Delay d'ETRE: Explict Temporal Ratios Lead to Impatience

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Abstract

When selecting a shipping speed on Amazon we are faced with a choice between getting our package sooner but paying more money, or getting our package later and paying less money. This shipping decision is a subset of a larger class of decisions known as intertemporal choices – choices involving different points in time. Previous research on intertemporal framing has shown that displaying times as dates – January 23rd – as opposed to delays – 6 weeks – increases patience. The present research expands this finding. Across three experiments I show that making temporal ratios explict leads to differing levels to increase impatience in standard intertemporal choices framed as gains, intertemporal choices framed as losses, and for an explicit shipping scenario. Taken together these results suggest that framing delays as ratios leads to greater impatience.

1 Introduction

Intertemporal choices "involve relative preferences and tradeoffs for costs and benefits that occur over time" (Urminsky & Zauberman, 2014, p. 2). A subset of intertemporal choices are shipping decisions. All of us have felt the itch to get the new purchase we made on Amazon as quickly as possible; sometimes leading us choosing expedited shipping, even at considerable cost.

Generally on Amazon we see shipping times as the number of days until you will receive your package, e.g. "Receive your package in 2 days". The shipping time could also be described as "Receive your package on December 17th". This reframing of delays – 2 days – into dates – December 17th – has been shown to increase patience (Read, Frederick, Orsel, & Rahman, 2005). Occasionally Amazon uses the date frame, ostensibly to induce more patience from customers.

However a firm may want consumers to be impatient and choose the expedited shipping option. If a firm's inventory is high they may want consumers to ship their items faster. The goal of this paper is to introduce how a novel temporal frame – namely explicit ratios – which leads to greater degrees of impatience.

Across 3 studies I show that by making implicit temporal ratios explicit people are more impatient in intertemporal choices. This result holds for intertemporal choices framed as gains, losses, and in an explicit shipping scenario. Firms wanting to decrease patience in their consumers may want to frame intertemporal choices as ratios as opposed to delays.

2 Literature Review

There are four general categories of research on intertemporal choices (see Read, Frederick, and Scholten (2013) for an overview). The first stream focuses on how magnitude of both time and money effects patience (Scholten & Read, 2006; Thaler & Shefrin, 1981) The second stream focuses on how choices relate to real world behavior. Individual differences in imputed discount functions predict real world phenomenon such as credit card debt, mortgage choice, and smoking (MacKillop et al., 2011; Meier & Sprenger, 2009; Johnson, Payne, & Atlas, 2011). The third stream focuses on how emotional states can alter intertemporal preferences, e.g. being shown freshly baked bread (Li, 2008). The fourth stream investigates how the framing of options affects patience. The current paper is mainly housed within the fourth stream, but also attempts to answer how temporal frames alter real world decisions.

An example of option framing in intertemporal choice is the hidden zero effect – when the implicit zeros in intertemporal choices are made explicit people are more patient (Magen, Dweck, & Gross, 2008). For instance when a choice between "receiving $100 now" and "$110 in 6 months" is reframed to be "receiving $100 now *and nothing in six months*" and "$110 in 6 months *and nothing now*" people are more patient.

Additionally Read et al. (2013) show that making the ratio between amounts salient affects intertemporal choices. Specifically when the magnitude of amounts is small, reframing the amounts as interest rates leads to increased patience. Taking the above example, when reframed as an interest rate, e.g. a choice between "receive $100 now" and "receive 10% more in six months" people are more patient. Read et al. (2013) posit that interest framed amounts lead to an increased reliance on ratios of monetary amounts.

Beyond amounts, times can also be reframed. The most famous example of temporal reframing is Lincoln's Gettysburg Address which made 87 years into the "Four score and seven years ago". Read et al. (2005) shows that how a times are framed in intertemporal choices can alter patience. Taking the above example, people are more patient when reframed it as a choice between "receive $100 now" and "receive $110 on June 15" – this is known as the delay/date effect. The delay/date effect demonstrates that perceived temporal distance is dependent on how delays are framed.

