or not ("soon"), when ambiguous timing information is provided ("soon" vs. "later").

	Coef.	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
dP	0.0158246	0.0124545	1.27	0.206	-0.0088224	0.0404716
dN	0.0040146	0.014633	0.27	0.784	-0.0249436	0.0329728
earlier	0.0308088	0.0357663	0.86	0.391	-0.0399715	0.1015892
dMoney	-0.0012474	0.0010873	-1.15	0.253	-0.0033991	0.0009043
constant	0.4851554	0.0163623	29.65	0.000	0.4527749	0.5175359

Table 3.6: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), the difference in amounts between the two options, the presence of the earlier ambiguous word for the option or not ("soon"), the interaction between present tense and difference in amounts, and the interaction between difference in amounts and the presence of the earlier ambiguous word, when ambiguous timing information is provided ("soon" vs. "later").

	Coef.	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
dP	0.0212787	0.0202766	1.05	0.296	-0.018848	0.0614055
dN	0.0073188	0.0132563	0.55	0.582	-0.0189149	0.0335525
earlier	-0.1692944	0.0455467	-3.72	0.000	-0.25943	-0.0791587
dMoney	-0.0004818	0.0009316	-0.52	0.606	-0.0023254	0.0013619
dpXdMoney	0.0011517	0.0014601	0.79	0.432	-0.0017378	0.0040412
earlierXdMoney	-0.0188325	0.0029339	-6.42	0.000	-0.0246385	-0.0130265
constant	0.4947847	0.0152466	32.45	0.000	0.4646121	0.5249573

Table 3.7: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), the difference in amounts between the two options, the presence of the earlier ambiguous word for the option or not ("now"), when ambiguous timing information is provided ("now" vs. "at some point").

	Coef.	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
dP	-0.0014683	0.0076188	-0.19	0.847	-0.0165256	0.013589
dN	0.0198413	0.0117312	1.69	0.093	-0.0033437	0.0430263
earlier	-0.1904129	0.0323722	-5.88	0.000	-0.2543916	-0.1264341
dMoney	-0.0007507	0.0011217	-0.67	0.504	-0.0029676	0.0014661
constant	0.4781049	0.0108269	44.16	0.000	0.4567072	0.4995026

Table 3.8: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), the difference in amounts between the two options, the presence of the earlier ambiguous word for the option or not ("now"), the interaction between present tense and difference in amounts, and the interaction between difference in amounts and the presence of the earlier ambiguous word, when ambiguous timing information is provided ("now" vs. "at some point").

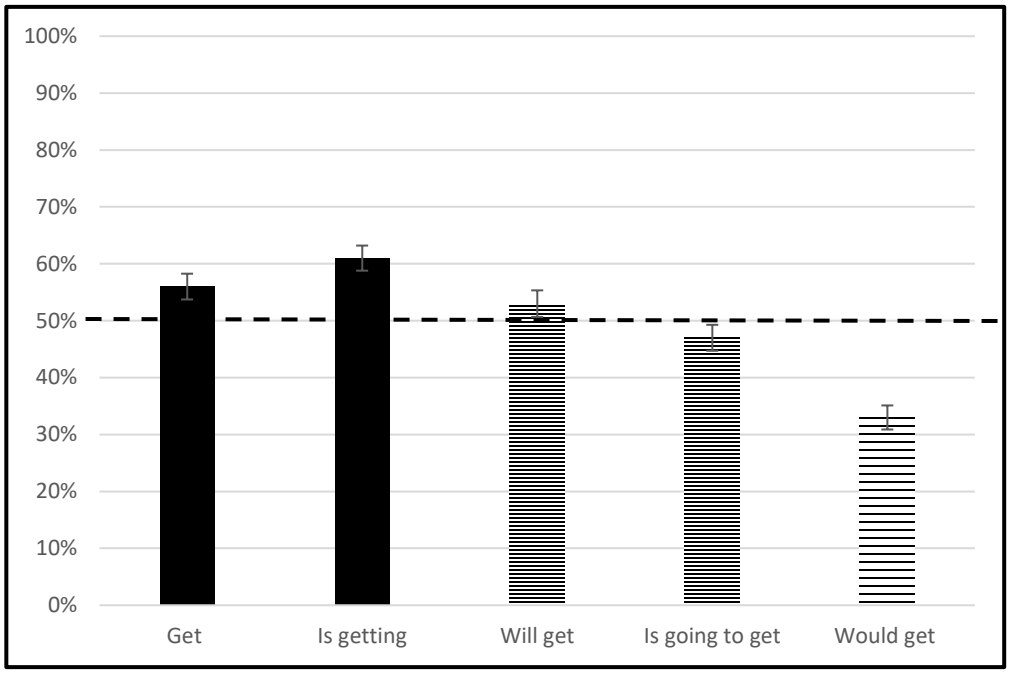
	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dP	0.0214436	0.0111197	1.93	0.056	-0.0005329	0.04342
dN	0.0219289	0.009915	2.21	0.029	0.0023334	0.0415244
earlier	-0.4088197	0.035764	-11.43	0.000	-0.4795018	-0.3381377
dMoney	-0.0009772	0.000919	-1.06	0.289	-0.0027935	0.0008392
dpXdMoney	0.002227	0.0011273	1.98	0.05	-9.62E-07	0.004455
earlierXdMoney	-0.0215508	0.0027786	-7.76	0.000	-0.0270422	-0.0160593
constant	0.4778867	0.0099623	47.97	0.000	0.4581977	0.4975756

Table 3.9: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), the difference in amounts between the two options, the dummy for presence of objective timing information, the dummy for presence of ambiguous timing information, and the relevant interactions, pooling across all data.

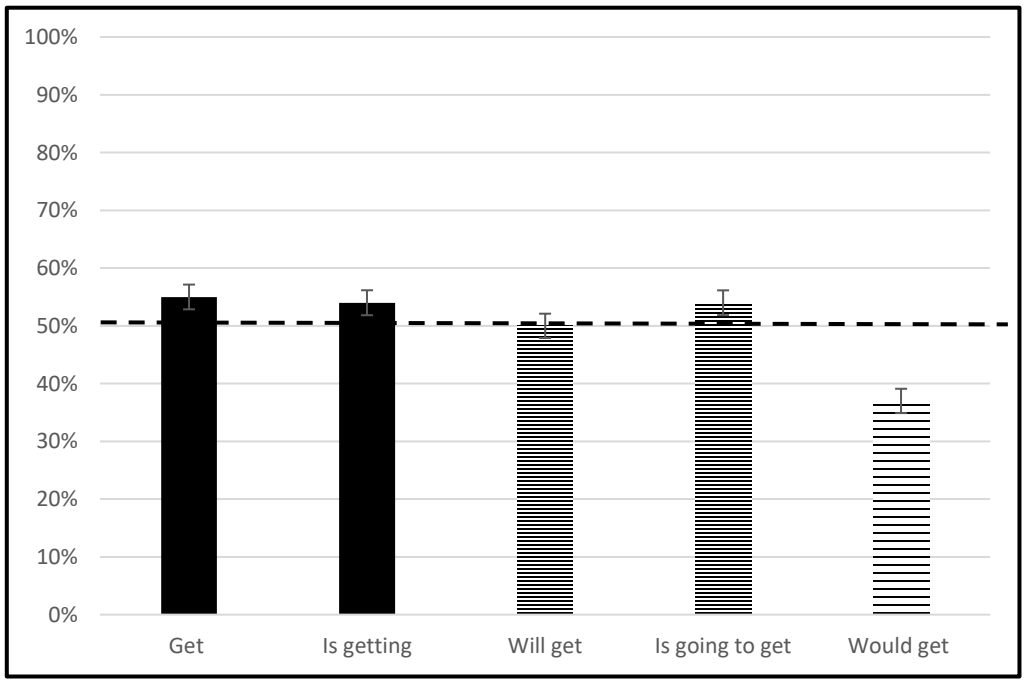
	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dP	0.0909011	0.0117085	7.76	0.000	0.0679106	0.1138916
dN	-0.0439352	0.0074345	-5.91	0.000	-0.0585334	-0.029337
dMoney	-0.0004431	0.0004581	-0.97	0.334	-0.0013426	0.0004564
objective time	-0.0040057	0.0084497	-0.47	0.636	-0.0205974	0.012586
ambiguous time	-0.0062027	0.0072817	-0.85	0.395	-0.0205009	0.0080956
dpXdMoney	0.0018399	0.0006514	2.82	0.005	0.0005608	0.0031189
dpXobjective	-0.0823971	0.0118784	-6.94	0.000	-0.1057212	-0.059073
dpXambiguous	-0.0839932	0.0113786	-7.38	0.000	-0.1063359	-0.0616505
constant	0.493308	0.0063898	77.2	0.000	0.4807612	0.5058547

Full Graphs: Percentage of people choosing an option described by each tense, by each condition:

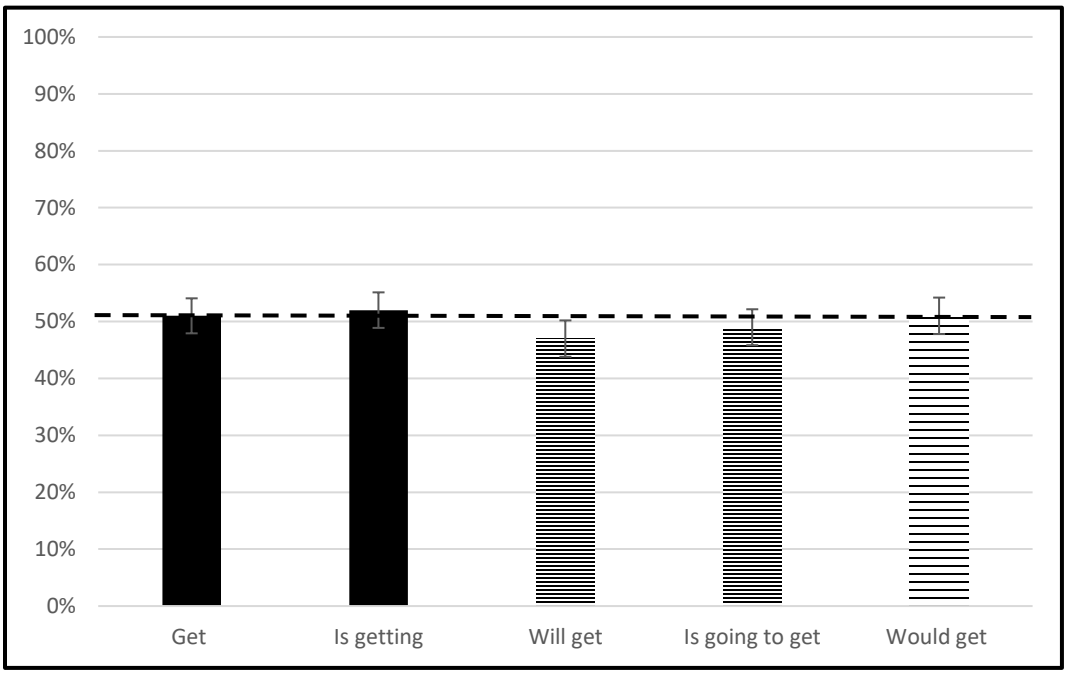
(1) No timing information, small differences in amounts:



