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Can asymmetric subjective opportunity cost effect explain impatience in intertemporal choice? A replication study

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Abstract

In "The value of nothing: asymmetric attention to opportunity costs drives intertemporal decision making" Read, Olivola and Hardisty (2017) proposed an asymmetric subjective opportunity cost (ASOC) effect to explain and predict why impatience can be detected in intertemporal choice. This work deserves to be replicated and extended for its novel and potentially important findings. The present study aimed to examine the reliability and robustness of the evidence presented by Read et al. by conducting precise replications of their key findings in Study 1. The ASOC effect (Read, et al., 2017) was important for expanding its application and reported to be typically stronger when baseline larger-but-later option (LL) and smaller-but-sooner option (SS) preferences were closer to 50% in the authors' original condition. Therefore, the present study also aimed to replicate and test the ASOC effect when baseline LL preferences were higher or lower than those in the original condition. We intended to set two additional conditions wherein either LL or SS is more obviously favored (i.e., baseline LL preferences were higher or lower than those in the original condition) by respectively applying the common difference effect (Kirby & Herrnstein, 1995) and the unit effect (Burson, Larrick & Lynch Jr., 2009; Pandelaere, Briers & Lembregts, 2011). Having successfully generated two more obviously favored conditions, the ASOC effect was replicated and confirmed under the original condition and one additional condition wherein SS was more obviously favored. However, the ASOC effect was not detected under the other additional condition wherein LL was more obviously favored. The implications of these findings were discussed.

Keywords: intertemporal choice, asymmetric subjective opportunity cost effect, replication, more obviously favored condition

1 Introduction

Individuals tend to be impatient when making intertemporal choices. Various decision effects have been investigated to identify ways to reduce impulsive choice behavior. Notable among recent efforts is the asymmetric subjective opportunity cost (ASOC) effect proposed to account for impatience (Read, Olivola & Hardisty, 2017).

The ASOC effect indicated that people are less likely to choose a smaller-but-sooner option (SS) over a larger-but-later option (LL) when the stimulus explicitly notes that getting SS now means getting $0 later; that is, the choice of SS goes down when the stimulus highlights its later opportunity cost (Read, Olivola & Hardisty, 2017).[1] However, when the opportunity costs of choosing LL rewards are highlighted, no effect is observed. The ASOC effect assumes that, although the opportunity costs of the LL option are naturally salient, the opportunity costs of its SS counterpart are often neglected or underweighted in intertemporal choice. In Study 1 of Read et al. (2017), opportunity costs were made explicit by providing people with subtle framing "nudges" (adding "£0"). For example, the SS zero frame was presented by describing the SS option as offering zero at the time when the LL outcome would occur. The LL choice proportions were then compared across four core frames: the Explicit zero frame (which makes both opportunity costs explicit), Hidden zero frame (with no explicit opportunity costs), SS zero frame (with the opportunity cost of choosing SS made explicit), and LL zero frame (with the opportunity cost of choosing LL made explicit). The ASOC effect was supported given a significant effect of the SS zero frame on patience. In the succeeding seven experiments, the generalizability of the ASOC effect was enhanced by changing the sizes or signs of the payoffs, adding delays, using an

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[1] We are grateful to a reviewer for suggesting this well-written rephrase of the ASOC effect.

incentive-compatible procedure, and utilizing alternative reminders. Evidence provided by Read et al. (2017) indicates that the prediction of the ASOC effect can adequately account for the Hidden zero phenomenon, which suggests that making zero outcomes explicit decrease impatience (Magen, Dweck & Gross, 2008), whereas other alternative explanations may not. The ASOC effect is then suggested as a possible effective means to prompt people to make patient choices. Read, Olivola and Hardisty's (2017) study deserves to be replicated and expanded for its novel and potentially important findings.

The so-called ASOC effect was first reported by Wu and He (2012, as indicated by Read et al., 2017). However, Wu and He focused on assessing the relationship between time perspective and the salience of future outcomes instead of directly investigating the ASOC effect itself. Considering that the ASOC effect was first found using a Chinese sample, a replication study testing whether this effect holds in a country with a high savings rate, such as China, would be interesting.