In work on the cognitive processes underlying intertemporal choices, Marzilli Ericson, White, Laibson, and Cohen (2015) show that in intertemporal choices framed as "receiving $100 now" and "$110 in 6 months", people rely on both differences and ratios of the attributes of intertemporal choices – monetary amounts and times. Their model – the Intertemporal Choice Heuristic (ITCH) – does better at predicting intertemporal choices than classic models, such as hyperbolic or exponential discounting. ITCH posits that people weight four attributes – amount difference, amount ratio, time difference, time ratio – to varying degrees when making intertemporal choices. Holding everything else constant and increasing the weight placed on the time ratio component, ITCH predicts that people will be more impatient on identical intertemporal choices.

Taken together, this suggests that by making temporal ratios more salient will lead to less patience. I propose a new framing effect in intertemporal choice: the Explicit Temporal Ratio Effect (ETRE). The ETRE posits that by making temporal ratios salient people will be more impatient. Specifically, the ETRE focuses on how framing times as ratios can decrease patience. When delays are sufficiently small, and when temporal ratios are made explicit, our attention

will be focused on how much *relatively longer* we will wait. For instance reframing a choice between "receiving $100 in 1 day" and "$110 in *10 days*" to being a choice between "receiving $100 in 1 day" and "$110 in 10 *times as long*", will focus participants on how much longer relatively they will wait for $110 as opposed to receiving the $100 today. This increased focus on how long they will wait, leads to decreased patience when times are framed as ratios.

I test the ETRE across three studies. The Study 1 tests the ETRE in standard intertemporal choices framed as gains. As a test of robustness, Study 2 tests how the ETRE effects patience in losses. Although losses have been shown to be a critical moderator of intertemporal preferences, few studies explore how losses affect intertemporal choices (Hardisty, Appelt, & Weber, 2013; Hardisty & Pfeffer, 2015). Further all studies cited so far have only looked at framing effects of intertemporal choices framed as gains (Magen et al., 2008; Read et al., 2005, 2013). Framing effects which are robust for gains, may affect losses differently.

Study 3 expands on Studies 1 and 2 by testing the ETRE in an explicit shipping scenario. Shipping scenarios are formatted differently than intertemporal choices in the previous studies. Study 3 serves as test that the ETRE happens in explicit shipping scenarios.

In what follows I explicitly state three hypotheses generated to test the ETRE. I then present three studies to test these hypotheses. Finally, I conclude with the discussion and implications of the ETRE.

2.1 Hypothesis

2.1.1 Hypothesis 1

Gain intertemporal choices take the form of receiving differing amounts of money at two times, e.g. "receiving $100 in 1 day" and "receiving $110 in 10 days". Given that people rely on differences and ratios between amounts and times in intertemporal choice, increasing the reliance on ratios for times with relatively small differences should lead to decreased patience.

Hypothesis 1: In gain intertemporal choices, when times are expressed as ratios, people will be more impatient than when expressed as delays.

2.1.2 Hypothesis 2

Loss intertemporal choices take the form of paying differing amounts of money at two times, e.g. "paying $100 in 1 day" and "paying $110 in 10 days". Similar to hypothesis 1 when framed as losses making temporal ratios explicit people will be more impatient.

Hypothesis 2: In loss intertemporal choices, when times are expressed as ratios, people will be more impatient than when expressed as delays.

2.1.3 Hypothesis 3

Although choosing a shipping speed is similar to a loss framed intertemporal choice, there is a subtle difference between the two. When selecting a shipping speed people are asked to pay now to receive something sooner, whereas

for the items in Study 2 people are asked to pay at two different times. However there is no good reason to suspect that the ETRE would change in the shipping scenario. Related to hypothesis 2 when framed an intertemporal choice is framed as a shipping scenario, making temporal ratios explicit people will induce less patience.

Hypothesis 3: In shipping scenarios, when times are expressed as ratios, people will be more impatient than when expressed as delays.

2.2 Summary of Studies

Study 1 shows that the explicit temporal ratios lead to less patience in intertemporal gains. Study 2 extends this effect to intertemporal losses. Finally, Study 3 shows that in an explicit shipping scenario people are less patient when temporal ratios are made explicit.

3 Study 1

Study 1 makes implicit temporal ratios explict in intertemporal gains. Participants chose between smaller sooner and larger later options. These options were displayed in one of two frames: implicit temporal ratios and explicit temporal ratios. Study 1 tests Hypothesis 1: In gain intertemporal choices, when times are expressed as ratios, people will be more impatient than when expressed as delays.