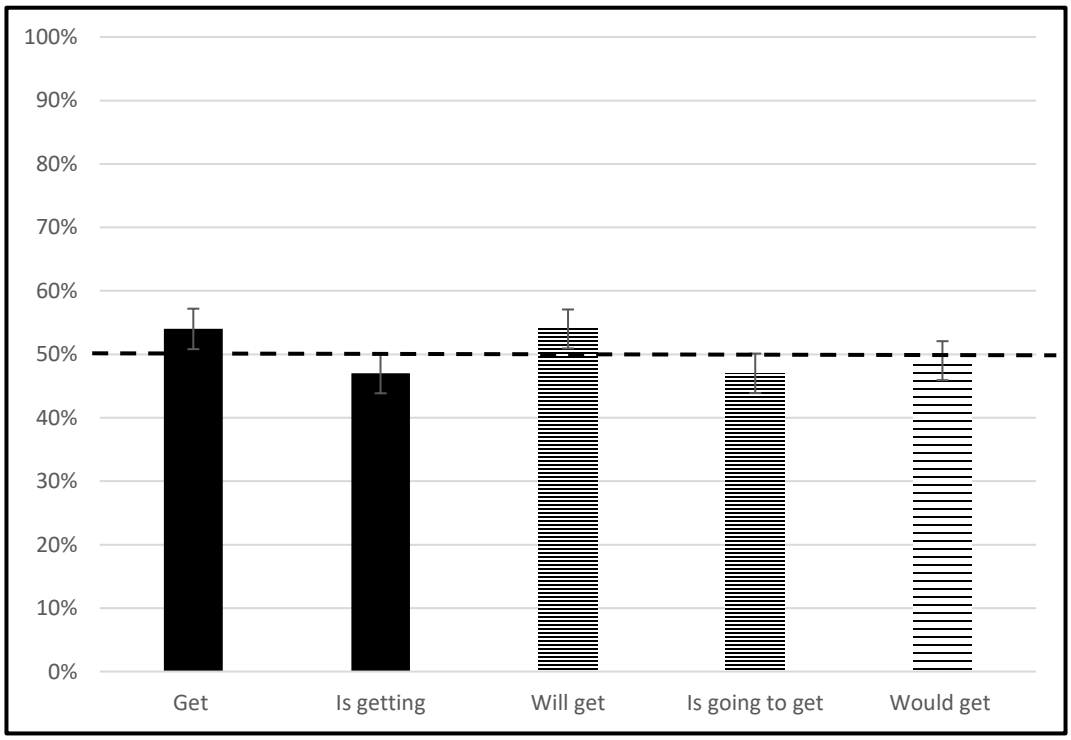
(2) No timing information, large differences in amounts:



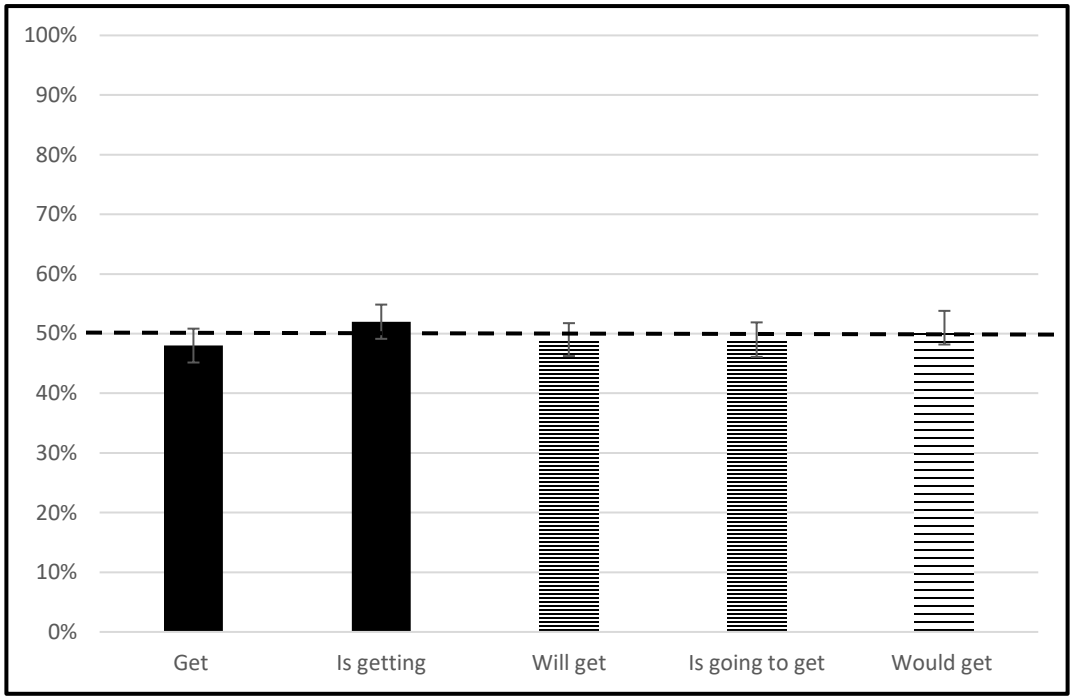
(3) Soon vs. Later, small differences in amounts:



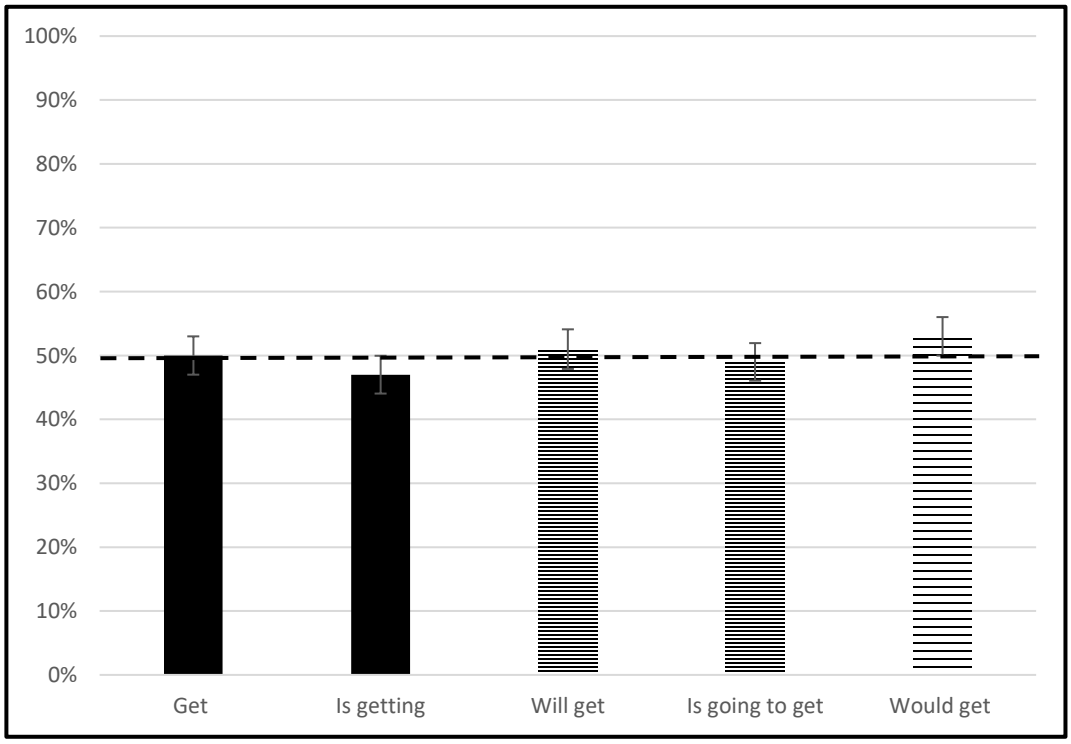
(4) Soon vs. Later, large differences in amounts:



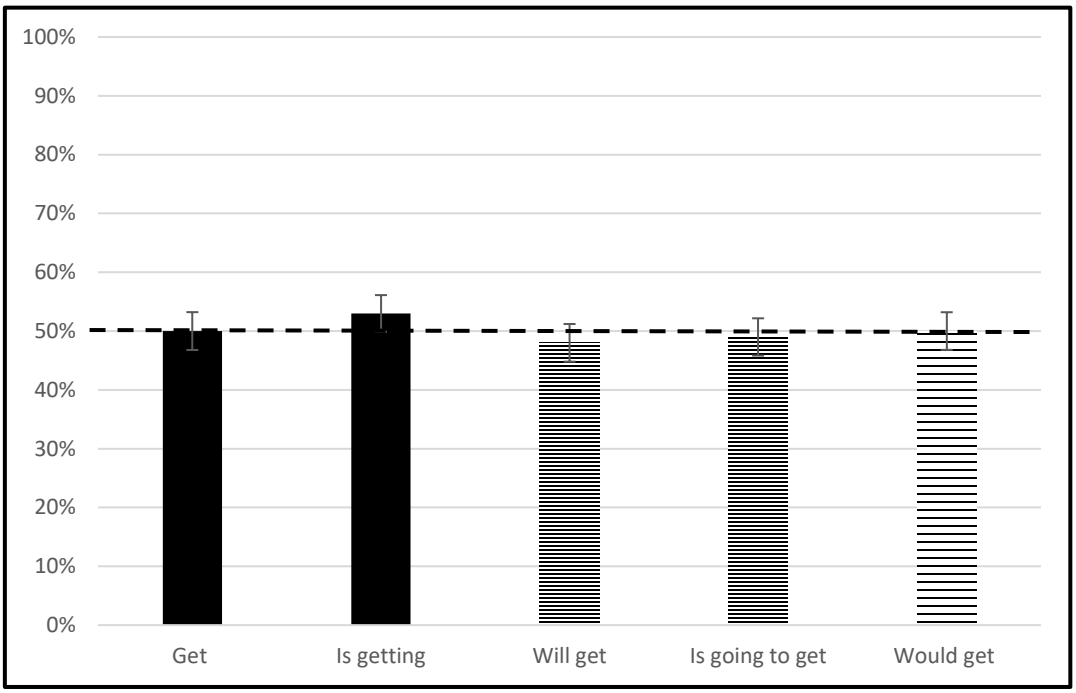
(5) Now vs. At some point, small differences in amounts:



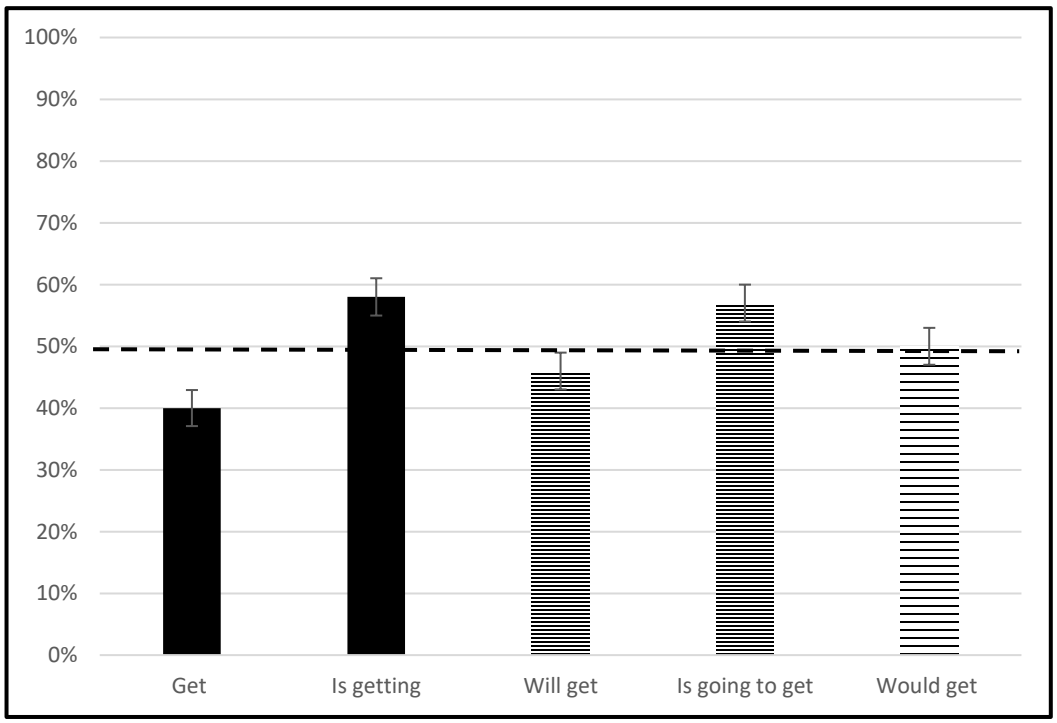
(6) Now vs. At some point, large difference in amounts:



(7) Objective timing, small differences in amounts:



(8) Objective timing, large differences in amounts:



Study 4A

Table 4a.1: Regression of choice of the first option in an earliness inference task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), when both the options were described as occurring "soon".