We also noticed that the ASOC effect was typically detected when baseline LL preferences were closer to 50% in Read et al.'s (2017) original condition. We conjectured that the ASOC effect might prompt people to be patient only when neither choice option clearly dominates in the standard Hidden zero frame. The ASOC effect could be absent when baseline LL preferences in the standard Hidden zero frame are away from 50%. This concern was acknowledged by Read et al. (2017) in their Discussion section. However, they did not manipulate the baseline preferences in the Hidden zero frame, so empirical evidence is lacking.

The present study aimed to examine the reliability and robustness of the evidence presented by Read et al. (2017) by conducting a precise replication of Study 1. The ASOC effect was observed under a condition wherein neither LL nor SS option was obviously favored (i.e., when baseline LL preferences were closer to 50%) by using Magen et al.'s (2008) 15 choice items. This replication study also aimed to test the ASOC effect when participants showed their obvious preference for either LL or SS option (in conditions where either LL or SS is more obviously favored). To be specific, we intended to set two additional more obviously favored conditions (i.e., baseline LL preferences higher or lower than those in the original condition) by respectively applying the common difference effect (Kirby & Herrnstein, 1995) and unit effect (Burson, Larrick & Lynch Jr., 2009; Pandelaere, Briers & Lembregts, 2011).[2] Between the two additional conditions, the common difference effect would increase patience by changing relative differences between two options on the **delay** dimension (adding a constant delay to both payoff dates of options), whereas the unit effect would decrease patience by changing relative differences between two options on the **outcome** dimension (changing the magnitude of payoffs of both options). This approach allowed us to perform additional replication and verification studies of these two effects on intertemporal choice.

To ensure interpretable results, we obtained original materials from Table 3 and the supplemental materials of the original paper by Read et al., (2017) (the same experimental materials were derived from Magen et al., 2008). In addition, we completed a replication checklist recipe (Brandt et al., 2014) and planned informative samples in advance (Simonsohn, 2015). Our materials and data are available on the Open Science Framework (https://osf.io/4ebzs/).[3]

1.1 Testing the ASOC effect in conditions where either SS or LL is more obviously favored

This study attempted to replicate the ASOC effect by adopting the original materials and investigating this effect in conditions wherein either SS or LL is more obviously favored. A 4 × 3 mixed design was employed in replicating the ASOC effect and testing it in more obviously favored conditions, with the zero frame as a between-subjects variable and the baseline condition as a within-subjects variable. On the basis of the findings of Read et al. (2017), we expected that, when the opportunity costs of choosing the SS option were highlighted, people would become more patient when baseline LL preferences were closer to 50% when using Magen et al.'s (2008) 15 choice items. Moreover, we aimed to test whether the ASOC effect would be reinforced or weakened when baseline LL preferences were higher or lower than those in the original condition.

1.2 Participants

In Read et al.'s (2017) Study 1, participants were recruited through Maximiles. They were randomly assigned to the four core frames and the Middle zero frame.[4] The calculation of the main effect of SS zero on patience reported in the original Study 1 involved only four frame groups of participants, excluding those who were assigned to the Middle zero frame group. Therefore, the sample size of the original reported ASOC effect was 563. The main effect of SS zero was reported (F (1, 561) = 30.65, $p < .001$, $\eta_p^2 = .05$). The confidence intervals of the reported effect size were calculated on the basis of the method provided by Smithson (2001): 90% CI [0.026, 0.084].

[2]The unit effect can be an instance of the magnitude effect (Thaler, 1981).

[3]In this article, we report how we determined our sample size, all data exclusions (if any), all manipulations, and all measures used in the study (Simmons, Nelson & Simonsohn, 2012).

[4]The "Middle zero" frame is the frame with zeros occurring halfway (in time) between the SS and LL outcomes. This frame was used to provide evidence supporting the ASOC effect rather than other accounts for explaining the Hidden zero effect.

As suggested by Simonsohn (2015), a replication needs 2.5 times the original sample size to have approximately 80% power. Given the reported original sample size of 563 participants, a goal was set to recruit at least 1,408 participants for informative replication sample sizes.