3.1 Method

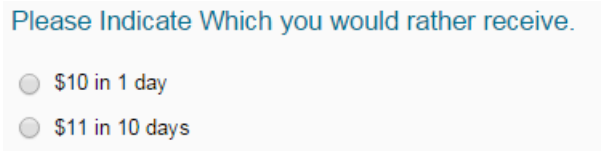
Two hundred participants with standard demographics from Amazon Mechanical Turk were recruited to take part in a "Decision Making Survey". Although the validity of Mechanical Turk has been called into question, Paolacci, Chandler, and Ipeirotis (2010) finds that classic effects in decision making replicate. Further, participants who have less than 50 HITs accepted or who have less than 95% of their HITs accepted were not allowed to participate in the study. Additionally only participants who passed an attention check were included in the final analysis. These precautions were taken to ensure that participants were paying attention to the study

Participants completed informed consent, then were given a test to ensure they understood the paradigm. Next they were assigned to one of the two conditions: implicit ratio or explicit ratio. They then were shown the five intertemporal choices in from the Study 1 section of Table 1. Choices were displayed in a randomized order

Table 1: Amounts and times of Stimuli for Studies 1-3

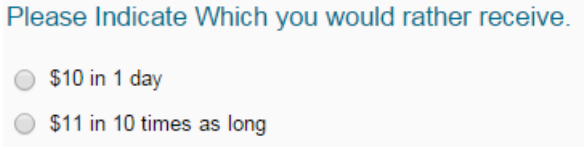
	A		B		C		D		E	
Question	Option 1	Option 2	Option 1	Option 2	Option 1	Option 2	Option 1	Option 2	Option 1	Option 2
Study 1 (Gains)										
Amount Gained	$10	$11	$9	$12	$4	$6	$5	$6	$14	$15
Delay (Days)	1 day	10 days	2 days	6 days	3 days	9 days	4 days	8 days	4 days	12 days
Delay (Ratio)	1 day	10 times as long	2 days	3 times as long	3 days	3 times as long	4 days	2 times as long	4 days	3 times as long
Study 2 (Losses)										
Amount Paid	($10)	($11)	($9)	($12)	($4)	($6)	($5)	($6)	($14)	($15)
Delay (Days)	1 day	5 days	2 days	8 days	2 days	12 days	3 days	9 days	3 days	12 days
Delay (Ratio)	1 day	5 times as long	2 days	4 times as long	3 days	6 times as long	3 days	3 times as long	3 days	4 times as long
Study 3 (Shipping)										
Shipping Cost	($14)	($5)	($11)	($8)	($8)	($5)	($9)	($7)	($8)	($3)
Shipping Time Days	1 day	5 days	2 days	8 days	2 days	12 days	3 days	9 days	3 days	12 days
Shipping Time Ratios	1 day	5 times as long	2 days	4 times as long	3 days	6 times as long	3 days	3 times as long	3 days	4 times as long

For participants in the implicit time ratio condition, intertemporal choice A was displayed as follows:



Choices B-E were displayed in the identical format.

For participants in the explicit time ratio condition, intertemporal choice A was displayed as follows:



Choices B-E were displayed in the identical format.

After completing their choices participants completed demographic information.

3.2 Results

Following Read et al. (2005) and Hardisty and Pfeffer (2015), the dependent variable was the number of times the participant chose sooner reward (option 1 in Table 1). As seen the Table 2 (note I did not actually collect data for this study I just put sample data down for illustrative purposes) there is a strong effect of explicit intertemporal ratios. Nearly twice as many people choose the sooner option when temporal ratios are explicit.

Table 2: Proposed Percent of choices for the sooner option given different temporal ratios

	Temporal Frame	
	Implict Ratio	Explicit Ratio
A (%)	30	60
B (%)	40	65
C (%)	42	70
D (%)	37	68
E (%)	39	66
Mean (%)	38	65.8
N	100	100

Statistical significance of the difference between explicit and implicit temporal ratios was tested via a Kruskal-Wallis test. Explicit ratio participants made significantly more sooner choices than implicit ratio participants. To confirm these results, I ran a robust logistic regression which allowed for correlated errors within participants. The dependent variable was choice (0 later option chosen, 1 sooner option chosen) and the independent variable was ratio frame. This regression confirmed the results of the Kruskal-Wallis test, namely that participants were more impatient when temporal ratios are make explicit.