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dP	0.4782609	0.052253	9.15	0.000	0.3753028	0.5812189
dN	-0.0782609	0.028478	-2.75	0.006	-0.1343733	-0.0221484
constant	0.3217391	0.0344124	9.35	0.000	0.2539338	0.3895445

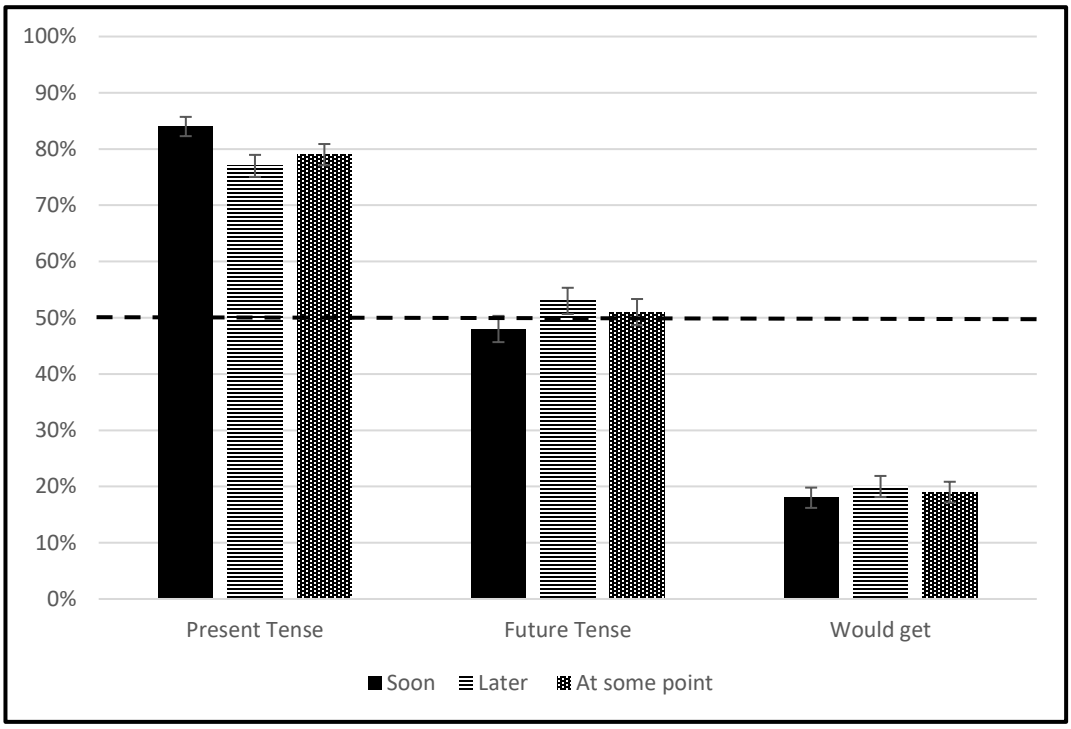
Table 4a.2: Regression of choice of the first option in an earliness inference task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), when both the options were described as occurring "later".

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dP	0.273913	0.0588273	4.66	0.000	0.158001	0.389825
dN	-0.1608696	0.0311773	-5.16	0.000	-0.2223006	-0.0994386
constant	0.4173913	0.0370089	11.28	0.000	0.3444699	0.4903128

Table 4a.3: Regression of choice of the first option in an earliness inference task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), when both the options were described as occurring "at some point".

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dP	0.2391304	0.0594879	4.02	0.000	0.1219169	0.356344
dN	-0.1869565	0.0305333	-6.12	0.000	-0.2471187	-0.1267943
constant	0.4608696	0.0373207	12.35	0.000	0.3873336	0.5344055

Full graph: Percentage of people choosing an option described by each tense (an expanded version of Fig 4a).



Study 4B

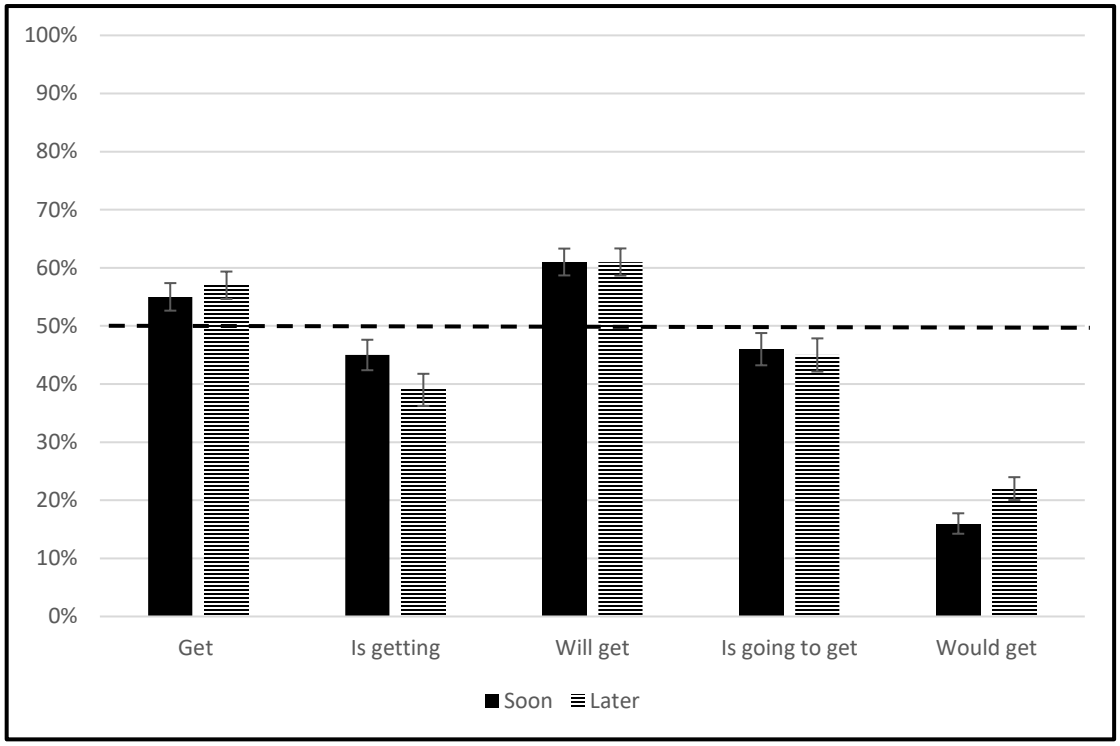
Table 4b.1: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), and the difference in monetary amounts between the two options, when both the options were described as occurring "soon".

	Coef.	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
dP	-0.0053447	0.023189	-0.23	0.818	-0.0510458	0.0403564
dN	-0.3395048	0.0227261	-14.94	0.000	-0.3842935	-0.2947161
dMoney	0.0300145	0.0177792	1.69	0.093	-0.0050249	0.0650539
constant	0.4931949	0.0171579	28.74	0.000	0.45938	0.5270098

Table 4b.2: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), and the difference in monetary amounts between the two options, when both the options were described as occurring "later".

	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
dP	-0.0181081	0.0249119	-0.73	0.468	-0.0672046	0.0309884
dN	-0.2895874	0.0252554	-11.47	0.000	-0.3393609	-0.239814
dMoney	-0.0042448	0.01835	-0.23	0.817	-0.040409	0.0319194
constant	0.4905429	0.0174121	28.17	0.000	0.4562271	0.5248587

Full graph: Percentage of people choosing an option described by each tense (an expanded version of Fig 4b).



Pretest Study 5a: Earliness Inferences of Immediate vs. Delayed Ambiguous words

Overview: People were asked to indicate the earliness inference between choices where one option was described in an immediate ambiguous word and the other was described using a delayed one – Eg.,

"Which of the two statements do you think would occur earlier? – "You will get $20 promptly" vs. "You will get $20 someday"". The only manipulated variable was the ambiguous word, but one was always an immediate word ("promptly" or "quickly") and the other was always a delayed word ("someday" or "eventually") (sample question in Appendix B).

Results summary:

- 'Promptly' vs. 'Someday': 80% chose promptly and 8% chose someday, t(117)=12.58, p<.001
- 'Promptly' vs. 'Eventually': 80% chose promptly and 8% chose someday, t(117)=12.58, p<.001
- 'Quickly' vs. 'Someday': 81% chose promptly and 8% chose someday, t(117)=13.01, p<.001
- 'Quickly' vs. 'Eventually': 81% chose promptly and 8% chose someday, t(117)=13.01, p<.001

Study 5a

Table 5a.1: Regression of choice of the first option in an earliness inference task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), when both the options were described using the immediate pair of ambiguous words ("promptly" vs. "quickly").

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dP	0.0877581	0.0194395	4.51	0.000	0.0492413	0.126275
dN	-0.109882	0.0186732	-5.88	0.000	-0.1468805	-0.0728835
constant	0.5103245	0.0104905	48.65	0.000	0.489539	0.53111

Table 5a.2: Regression of choice of the first option in an earliness inference task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), when both the options were described using the delayed pair of ambiguous words ("someday" vs. "eventually").

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dP	0.070059	0.0179009	3.91	0.000	0.0345906	0.1055273

dN	-0.0634218	0.0190521	-3.33	0.001	-0.1011712	-0.0256725
constant	0.5110619	0.0156729	32.61	0.000	0.4800081	0.5421158

Study 5b

Table 5b.1: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), and the difference in monetary amounts between the options, when both the options were described using the immediate pair of ambiguous words ("promptly" vs. "quickly"), overall.

	Coef.	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
dP	0.0186817	0.0143327	1.3	0.194	-0.009581	0.0469444
dMoney	0.0266566	0.0025414	10.49	0.000	0.0216452	0.0316681
constant	0.5235151	0.0143374	36.51	0.000	0.4952433	0.5517869

Table 5b.2: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), when both the options were described using the immediate pair of ambiguous words ("promptly" vs. "quickly") and the difference in amounts was small.

	Coef.	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
dP	0.0285272	0.0213573	1.34	0.183	-0.0135871	0.0706415
constant	0.5160272	0.0213573	24.16	0.000	0.4739129	0.5581415

Table 5b.3: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), when both the options were described using the immediate pair of ambiguous words ("promptly" vs. "quickly") and the difference in amounts was large.

	Coef.	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
dP	-0.0005239	0.0205871	-0.03	0.98	-0.0411195	0.0400717

constant	0.5219761	0.0205871	25.35	0.000	0.4813805	0.5625717

Table 5b.4: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), when both the options were described using the immediate pair of ambiguous words ("promptly" vs. "quickly") and the interaction between tense and monetary differences between two amounts.

	Coef.	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
dp	0.0186126	0.0143502	1.3	0.196	-0.0096846	0.0469097
dMoney	0.0266013	0.0024766	10.74	0.000	0.0217177	0.0314848
dpXdMoney	-0.0003509	0.0024766	-0.14	0.887	-0.0052344	0.0045327
constant	0.5234441	0.0143502	36.48	0.000	0.495147	0.5517412

Table 5b.5: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), and the difference in monetary amounts between the options, when both the options were described using the delayed pair of ambiguous words ("someday" vs. "eventually"), overall.

	Coef.	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
dP	-0.0227086	0.0109129	-2.08	0.039	-0.0442271	-0.0011902
dMoney	0.0190996	0.0023964	7.97	0.000	0.0143742	0.023825
constant	0.5143821	0.010906	47.17	0.000	0.4928772	0.535887

Table 5b.6: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), when both the options were described using the delayed pair of ambiguous words ("someday" vs. "eventually") and the difference in amounts was small.

	Coef.	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
dP	-0.0462618	0.0170069	-2.72	0.007	-0.0797967	-0.0127269
constant	0.5258536	0.0170069	30.92	0.000	0.4923187	0.5593885

Table 5b.7: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), when both the options were described using the delayed pair of ambiguous words ("someday" vs. "eventually") and the difference in amounts was large.

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dP	0.0038265	0.0169064	0.23	0.821	-0.0295102	0.0371632
constant	0.5038265	0.0169064	29.8	0.000	0.4704898	0.5371632

Table 5b.8: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), when both the options were described using the immediate pair of ambiguous words ("someday" vs. "eventually") and the interaction between tense and monetary differences between two amounts.

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dp	-0.0226184	0.0109463	-2.07	0.040	-0.0442026	-0.0010341
dMoney	0.0188419	0.0024095	7.82	0.000	0.0140909	0.023593
dpXdMoney	-0.0029248	0.0024095	-1.21	0.226	-0.0076759	0.0018262
constant	0.5146166	0.0109463	47.01	0.000	0.4930324	0.5362009

Table 5b.9: Regression of choice of the first option in an intertemporal choice task by whether the first option had the word "promptly" or the word "quickly".

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
promptly_first	-0.0499502	0.047512	-1.05	0.294	-0.143639	0.0437385
constant	0.54	0.0366457	14.74	0.000	0.4677386	0.6122614

Table 5b.10: Regression of choice of the first option in an intertemporal choice task by whether the first option had the word "someday" or the word "eventually".