The sample of the present replication study was recruited online via Sojump (http://www.Wjx.cn), an online platform similar to Mechanical Turk or Qualtrics, which is used to launch nationwide e-surveys in China and is widely employed in behavioral and psychological studies. To rule out the participants who we assumed did not take the task seriously, 130% of the target was recruited to accommodate the exclusion criteria (Calin-Jageman, 2018). We thus placed an order of 1,830 participants with Sojump, with the request that all participants pass four attention check items. Participants from the sample of 1,830 respondents who gave nonsensical answers (always chose SS or LL) in all 45 choice items or who showed an inconsistent discount rate[5] were excluded. The final valid dataset consisted of 1,730 Chinese respondents (51% female; mean age = 30.56 years) and contained nearly 433 participants per between-subjects cell. The participants were paid ¥ 9 for their participation.

1.3 Procedures

The procedure of this replication study was modeled after the original, with the same instructions and similar choice items translated into Chinese. The only difference in the current procedure was that participants were required to make hypothetical choices in two additional more obviously favored conditions (i.e., baseline LL preference was supposed to be higher or lower than that in original condition). Participants in the original study needed to make hypothetical choices only in the baseline condition using Magen et al.'s (2008) 15 choice items.

As in the original study, participants were randomly assigned to one of the four core frame groups: Explicit zero frame, Hidden zero frame, SS zero frame, and LL zero frame.[6] Participants in each group needed to complete all three sets of choice items presented in the assigned frame, with each set containing 15 choice items. The choice items in the baseline condition were presented first, then the presentation order of two additional sets of paired choice items was counterbalanced within the group. The presentation order of choice items was randomized within each set for each participant. In the study by Read et al. (2017), patience was found to be unaffected by the presentation format of options.

[5]Take the paired of choice "£4.50 today or £7.70 in 28 days" and "£4.70 today or £5.40 in 92 days" as an example, if LL was chosen in the pair of "£4.70 today or £5.40 in 92 days", then LL in the pair of "£4.50 today or £7.70 in 28 days" should be dominantly favored and chosen according to a discounting model in intertemporal choice. Otherwise, an inconsistent discount rate was revealed.

[6]Compared with the original study, the middle zero frame was omitted in the present research.

Table 1: Delay lengths and payoff magnitudes for the 15 items drawn from Magen et al. (2008). (Payments were in "£" for the present study.)

Smaller, sooner (SS) amount	Larger, later (LL) amount	Delay (days)
£2.00	£8.50	18
£3.10	£8.50	7
£3.30	£8.00	14
£4.10	£7.50	20
£4.30	£7.50	22
£4.50	£7.70	28
£4.70	£5.40	92
£4.90	£5.80	42
£5.00	£7.20	34
£5.40	£8.00	30
£5.50	£7.50	61
£6.00	£8.50	46
£6.70	£7.50	119
£6.90	£8.70	102
£8.00	£8.40	140

Therefore, the choice items were presented individually (i.e., one pair of options at a time), and the options of each item were presented vertically. Finally, demographic information, including age and gender, was collected.

1.4 Materials

Choice items were presented in four zero frames as in the original study. Below are four corresponding examples:

> Hidden zero frame: £2.00 today OR £8.50 in 18 days;
>
> Explicit zero frame: £2.00 today and £0 in 18 days OR $0 today and £8.50 in 18 days;
>
> SS zero frame: £2.00 today and $0 in 18 days OR £8.50 in 18 days;
>
> LL zero frame: £2.00 today OR $0 today and £8.50 in 18 days.

Three sets of paired choice items were used to examine the reliability and robustness of the ASOC effect and investigate it in conditions wherein either SS or LL is more obviously favored.

Original baseline condition: 15 choice items drawn from Magen et al. (2008), which were the same materials adopted in Study 1 of Read et al. (2017).