3.3 Discussion

Study 1 demonstrated that explicit temporal ratios lead to greater impatience.

4 Study 2

Study 2 extends the results of Study 1 to losses. Although most intertemporal choice studies use gains, a large number of real world intertemporal choices involve losses (Hardisty et al., 2013). For instance waiting to pay off your credit card incurs greater losses if you wait – the compounding interest – than if pay it off immediately. Intertemporal choices framed as losses measured in the lab take the form of choices between "Pay $100 immediately" and "Pay $110 in 6 months" (Hardisty & Pfeffer, 2015).

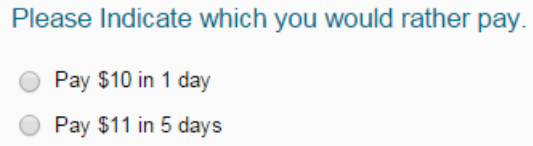
4.1 Method

Two hundred participants from Amazon Mechanical turk we recruited to take part in a "Decision Making Survey". Participants who participated in Study 1 were not allowed to participate in Study 2. Participants who have less than 50 HITs accepted or who have less than 95% of their HITs accepted were not allowed to participate in the study. Additionally only participants who passed an attention check were included in the final analysis. These precautions were taken to ensure that the sample included qualtiy participants who were paying attention to the study.

Participants completed informed consent, then were given a test to ensure they understood the paradigm. Next, participants read the instruction "Please imagine you face a set of choices about paying a bill at a short time from now, or another bill later". Next they were assigned to one of the two conditions: implicit ratio or explicit ratio.

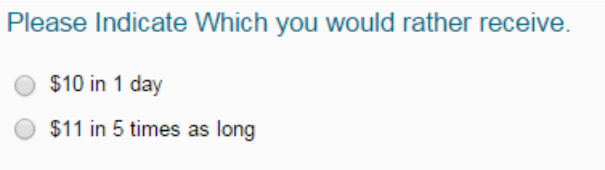
They then were shown the five intertemporal choices in from the Study 2 section of Table 1. Choices were displayed in a randomized order

For the implicit time ratio condition, intertemporal choice A was displayed as follows:



Choices B-E were displayed in the identical format.

In the explicit time ratio condition, intertemporal choice A was displayed as follows:



Choices B-E were displayed in the identical format.

Further each choice was displayed in a random order to each participant. After completing their choices participants completed demographic information.

4.2 Results

As with Study 1, the dependent variable was the number of times the participant chose sooner reward (option 1 in Table 1). As seen the Table 3 (note I did not actually collect data for this study I just put sample data down for illustrative purposes) there is a strong effect of explicit intertemporal ratios. Nearly twice as many people choose the sooner option when temporal ratios are explicit.

Table 3: Proposed Percent of choices in Losses for the sooner option in different temporal ratios

	Temporal Frame	
	Implict Ratio	Explicit Ratio
A (%)	20	48
B (%)	25	50
C (%)	27	57
D (%)	28	54
E (%)	24	58
Mean (%)	38	65.8
N	100	100

Statistical significance of the difference between explicit and implicit temporal ratios was tested via a Kruskal-Wallis test. Overall the effect of ratio was significant. To confirm these results, I ran a robust logistic regression which allowed for correlated errors within participants. The dependent variable was choice (0 later option chosen, 1 sooner option chosen) and the independent variable was ratio frame. This regression confirmed the results of the Kruskal-Wallis test, namely that participants were more impatient when temporal ratios are make explicit.

4.3 Discussion

Study 2 replicated the ETRE – explicit temporal ratios yeild more impatience – for intertemporal losses.