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
someday_first	-0.0816832	0.045078	-1.81	0.071	-0.1705697	0.0072034
constant	0.5544554	0.0278271	19.93	0.000	0.499585	0.6093258

Post-test Study 5b

Overview: People were asked to make a decision on which option is more likely to occur, when the only thing that differed between the options was the tense. Eg., "Which of the following do you think is more likely to occur? – "You get $20" vs. "You will get $20"" (sample question in Appendix B).

Results Summary:

- **Present Tense vs. Future Tense:** For their inference of likelihood of occurrence, people chose future tense (will get) 55% of the times and present tense (get) 32% of the times ($t(127)=-4.23$, $p<.001$).

- **Neutral Tense vs. Future Tense:** For their inference of likelihood of occurrence, people chose future tense (will get) 55% of the times and neutral tense (get) 20% of the times ($t(127)=-5.03$, $p<.001$).

Interpretation: In Study 5b, for the pair of someday vs. eventually, the option with the future tense ("will get") was chosen significantly more than the option with present tense ("get"). This post-test suggests that "will get" seems more likely to occur than "get" (and "would get") and hence seems to resolve some uncertainty, if there is any in the context. We hypothesized that may be "someday" and "eventually" seemed too risky, in that they were seen as less likely to occur, and that is why in that context "will get" was chosen more often to resolve the uncertainty. However, that explanation seems unlikely since we ran likelihood questions for "someday" and "eventually" (compared to "promptly" and "quickly", along with the earliness inferences in pretest 5a) and found no significant results. That is, "someday" and "eventually" are **not** seen as less likely to occur than "promptly" and "quickly", even though they are seen as occurring later than "promptly" and "quickly".

Meta-Analysis

Table 6.1: Regression of choice of the first option in an earliness inference task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), when no timing information was present.

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dp	0.3310484	0.0141823	23.34	0.000	0.3031147	0.358982
dn	-0.1762097	0.0148567	-11.86	0.000	-0.2054717	-0.1469477
constant	0.5229839	0.0085735	61	0.000	0.5060974	0.5398704

Note: Since only one study (Study 1a) did this, there are no fixed effects by study in this regression.

Table 6.2: Regression of choice of the first option in an earliness inference task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense) with the

fixed effects for the appropriate study, when ambiguous timing information was present (pooling across all relevant studies).

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dp	0.0985724	0.0145568	6.77	0.000	0.0699402	0.1272046
dn	-0.1552307	0.0122156	-12.71	0.000	-0.1792578	-0.1312037
study 4a	0.0438817	0.0190839	2.3	0.022	0.0063451	0.0814183
constant	0.5106932	0.0107666	47.43	0.000	0.4895162	0.5318702

Table 6.3: Regression of choice of the first option in an earliness inference task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense) with the fixed effects for the appropriate study, and both no timing and ambiguous timing along with their interaction with present tense difference (pooling across all relevant studies).

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dp	0.577727	0.034008	16.99	0.000	0.5109356	0.6445184
dn	-0.1612226	0.0097583	-16.52	0.000	-0.1803878	-0.1420574
Timing info	-0.0122907	0.0137517	-0.89	0.372	-0.0392988	0.0147175
dpXtime	-0.2416829	0.0217334	-11.12	0.000	-0.2843671	-0.1989987
study 4a	0.0466892	0.0193686	2.41	0.016	0.0086494	0.084729
constant	0.5352745	0.0202257	26.47	0.000	0.4955513	0.5749977

Table 7.1: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense) with the fixed effects for the appropriate studies, when no timing information was present and difference between amounts was small (pooling across all relevant studies).

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dp	0.1014053	0.0109608	9.25	0.000	0.0798792	0.1229314
dn	-0.1067143	0.0134108	-7.96	0.000	-0.133052	-0.0803765
study 1b	-0.0389046	0.0190637	-2.04	0.042	-0.0763442	-0.001465
study 3	-0.0358151	0.019107	-1.87	0.061	-0.0733397	0.0017096
constant	0.5209992	0.0153272	33.99	0.000	0.4908979	0.5511006

Table 7.2: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense) with the

fixed effects for the appropriate studies, when no timing information was present and difference between amounts was large (pooling across all relevant studies).

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dp	0.0188342	0.0105949	1.78	0.076	-0.0020037	0.0396721
dn	-0.1335446	0.0159096	-8.39	0.000	-0.1648354	-0.1022539
study 1b replication	0.000118	0.02357	0.01	0.996	-0.0462391	0.046475
constant	0.5041809	0.0058134	86.73	0.000	0.4927473	0.5156145

Table 7.3: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense) with the fixed effects for the appropriate studies, when ambiguous timing information was present and difference between amounts was small (pooling across all relevant studies).

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dp	-0.0027568	0.0085848	-0.32	0.748	-0.0196093	0.0140957
dn	-0.2127318	0.0150392	-14.15	0.000	-0.2422547	-0.1832089
study 3	-0.0225919	0.0165005	-1.37	0.171	-0.0549834	0.0097997
study 4b	-0.0318177	0.0178608	-1.78	0.075	-0.0668796	0.0032442
constant	0.5225263	0.0118054	44.26	0.000	0.4993514	0.5457011

Table 7.4: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense) with the fixed effects for the appropriate studies, when ambiguous timing information was present and difference between amounts was large (pooling across all relevant studies).

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dp	-0.0044082	0.0100905	-0.44	0.662	-0.0242219	0.0154055
dn	0.002425	0.0145137	0.17	0.867	-0.026074	0.0309241
study 3	-0.0112149	0.0189365	-0.59	0.554	-0.0483985	0.0259686
constant	0.5006726	0.0166827	30.01	0.000	0.4679146	0.5334306

Table 7.5: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense) with the

fixed effects for the appropriate studies, when objective timing information was present and difference between amounts was small (pooling across all relevant studies).

	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
dp	0.0253803	0.0172591	1.47	0.143	-0.0086908	0.0594514
dn	0.0376215	0.0190171	1.98	0.050	0.0000797	0.0751632
study 2a	-0.0887308	0.0518978	-1.71	0.089	-0.1911822	0.0137207
constant	0.5090662	0.0166463	30.58	0.000	0.4762048	0.5419277

Table 7.6: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense) with the fixed effects for the appropriate studies, when objective timing information was present and difference between amounts was small (pooling across all relevant studies).

	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
dp	0.0094642	0.0098571	0.96	0.337	-0.0098699	0.0287984
dn	-0.0035861	0.0125905	-0.28	0.776	-0.0282816	0.0211094
study 2b	-0.1174569	0.0430622	-2.73	0.006	-0.2019209	-0.0329928
study 3	0.1494452	0.0435977	3.43	0.001	0.0639309	0.2349596
constant	0.3383278	0.0419666	8.06	0.000	0.2560127	0.420643

Table 7.7: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), difference in monetary amounts between two options and its interaction with present tense difference, with the fixed effects for the appropriate studies, for no timing information (pooling across all relevant studies).

	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
dp	0.0856483	0.0095037	9.01	0.000	0.0669908	0.1043058
dn	-0.1170763	0.0103283	-11.34	0.000	-0.1373526	-0.0968
dMoney	0.0089648	0.0011071	8.1	0.000	0.0067914	0.0111381
dpXdMoney	0.0026007	0.000764	3.4	0.001	0.0011009	0.0041005
study 1b	-0.1143082	0.0170524	-6.7	0.000	-0.147785	-0.0808313
study 1b replication	-0.0796836	0.018115	-4.4	0.000	-0.1152466	-0.0441207
constant	0.5964589	0.0129789	45.96	0.000	0.570979	0.6219388

Table 7.8: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), difference

in monetary amounts between two options and its interaction with present tense difference, with the fixed effects for the appropriate studies, for ambiguous timing information (pooling across all relevant studies).

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dp	0.0010182	0.0070869	0.14	0.886	-0.0128907	0.0149272
dn	-0.1362141	0.0116706	-11.67	0.000	-0.1591189	-0.1133093
dMoney	0.0052093	0.000721	7.22	0.000	0.0037942	0.0066245
dpXdMoney	0.0012064	0.0007628	1.58	0.114	-0.0002907	0.0027034
study 4b	-0.0397471	0.0152224	-2.61	0.009	-0.0696227	-0.0098715
constant	0.5304409	0.0072105	73.57	0.000	0.5162895	0.5445922

Table 7.9: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense), difference in monetary amounts between two options and its interaction with present tense difference, with the fixed effects for the appropriate studies, for objective timing information (pooling across all relevant studies).

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dp	0.0088225	0.0067329	1.31	0.190	-0.0043836	0.0220287
dn	0.0047756	0.0076064	0.63	0.530	-0.010144	0.0196951
dMoney	0.0007344	0.0008926	0.82	0.411	-0.0010164	0.0024852
dpXdMoney	0.0006566	0.0005339	1.23	0.219	-0.0003905	0.0017037
study 2a	0.1642672	0.0476952	3.44	0.001	0.0707157	0.2578186
study 3	0.2966882	0.0295118	10.05	0.000	0.2388025	0.354574
constant	0.2061574	0.020224	10.19	0.000	0.1664891	0.2458257

Table 7.10: Regression of choice of the first option in an intertemporal choice task by the difference in the occurrence of present tense and neutral tense in the two options (compared against future tense) with the fixed effects for the appropriate studies, type of timing information, difference in amounts between the two options, and the relevant interactions with difference in present tense (pooling across all relevant studies).

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dp	0.135913	0.0120716	11.26	0.000	0.1122432	0.1595829
dn	-0.0975377	0.0063534	-15.35	0.000	-0.1099953	-0.08508
dMoney	0.0065103	0.000599	10.87	0.000	0.0053359	0.0076847
timing info	-0.0021283	0.0047779	-0.45	0.656	-0.0114967	0.0072401
dpXtime	-0.0568627	0.0053909	-10.55	0.000	-0.0674331	-0.0462923

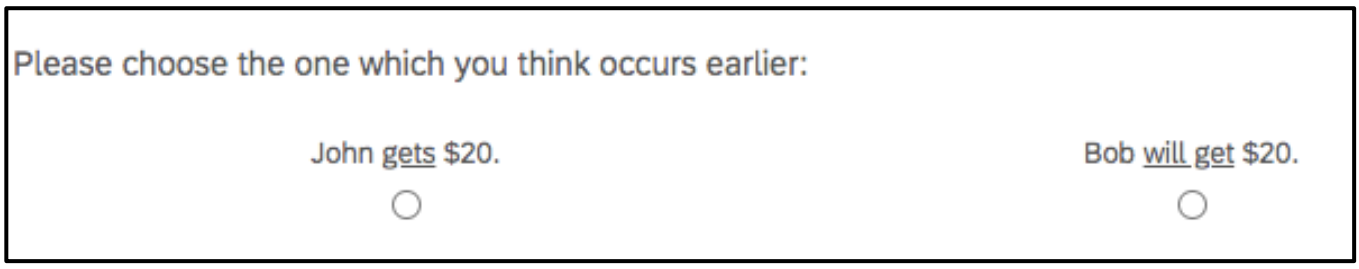
dpXdMoney	0.001953	0.0003901	5.01	0.000	0.0011881	0.0027179
study 1b	0.0791281	0.0433209	1.83	0.068	-0.0058151	0.1640713
study 1b replication	0.1135242	0.0436296	2.6	0.009	0.0279758	0.1990726
study 2b	-0.3080767	0.0441653	-6.98	0.000	-0.3946755	-0.2214779
study 3	0.1636497	0.0413486	3.96	0.000	0.0825738	0.2447255
study 4b	0.0897275	0.0431211	2.08	0.038	0.0051763	0.1742788
study 5b	0.1175326	0.0420807	2.79	0.005	0.0350213	0.2000439
constant	0.4051368	0.0431794	9.38	0.000	0.3204711	0.4898025

Appendix B: Sample questions

Study 1a

Overview: The study included 10 earliness inference questions, where only the tense form was changed between options within subjects. We tested 5 total tense forms – two present tense forms ("get" and "is getting"), two future tense forms ("will get" and "is going to get"), and one neutral tense form ("would get").