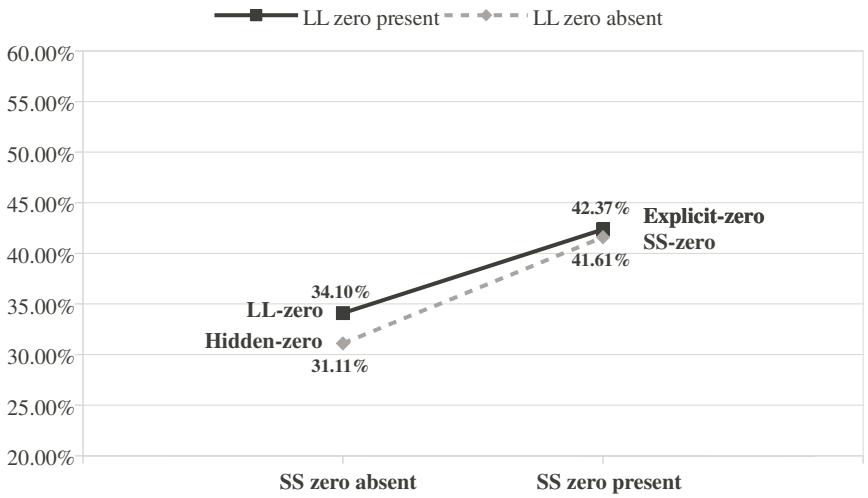

FIGURE 1: Mean level of patience (proportion of LL choices) as a function of zero framing in the original baseline condition The horizontal axis indicates the presence or absence of the SS zero. The solid line indicates the presence of the LL zero, and the dotted line indicates its absence.

Example of original items:

Choose between

£2.00 today OR £8.50 in 18 days

Common Delay condition: 15 newly generated choice items with LL preferences that were supposed to be higher than those in the original condition. The common difference effect (Kirby & Herrnstein, 1995) suggests that adding a constant delay to both payoff dates of options would shift preference from SS to LL option. Accordingly, we added a common constant additional delay to both original options, in the hope that a stronger preference for the LL option could be reached.

Example of generated items (adding a common delay interval of 100 days to both original choice options):

Choose between

£2.00 in 100 days OR £8.50 in 118 days

Money Unit condition: 15 newly generated choice items with LL preferences that were supposed to be lower than those in the original condition. The Unit effect (Burson, Larrick & Lynch Jr., 2009; Pandelaere, Briers & Lembregts, 2011) suggests that expressing quality information in a currency unit that has a lower value makes the perceived relative difference between two options on the **outcome** dimension smaller. Accordingly, we replaced the payoffs' unit of "pound" with the unit of "Thai Baht" in both original options (e.g., replacing £2.00 with ฿2.00), in the hope that a stronger preference for the SS option could be reached.

Example of generated items (the familiarity of "฿"might be similar to that of "£" for Chinese participants, ฿1 ≈ £0.02):

Choose between

฿2.00 today OR ฿8.50 in 18 days

Patience was measured in terms of the proportion of LL choices in each of the three sets of pairs of intertemporal choice items.

2 Results

First, we intended to replicate and test the ASOC effect. Read et al. (2017) predicted an ordering of LL choice proportions across the four conditions as follows: SS zero = Explicit zero > Hidden zero = LL zero.[7] As in the original study, we calculated patience (the proportion of LL responses) for each participant. Then we compared the effects of the four core zero frames on the proportion of the LL choices in the **original** condition (Figure 1). The results indicated that participants were more patient in the SS zero frame than in the Hidden zero frame (41.61% vs. 31.11%, t (870) = 6.10, p < .001, d = .41, 95% CI [0.279, 0.547]), which is consistent with the original study. No significant differences in patience were noted between the SS and Explicit zero frames (p = .68) as well as the LL and Hidden zero frames (p = .09).

We then conducted a 2 (SS zero: present vs. absent) × 2 (LL zero: present vs. absent) × 3 (Condition: original condition, Common Delay condition, and Money Unit condition) ANOVA, with condition as a within-subjects factor and SS

[7]Compared with the original study, the middle zero frame was omitted in the present study.

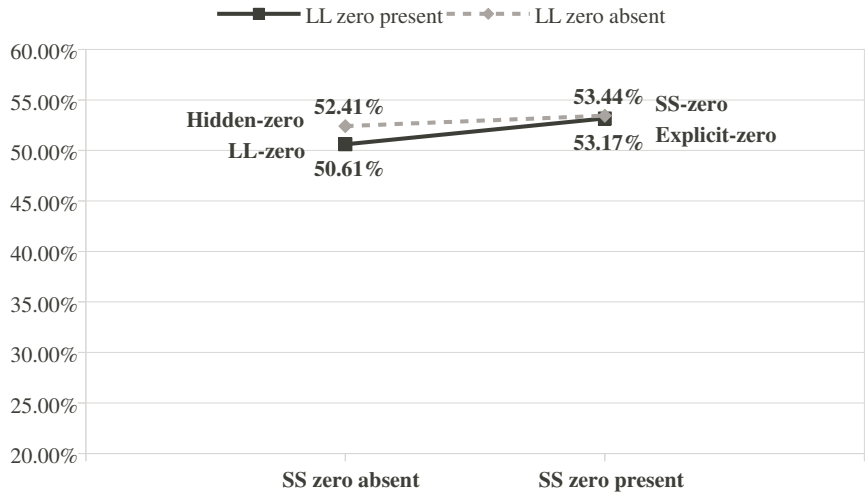

FIGURE 2: Mean level of patience (proportion of LL choices) as a function of zero framing in the Common Delay condition The horizontal axis indicates the presence or absence of the SS zero. The solid line indicates the presence of the LL zero, and the dotted line indicates its absence.

zero frame and LL zero frame as between-subjects factors. The ANOVA revealed a main effect of SS zero (F (1, 1725) = 59.06, p < .001, η_p^2 = .033, 90% CI [0.021, 0.048]), and a main effect of conditions (F (2, 1724) = 354.16, p < .001, η_p^2 = .291, 90% CI [0.262, 0.318]). Moreover, the ANOVA revealed a significant condition-by-SS zero interaction (F (2, 1724) = 20.02, p < .001, η_p^2 = .023, 90% CI [0.012, 0.035]), and a significant condition-by-LL zero interaction (F (2, 1724) = 3.08, p = .05, η_p^2 = .004, 90% CI [0.000, 0.009]). No other significant effect was found ($ps \geq .15$).

Simple effect analysis of condition-by-SS zero interaction showed that under original condition, patience in the presence of SS zero frame (M = 41.99%) was significantly higher than that in the absence of SS zero frame (M = 32.60%) (p < .001) (Figure 1). Under Money Unit condition, patience in the presence of SS zero frame (M = 39.12%) was significantly higher than that in the absence of SS zero frame (M = 29.08%) (p < .001) (Figure 3). However, no significant difference between the presence and absence of SS zero frames was found under Common Delay condition (p = .13) (Figure 2). Simple effect analysis of condition-by-LL zero interaction showed that no significant difference between the presence and absence of LL zero frames was found in each of three conditions ($ps \geq .07$).

The results of the present study supported the ASOC effect of Read, Olivola and Hardisty (2017) in their original condition. Specifically, people became more patient when the opportunity cost of the SS option was highlighted, whereas patience remained constant when the opportunity cost of the LL option was highlighted. The effect sizes found in the present study were comparable to those observed in the original study (η_p^2 = .05, 90% CI [0.017, 0.049]), though slightly weaker in our Chinese sample. A statistically significant main effect of SS zero frame on the proportion of LL choices with the same direction as the original study were detected, which indicated that this replication were as successful as the results in the original study (Camerer et al., 2016; Open Science Collaboration, 2015).

Having successfully replicated the ASOC effect under the original condition in the present study, we found mixed results of the ASOC effect in the two additional more obviously favored conditions. First, ASOC effect was obtained in Money Unit condition when baseline LL preferences were *lower* than those in the original condition (by applying unit effect). Second, little to no effect of SS zero framing on patience were detected in Common Delay condition when baseline LL preferences were higher than those in the original condition (by applying the common difference effect).

2.1 Replication and verification of the common difference effect and unit effect

To generate two additional conditions for investigating the ASOC effect in the more obviously favored conditions, we chose to apply the common difference effect and unit effect respectively to the original baseline condition. Therefore, the robustness of the common difference effect (Kirby & Herrnstein, 1995) and unit effect (Burson, Larrick & Lynch Jr., 2009; Pandelaere, Briers & Lembregts, 2011) could be replicated and verified separately as byproducts in this study.