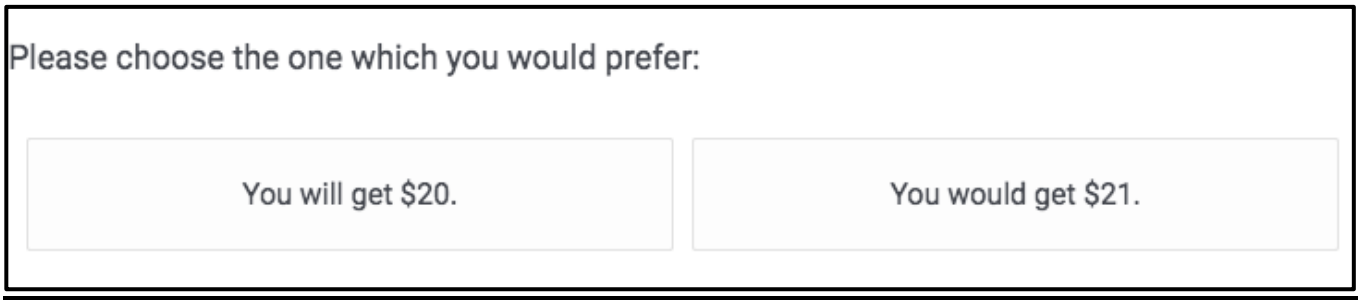
Sample Question: The other pairs tested were "will get" vs. "would get"; "will get" vs. "is getting"; "will get" vs. "is going to get"; "gets" vs. "would get"; "gets" vs. "is getting"; "gets" vs. "is going to get"; "is getting" vs. "would get"; "is getting" vs. "is going to get"; "is going to get" vs. "would get".



Study 1b

Overview: The study included 10 choice questions, where the tense form was changed between options within subjects. We tested 5 total tense forms – two present tense forms ("get" and "is getting"), two future tense forms ("will get" and "is going to get"), and one neutral tense form ("would get"). The amounts were also manipulated to be between $19-21 for *each* option.

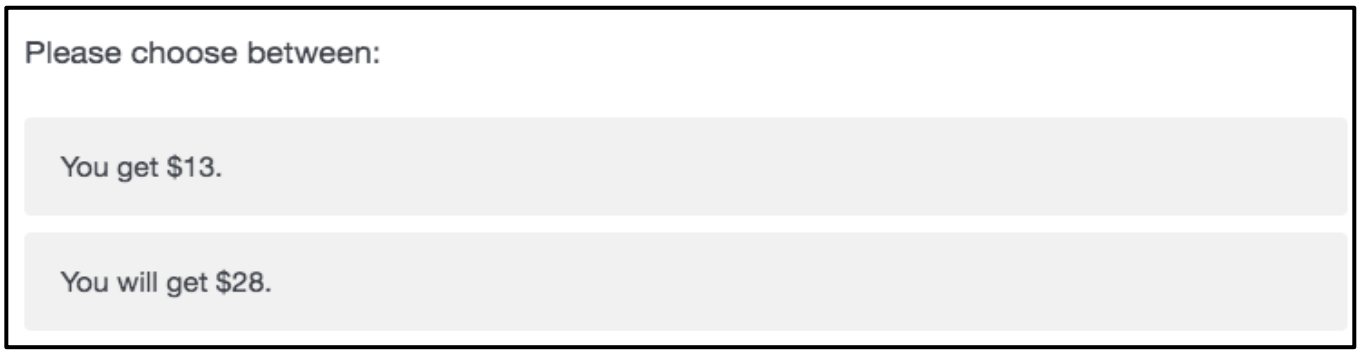
Sample Question: The other tense pairs tested were "get" vs. "will get"; "will get" vs. "is getting"; "will get" vs. "is going to get"; "gets" vs. "would get"; "gets" vs. "is getting"; "gets" vs. "is going to get"; "is getting" vs. "would get"; "is getting" vs. "is going to get"; "is going to get" vs. "would get". For each option, the amount could be $19, $20, or $21.



Replication of Study 1b

Methods: In this replication, participants (N=189, after exclusions) were recruited from AMT, made a series of 8 hypothetical test choices between two options, out of which 4 questions were test trials (i.e. tense differed between the options) and 4 were filler trials (i.e. tense was the same between the options). For the test trials, the tense form was changed between options within subjects. We tested 2 total tense forms – one present tense form ("get") and one future tense form ("will get"). Each option specified only the amount (randomly determined, between $10 and $30) and verb tenses were randomized, from among the four aforementioned forms. No other cues as to timing were presented in the choice options. For example, a participant would be asked to choose between "You get $13" and "You will get $28".

Sample Question: For each option, the amount could be any whole number between $10 and $30 (inclusive).



Study 2a

Overview: The study included 18 choice questions. We split the sample into two groups. One group saw the following three tense forms – neutral ("would get"), short version of present tense ("get"), and short version of future tense ("will get"). The other group saw the following three tense forms – neutral ("would get"), longer version of present tense ("are getting"), and longer version of future tense ("are going to get"). The sooner-smaller amount ranged between $10-16. The later larger amount ranged between $3-6 MORE than its corresponding sooner-smaller amount. Eg., If the sooner-smaller was $10, the later larger would be something between $13-16 (inclusive). Finally, the later-larger amount's delay was between 6 to 8 days, and the sooner-smaller amount was always "today".

Sample Question:

> **Shorter versions of the tenses:** The other tense pairs tested (test trials) were "will get" vs. "would get", "get" vs. "would get".

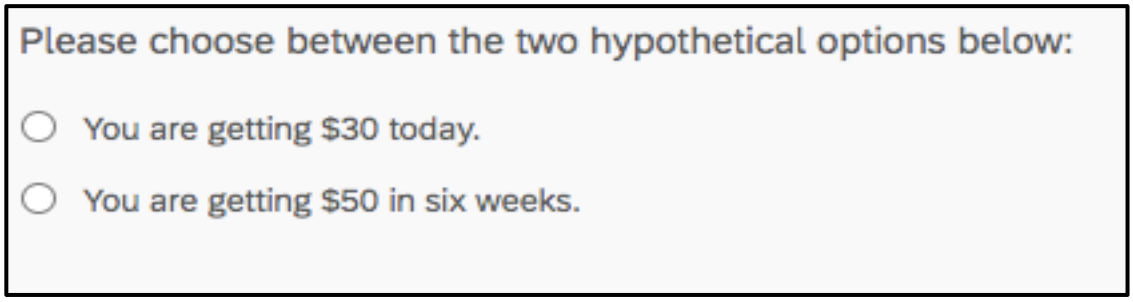
Longer versions of the tenses: The other tense pairs tested (test trials) were "are going to get" vs. "would get", "are getting" vs. "would get".

Study 2b

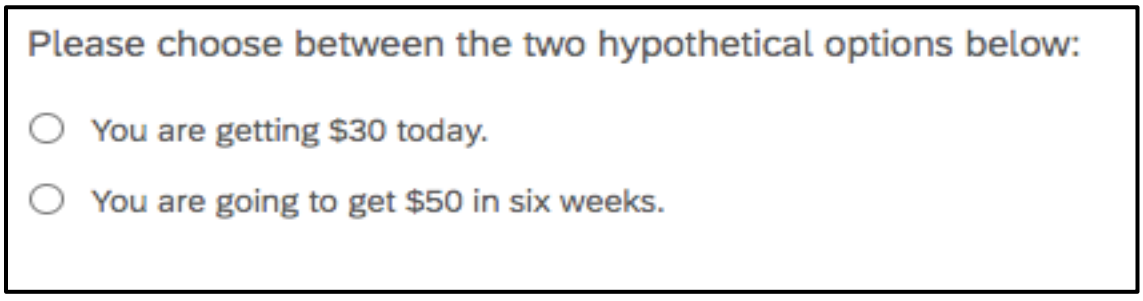
Overview: The study included 20 conditions in a 5(tense-display) x 2(date vs. delay format) x 2(standard vs. hidden zero highlighted) between subjects design, for intertemporal choice questions.

Types, First Factor (tense-display): Both sooner-smaller and later-larger in present tense ("are getting"), both in future tense ("are going to get"), sooner-smaller in present tense and later-larger in future tense, sooner-smaller in future tense and later-larger in present tense, and both options tense-less.

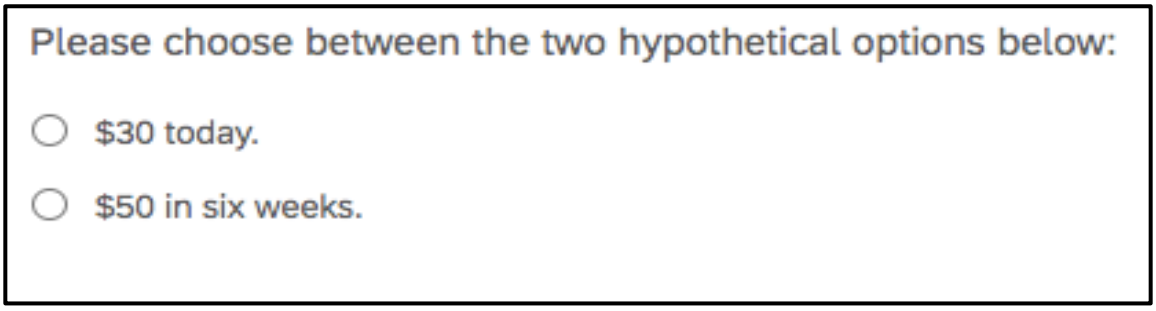
Sample Question First Factor (tense-display), same tense for both options: The other tense used for both options was "are going to get".



Sample Question First Factor (tense-display), different tense for both options: Tense for sooner-smaller and later-larger counterbalanced. That is, sooner-smaller was also paired with future tense "are going to get" and later-larger with present tense "are getting".

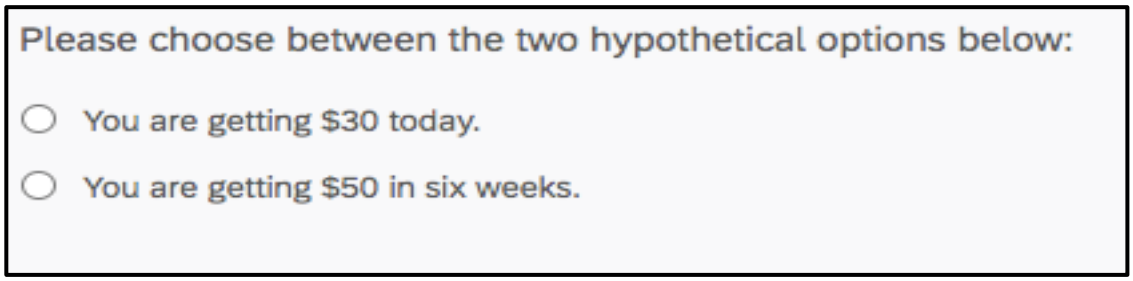


Sample Question First Factor (tense-display), tense-less for both options:

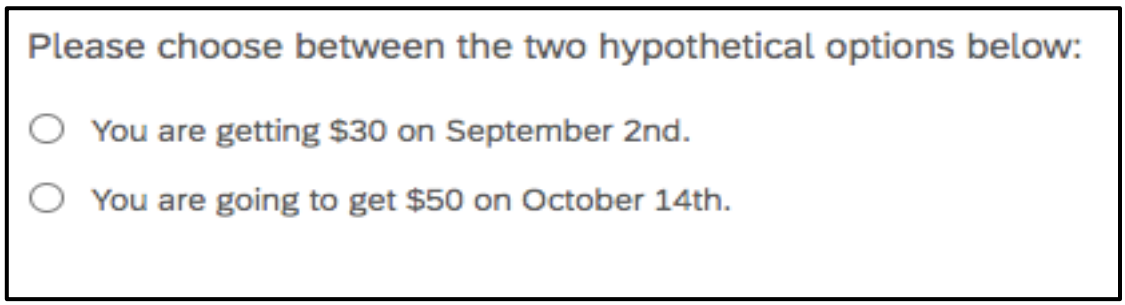


Types, Second Factor (date vs. delay): Timing of sooner-smaller and later-larger in delay format or date format.