Regarding the common difference effect, a paired-sample t test was performed for participants assigned to the Hidden zero frame group to compare the differences in patience between the original condition and Common Delay condition. Patience in the Common Delay condition was significantly higher than that in the original condition (52.41% vs. 31.11%

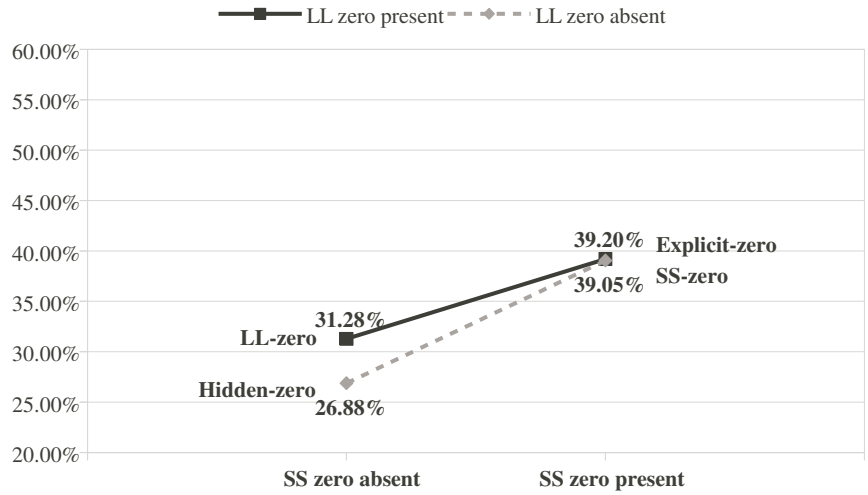

FIGURE 3: Mean level of patience (proportion of LL choices) as a function of zero framing in the Money Unit condition. The horizontal axis indicates the presence or absence of the SS zero. The solid line indicates the presence of the LL zero, and the dotted line indicates its absence.

LL choice, t (446) = 16.65, $p < .001$, d = 1.12, 95% CI [0.964, 1.265]).

As for unit effect, a paired-sample t test was performed for participant assigned to the Hidden zero frame group to compare the differences in patience between the original condition and Money Unit condition. Participants were less patient in Money Unit condition than in the original condition (26.88% vs. 31.11% LL choice, t (444) = −3.70, $p < .001$, d = .25, 95% CI [0.115, 0.380]).

The analysis investigated the common difference effect and the unit effect based on the proportion of LL option (Figure 4). We have further analyzed participants' choice at the item level. Table 2 provides a close look at the item-level data.

In the Common Delay condition, the item-level data analysis revealed that, for all the 15 pairs of choices (100% of all the choice items), the choices of participants shifted in the expected direction (i.e., shifting choices from SS into LL). In addition, all the McNemar χ^2 values were statistically significant ($ps < .001$), indicating that applying the common difference effect to prompt people to be **more** patient is successful. In the Money Unit condition, item-level data analysis revealed that for 11 out of the 15 pairs of choices (73% of all the choice items), the choices of participants shifted in the expected direction from that in the original condition (i.e., shifting choices from LL into SS) and the McNemar χ^2 values were statistically significant ($ps < .05$), indicating that applying the unit effect to prompt people to be **less** patient is similarly successful.

The common difference effect and the unit effect were also replicated and verified. This result made generating two more obviously favored conditions possible and feasible by applying these two effects separately.

3 Discussion

The goal of this study was to assess the replicability of the research presented by Read, Olivola and Hardisty (2017) in support of the ASOC effect. Consistent with the original findings, the present replication of Study 1 confirmed that the ASOC effect was robust when using Magen et al.' s (2008) 15 choice items adopted by Read et al. (2017). The resulting effect size of the SS zero frame on patience in our experiment was comparable to but weaker than that reported in the original study. The ASOC effect observed using a Chinese sample in the present study, together with those found using Western (American and British) and Indian samples reported in the original study, adds to the accumulating evidence that the ASOC effect is a general human tendency rather than the product of culture.

Our Chinese participants showed lower than expected patience in the original condition (around 30% in the present study, 50% in the original study). The reason our results differed from our expectations might be that the hypothetical payoff and delay adopted in this study were relatively smaller and shorter compared with the large magnitude outcome and long delay of real-world saving behavior. Interval effect (Read, 2001; Read & Roelofsma, 2003) suggested that small payoff/short-term intertemporal preference might not sufficiently describe and predict the large payoff/long-term saving behaviors.

To expand the application of the ASOS effect, the common difference effect (Kirby & Herrnstein, 1995) and unit effect (Burson et al., 2009; Pandelaere et al., 2011) were applied separately to generate two additional more obviously favored conditions. The common difference effect was successfully demonstrated to prompt people to select more LL

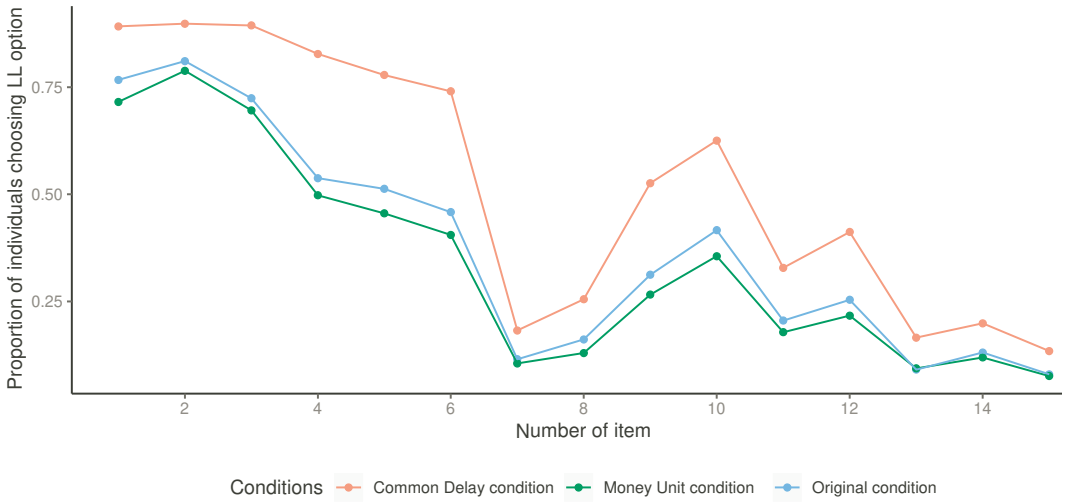

FIGURE 4: Proportion of individuals choosing LL option in each of the 15 items, as a function of the common difference effect (in red) and unit effect (in green).[8]

options, whereas unit effect was also demonstrated to be able to prompt people to select more SS options.

The common difference effect was verified in the present study to generate conditions wherein the LL option was more obviously favored. However, no significant ASOC effect was observed in our Common Delay condition, suggesting it might be a condition beyond which further manipulations (e.g., the ASOC effect) have no additional effect on improving patience. A strong ASOC effect was detected in a front-end delay condition included in Study 3 in the original paper by Read et al. (2017). Nonetheless, the front-end delay effect was not obtained in their study. The front-end delay and the common difference effect suggest that adding delays to original options could increase patience. However, a few differences were observed between the original paper and the present study. First, from the perspective of adding time intervals, a constant delay of 100 days was added to both SS ad LL options in the present study, whereas the original LL delay to both SS and LL options were added in each choice item in original paper of Read, Olivola and Hardisty (2017). Second, from the perspective of selecting choice items, all 15 choice items drawn from Magen et al. (2008) were used in the present study, whereas 11 out of 15 choice items were selectively adopted in the original paper. Third, the baseline patience of participants differed between the two studies.

The unit effect was successfully replicated, in order to generate conditions wherein the SS option was more obviously favored in this study, although the effect was not as strong as the common difference effect on patience. We speculated that the reason might be that familiarity with the "Thai Baht" was not as high as expected in our Chinese sample. Consequently, participants had to convert the outcomes' unit of "Thai Baht" (฿) into "British Pound" (£) and then into "Chinese Yuan" (¥), which might have caused additional difficulty for our Chinese participants.

More generally, to reach a more obvious preference for the LL option, the common difference effect was applied in the present study to change the perceived relative differences between two options on the *delay* dimension. We conjectured that any other effects, such as date/delay effect (see Read, Frederick, Orsel & Rahman, 2005), that might play a similar role in changing the perceived relative differences between two options on the delay dimension could be applied to improve patience in the intertemporal choice. To reach a more obvious preference for the SS option, the unit effect was employed in the present study to change the perceived relative differences between two options on the *outcome* dimension. Future research may consider 1) re-examining the unit effect by directly replacing the unit of payoffs with "Chinese Yuan" or using other currency of even lower value (e.g., Japanese Yen) and 2) enhancing impulsive choice by using any other effects, such as magnitude effect (Thaler, 1981), that might play similar roles in changing the perceived relative differences between two options on the outcome dimension.