Sample Question Second Factor (delay):

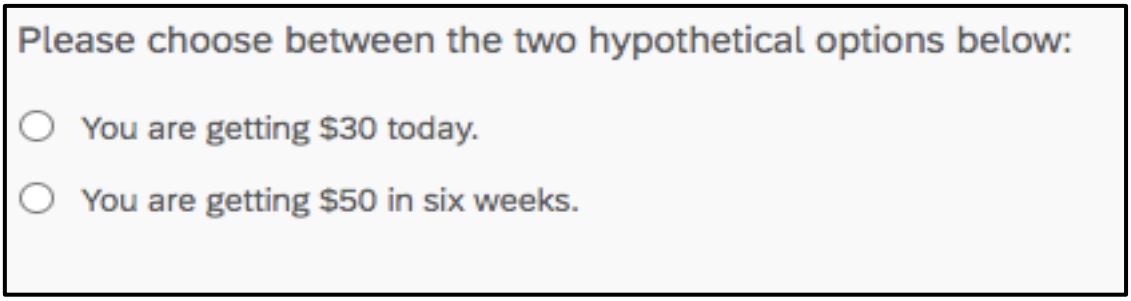


Sample Question Second Factor (date):

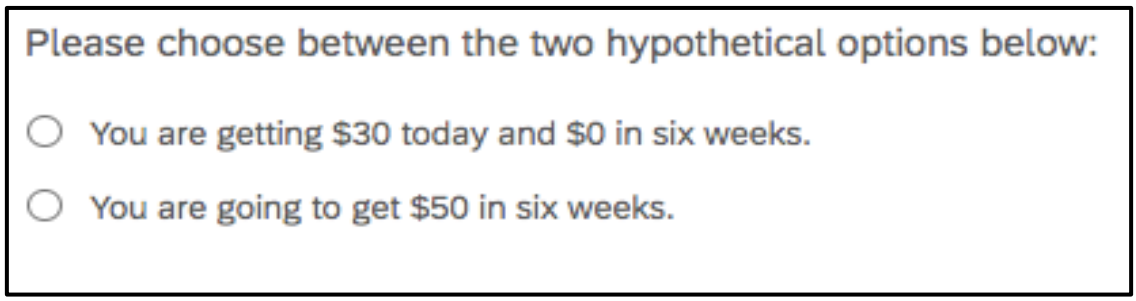


Types, Third Factor (standard vs. hidden zero): Hidden zero highlighted with choice or not.

Sample Question Third Factor (standard):



Sample Question Third Factor (hidden zero):

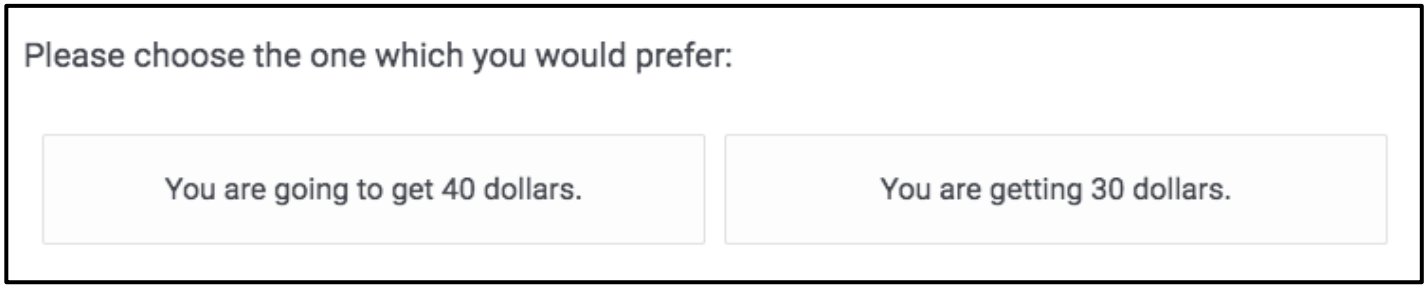


Study 3

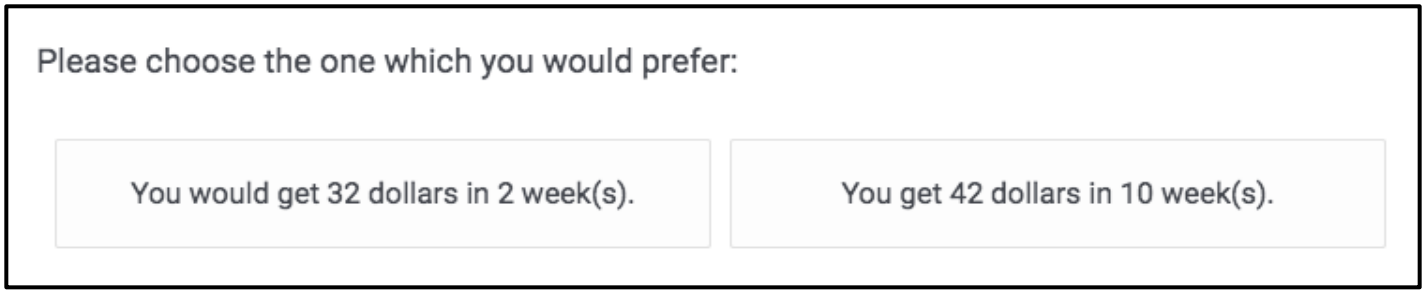
Overview: This study had four main conditions, displayed between subjects – one with no timing information, one with objective timing information, one with ambiguous timing information ("soon" vs. "later"), and the last with another type of ambiguous timing information ("now" vs. "at some point"). Each participant made 15 intertemporal choices. Across these choices, we randomized the verb tense (across two present-tense forms, two future tense forms and the neutral tense). We also varied (within subjects) the difference in magnitude between the sooner-smaller and later-larger amount. The smaller amounts ranged between $30 and $35 and the larger amounts were between $1 and $30 *more* than the smaller amount.
Most importantly, tense was manipulated between options to be one of the 5 tense forms – two present tense forms ("get" and "is getting"), two future tense forms ("will get" and "is going to get"), and one neutral tense form ("would get").

Sample Questions:

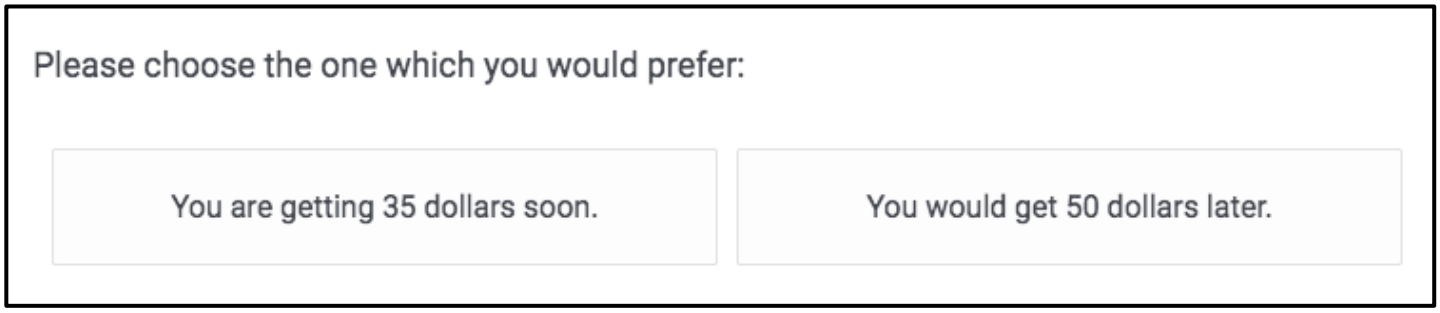
No timing information: The other tense pairs tested were "get" vs. "will get"; "will get" vs. "are getting"; "will get" vs. "are going to get"; "will get" vs. "would get"; "get" vs. "would get"; "get" vs. "are getting"; "get" vs. "are going to get"; "are getting" vs. "would get"; "are going to get" vs. "would get".



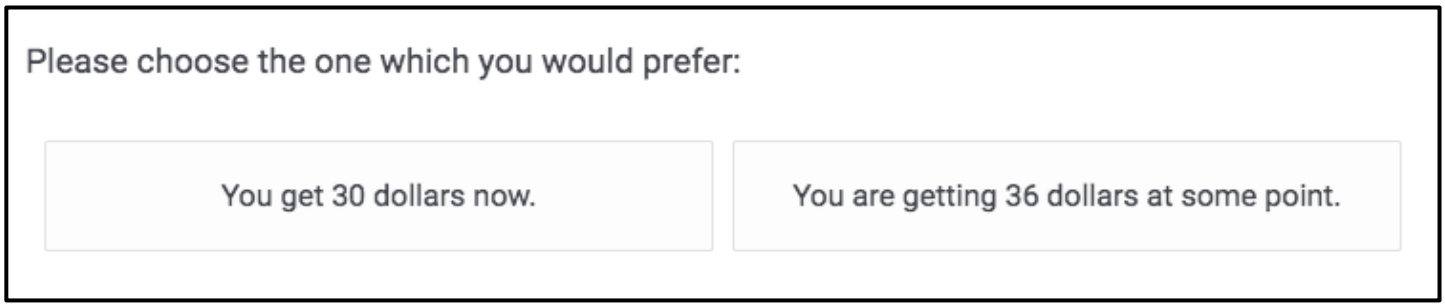
Objective timing information: The other tense pairs tested were “get” vs. “will get”; “will get” vs. “are getting”; “will get” vs. “are going to get”; “will get” vs. “would get”; “get” vs. “are getting”; “get” vs. “are going to get”; “are getting” vs. “would get”; “are going to get” vs. “would get”; “are going to get” vs. “are getting”. Order of tenses, and delays counterbalanced between the two options.



Ambiguous timing information (soon vs. later): The other tense pairs tested were “get” vs. “will get”; “will get” vs. “are getting”; “will get” vs. “are going to get”; “will get” vs. “would get”; “get” vs. “are getting”; “get” vs. “are going to get”; “get” vs. “would get”; “are going to get” vs. “would get”; “are going to get” vs. “are getting”. Order of tenses, and “soon” vs. “later” counterbalanced between the two options.



Ambiguous timing information (now vs. at some point): The other tense pairs tested were "get" vs. "will get"; "will get" vs. "are getting"; "will get" vs. "are going to get"; "will get" vs. "would get"; "get" vs. "are going to get"; "get" vs. "would get"; "are going to get" vs. "would get"; "are getting" vs. "would get" ; "are going to get" vs. "are getting". Order of tenses, and "now" vs. "at some point" counterbalanced between the two options.

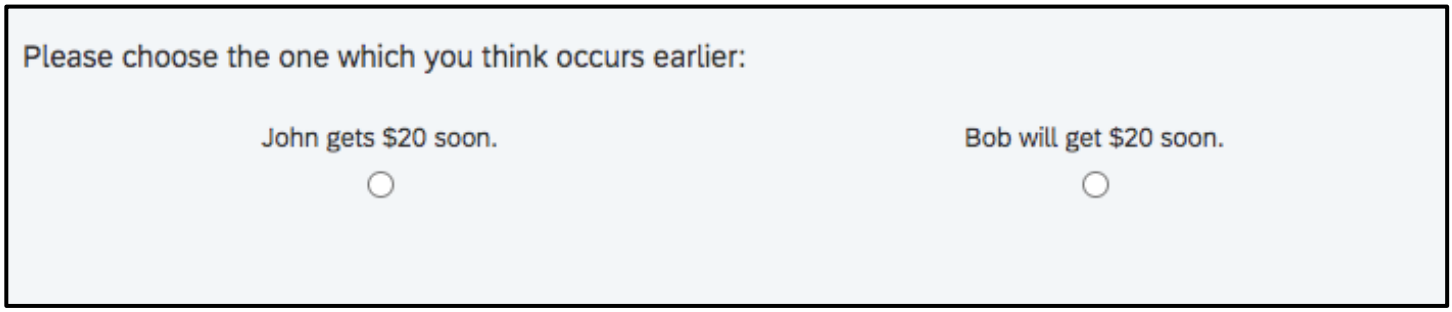


Study 4a

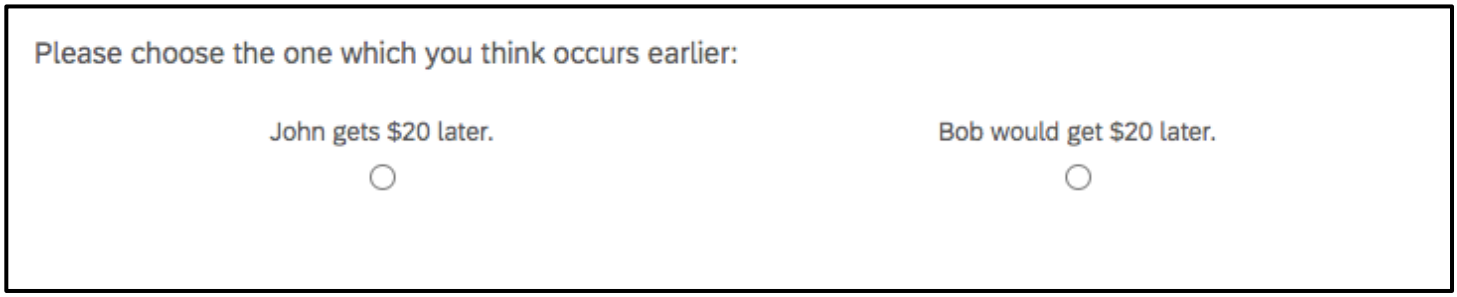
Overview: The study included 9 earliness inference questions, where only the tense form was changed between options within subjects. We tested 3 total tense forms – one present tense form ("get"), one future tense form ("will get"), and one neutral tense form ("would get"). 3 of the 9 questions had the ambiguous word "soon" in both options, 3 had "later" in both options, and the remaining 3 had "at some point" in both options.