In view of the balanced evidence, an asymmetry in the ASOC effect on prompting the patience was observed in this study. That is, little to no ASOC effect was observed in the Common Delay condition, but the ASOC effect was detected in the Money Unit condition with a slightly larger effect size than that in the original condition. It leaves the possibility that the failure to find the ASOC effect in the condition wherein the LL option was more obviously favored was due to a change in baseline patience or a change in the framing of options. An overall explanation might be that the room for improvement (from SS to LL) determined the asymmetry in the ASOC effect on prompting patience. The

[8]We acknowledge Editor Jonathan Baron for suggesting that we apply this analysis.

TABLE 2: Choice results from the 15 pairs of choices in the original condition, Common Delay condition, and Money Unit condition, with McNemar χ^2 tests.

		Original Condition															
		Item 1		Item 2		Item 3		Item 4		Item 5		Item 6		Item 7		Item 8	
		SS	LL	SS	LL	SS	LL	SS	LL	SS	LL	SS	LL	SS	LL	SS	LL
Common delay condition	SS	101	86	71	105	108	75	220	78	290	93	353	96	1313	102	1182	107
	LL	302	1241	256	1298	369	1178	580	852	553	794	584	697	218	97	269	172
		χ^2=119.14		χ^2=62.33		χ^2=193.35		χ^2=381.46		χ^2=326.13		χ^2=348.78		χ^2=41.33		χ^2=68.94	
		$p < .001$		$p < .001$		$p < .001$		$p < .001$		$p < .001$		$p < .001$		$p < .001$		$p < .001$	

		Item 9		Item 10		Item 11		Item 12		Item 13		Item 14		Item 15	
		SS	LL	SS	LL	SS	LL	SS	LL	SS	LL	SS	LL	SS	LL
	SS	714	106	527	121	1063	99	921	96	1387	57	1307	79	1432	66
	LL	476	434	483	599	312	256	370	343	186	100	197	147	160	72
		χ^2=233.95		χ^2=215.76		χ^2=109.35		χ^2=159.93		χ^2=67.42		χ^2=49.60		χ^2=38.27	
		$p < .001$		$p < .001$		$p < .001$		$p < .001$		$p < .001$		$p < .001$		$p < .001$	

		Item 1		Item 2		Item 3		Item 4		Item 5		Item 6		Item 7		Item 8	
		SS	LL	SS	LL	SS	LL	SS	LL	SS	LL	SS	LL	SS	LL	SS	LL
Money unit condition	SS	227	265	173	193	261	265	543	326	592	350	699	330	1412	136	1316	190
	LL	176	1062	154	1210	216	988	257	604	251	537	238	463	119	63	135	89
		χ^2=17.56		χ^2=4.16		χ^2=4.79		χ^2=7.93		χ^2=15.98		χ^2=14.58		χ^2=1.00		χ^2=8.97	
		$p < .001$		$p = .041$		$p = .029$		$p = .005$		$p < .001$		$p < .001$		$p = .316$		$p = .003$	

		Item 9		Item 10		Item 11		Item 12		Item 13		Item 14		Item 15	
		SS	LL	SS	LL	SS	LL	SS	LL	SS	LL	SS	LL	SS	LL
	SS	1000	270	798	317	1224	198	1107	248	1467	101	1381	143	1502	97
	LL	190	270	212	403	151	157	184	191	106	56	123	83	90	41
		χ^2=13.57		χ^2=20.45		χ^2=6.06		χ^2=9.19		χ^2=.08		χ^2=1.36		χ^2=.19	
		$p < .001$		$p < .001$		$p = .014$		$p = .002$		$p = .781$		$p = .244$		$p = .661$	

baseline LL preferences in the Money Unit condition by applying unit effect were relatively low, leaving adequate room for the ASOC effect or other effects to prompt people into making more patient choices. By contrast, the baseline LL preferences in the Common Delay condition by applying the common difference effect were relatively high, therefore leaving little room for the ASOC effect or other effects to play a role in improving patience. This asymmetry feature will pose a challenge for future researchers who may be interested in conducting additional research on prompting patient choices.

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