Sample Question:

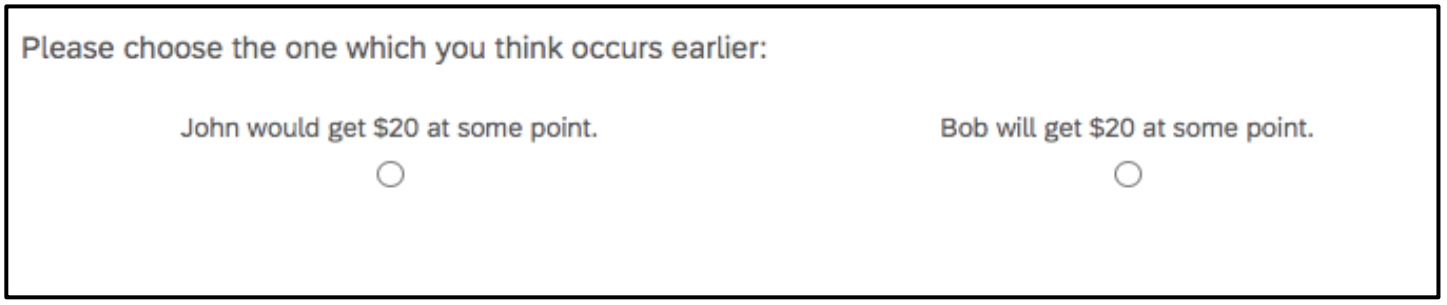
Soon in both options: The other pairs tested were "will get" vs. "would get"; "gets" vs. "would get". Tense order counterbalanced between both options.



Later in both options: The other pairs tested were “will get” vs. “would get”; “gets” vs. “will get”. Tense order counterbalanced between both options.



At some point in both options: The other pairs tested were “will get” vs. “gets”; “gets” vs. “would get”.



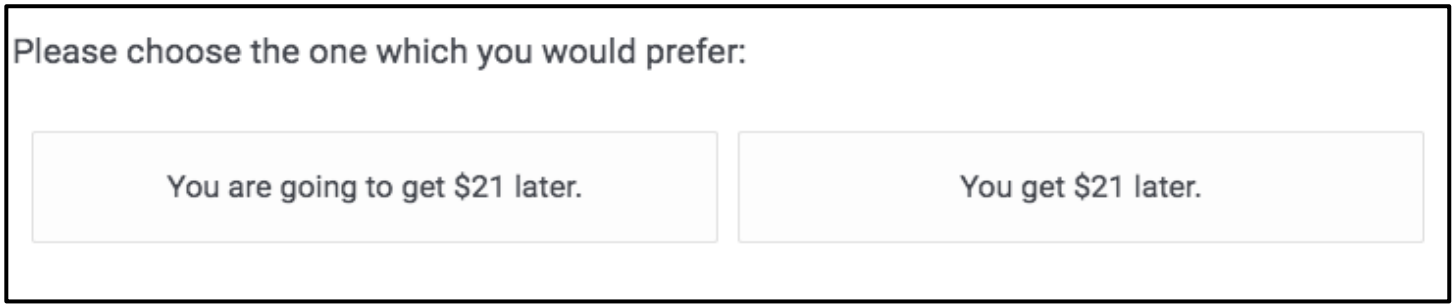
Study 4b

Overview: The study included 10 choice questions, where the tense form was changed between options within subjects. We tested all the 5 tense forms. Five of the 10 questions had the ambiguous word “soon” in both options and the other 5 had “later” in both options.

Sample Question:

Soon in both options: The other tense pairs tested were “get” vs. “will get”; “will get” vs. “are getting”; “will get” vs. “are going to get”; “will get” vs. “would get”; “get” vs. “are going to get”; “get” vs. “are getting”; “are going to get” vs. “would get”; “are getting” vs. “would get” ; “are going to get” vs. “are getting”. Amounts in each option between $19-21. Order of tense counterbalanced.

Later in both options: The other tense pairs tested were "get" vs. "will get"; "will get" vs. "are getting"; "will get" vs. "are going to get"; "will get" vs. "would get"; "get" vs. "would get"; "get" vs. "are getting"; "are going to get" vs. "would get"; "are getting" vs. "would get" ; "are going to get" vs. "are getting". Amounts in each option between $19-21. Order of tense counterbalanced.

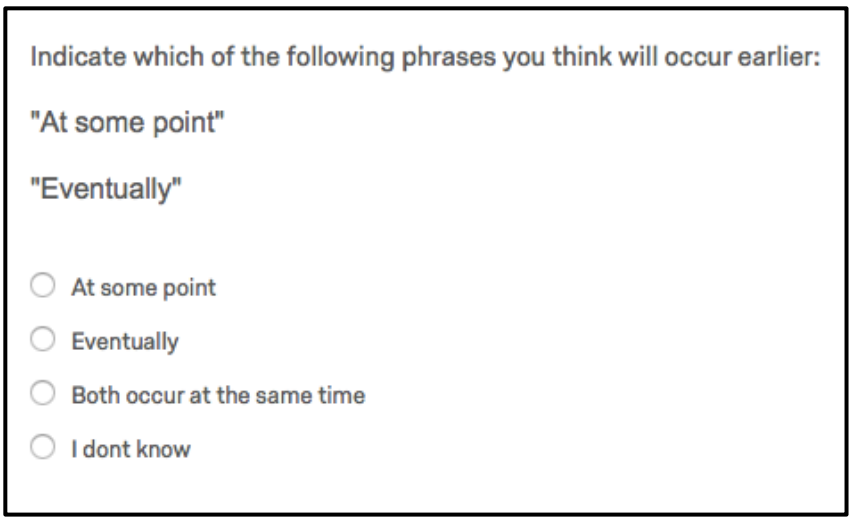


Pretest for Study 5a – Similar Meaning Ambiguous Word Pairs

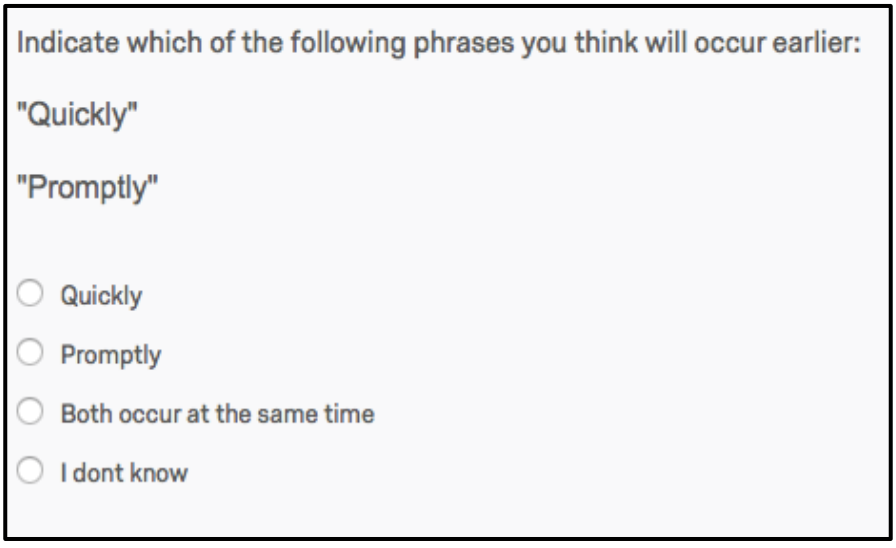
Methods: In these two pre-tests we recruited participants from AMT to test which pair of ambiguous words sounded the closest to each other in terms of timing. Participants were asked to indicate which out of the two given ambiguous words would occur earlier (sample questions below). We tested the delayed sounding word pairs in one and the immediate sounding word pairs in the other. For the delayed ambiguous words pretest, participants answered 3 questions, and the for the immediate ambiguous words pretest, participants answered 10 questions. The purpose of these pre-tests was to see which pairs of words were chosen as occurring earlier almost the same number of times.

Sample Question:

Delayed ambiguous words (N=65, after exclusions) : The other word pairs were – "Someday" vs. "Eventually"; "At some point" vs. "Someday".



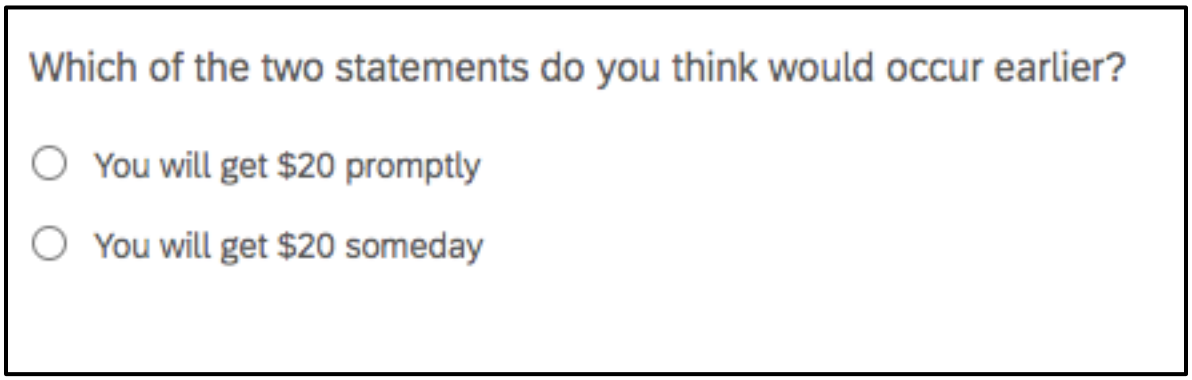
Immediate ambiguous words (N=95, after exclusions): The other word pairs were – “Shortly” vs. “Presently”; “Shortly” vs. “Promptly”; “Shortly” vs. “Quickly”; “Shortly” vs. “Swiftly”; “Presently” vs. “Promptly”; “Presently” vs. “Quickly”; “Presently” vs. “Swiftly”; “Promptly” vs. “Swiftly”; “Quickly” vs. “Swiftly”.



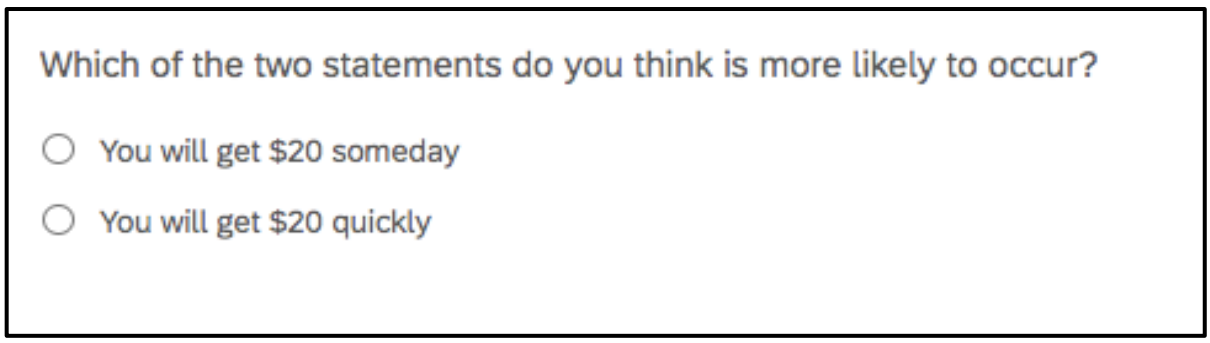
Pretest for Study 5a: Earliness and Likelihood Inferences for Immediate vs. Delayed Pair of Ambiguous Words

Methods: In this pre-test (N=240, after exclusions), we recruited participants from AMT to test whether the immediate ambiguous word pair chosen from the last pre-test ("promptly" and "quickly") were seen as occurring earlier than the delayed ambiguous word pair ("someday" and "eventually"). Participants were randomly assigned to the earliness or the likelihood inference condition. In the earliness inference condition, participants were asked 4 questions (as shown in sample question below), where only the ambiguous word was manipulated between the options (the tense was kept at future tense, and amount at $20 for both options). In the likelihood inference condition, we asked participants whether immediate ambiguous words would be seen as more likely to occur than the delayed ones, however we did not find any significant result for that. Participants in this condition also answered 4 questions, where again only the ambiguous word was manipulated between the two options (see sample question below).

Sample Question (Earliness) : The other word pairs were – "Promptly" vs. "Eventually"; "Quickly" vs. "Someday"; "Quickly" vs. "Eventually".



Sample Question (Likelihood) : The other word pairs were – "Promptly" vs. "Eventually"; "Promptly" vs. "Someday"; "Quickly" vs. "Eventually".

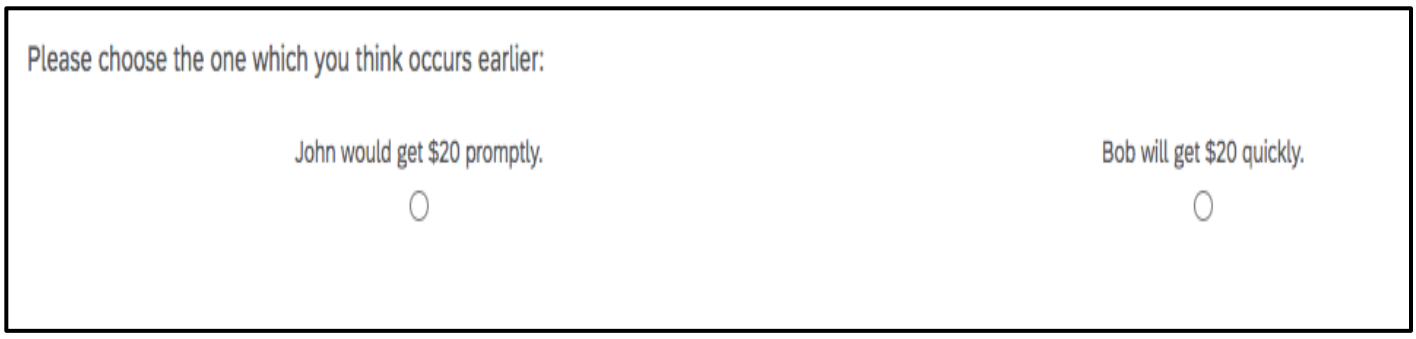


Study 5a

Overview: The study included 24 earliness inference questions, where the tense form was changed between options within subjects. We tested 3 total tense forms – one present tense form ("get"), one future tense form ("will get"), and one neutral tense form ("would get"). Twelve out of the 24 questions had "promptly" vs. "quickly" (counterbalanced) in the two options, and the remaining 12 had "someday" vs. "eventually" (counterbalanced) in the two options. Order of tense also counterbalanced between options.

Sample Questions

Promptly vs. Quickly: The other pairs tested were “will get” vs. “gets”; “gets” vs. “would get”.



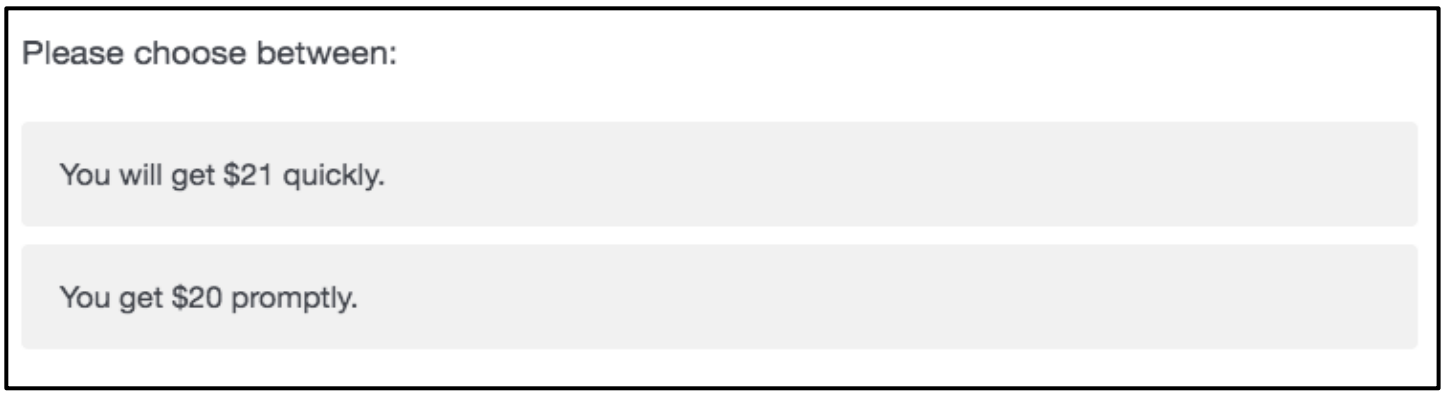
Someday vs. Eventually: The other pairs tested were “will get” vs. “gets”; “gets” vs. “would get”.

Study 5b

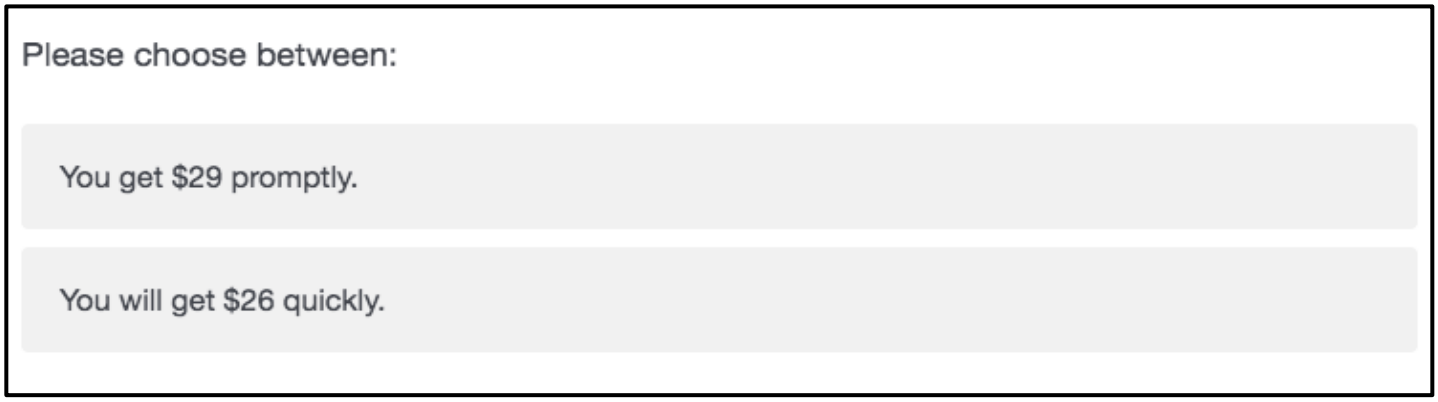
Overview: In this study, there were two groups making intertemporal choices – one that would only see options with the immediate pair of words (‘promptly’ vs. ‘quickly’) and the other that would see options with the delayed pair of words (‘someday’ vs. ‘eventually’). There were 16 choices between two options that varied in verb tense (either present “get” or future tense “will get”), described either using the immediate word pair (promptly/quickly, order counterbalanced) or the delayed word pair (someday/eventually, order counterbalanced).We also varied the differences in option amounts within-subjects, such that participants made choices both between options with small differences (values for both options ranging from $19-21) and between options with large differences (values for both options ranging from $10-30).

Sample Questions

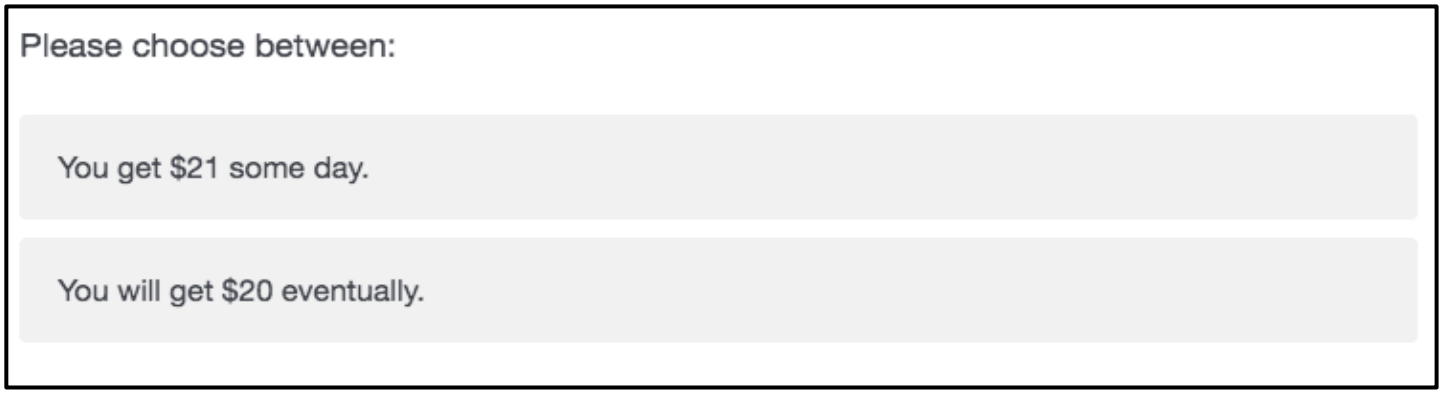
Promptly vs. Quickly, small differences:



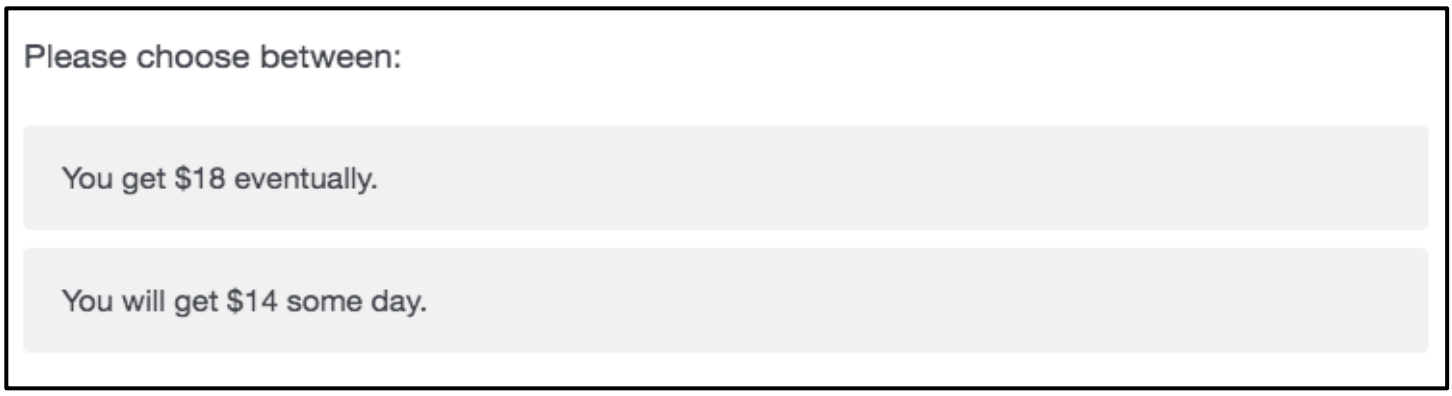
Promptly vs. Quickly, large differences:



Someday vs. Eventually, small differences:



Someday vs. Eventually, large differences:



Post-Test for Study 5b: Likelihood inferences of future tense compared to present and neutral tenses

Overview: In this post-test (N=128, after exclusions), participants were recruited from AMT to test whether the future tense is seen as more likely to occur compared to present tense and neutral tense. Participants were asked 2 questions, where only the tense was manipulated between the two options (amount held constant at $20). Specifically, future tense was tested against the present and neutral tense (see sample question below).

Sample question: The other option pair was 'will get' vs. 'would get', order counterbalanced