5 Study 3

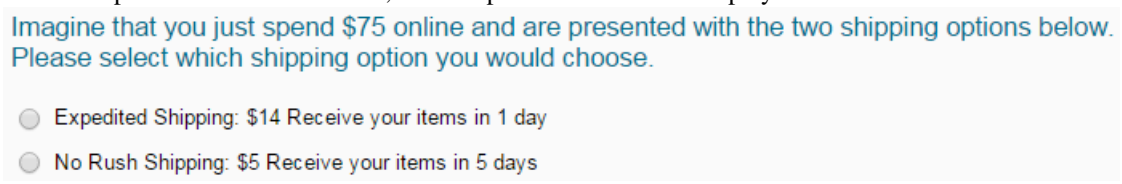
Study 3 extends the results from Study 1 and Study 2 to intertemporal choices explicitly framed as shipping scenarios. Shipping scenarios are typically displayed as a choice between "Receive your items in 2 days and pay $8" and "Receive your items in 10 days and pay $4" Although choosing a shipping speed is similar to the intertemporal choices shown in Studies 1 and 2 there is a subtle, yet possibly significant difference between the two. Shipping decisions can be thought of as *paying more now to receive an item sooner* whereas the intertemporal choices shown in Study 2 can be thought of as *paying something smaller sooner to avoid paying something larger later*.

5.1 Method

Two hundred participants from Amazon Mechanical turk we recruited to take part in a "Decision Making Survey". Participants who have less than 50 HITs accepted or who have less than 95% of their HITs accepted were not allowed to participate in the study. Further, participants who had participated in either Study 1 or Study 2 were not allowed to take Study 3. Additionally, only participants who passed an attention check were included in the final analysis. These precautions were taken to ensure that the sample included qualtiy participants who were paying attention to the study.

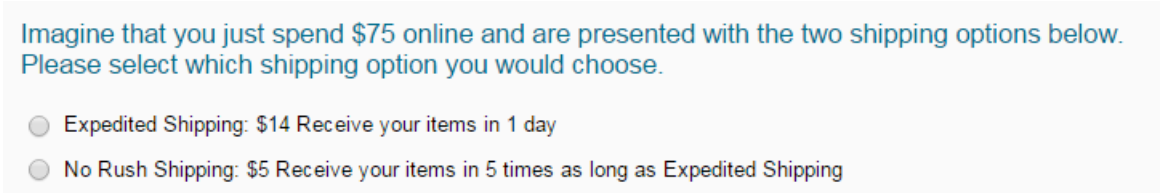
Participants completed informed consent, then were given a test to ensure they understood the paradigm. Next they were assigned to one of the two conditions: implicit ratio or explicit ratio. Participants read the instruction "Imagine that you have just spent $75 dollars shopping online. None of your purchases are absolutely necessary to have, but you would enjoy having all of them. You are about to check out and are presented with two shipping options." They then were shown the five shipping choices in from the Study 3 section of Table 1. Choices were displayed in a randomized order

For the implicit time ratio condition, intertemporal choice A was displayed as follows:



Choices B-E were displayed in the identical format.

In the explicit time ratio condition, intertemporal choice A was displayed as follows:



Choices B-E were displayed in the identical format.

Further each choice was displayed in a random order to each participant. After completing their choices participants completed demographic information.

5.2 Results

As with Studies 1 and 2, the dependent variable was the number of times the participant chose sooner reward (option 1 in Table 1). As seen the Table 4 (NOTE: I did not actually collect data for this study I just put sample data down for illustrative purposes) there is a strong effect of explicit intertemporal ratios. Nearly twice as many people choose to expedite their shipping temporal ratios are explicit.

Statistical significance of the difference between explicit and implicit temporal ratios was tested via a Kruskal-Wallis tests. Overall the effect of ratio was significant. To confirm these results, I ran a robust logistic regression which allowed for correlated errors within participants. The dependent variable was choice (0 No Rush Shipping

Table 4: Proposed Percent of choices in shipping for the sooner option in different temporal ratios

	Temporal Frame	
	Implict Ratio	Explicit Ratio
A (%)	30	58
B (%)	40	60
C (%)	31	61
D (%)	42	55
E (%)	38	68
Mean (%)	38	65.8
N	100	100

Chosen, 1 Expedited Shipping Chosen) and the independent variable was ratio frame. This regression confirmed the results of the Kruskal-Wallis test, namely that participants were more impatient when temporal ratios are make explicit.

5.3 Discussion

Study 3 replicated the ETRE – explicit temporal ratios yield more impatience – for intertemporal choices explicitly framed as shipping.

6 General Discussion

Across three studies we demonstrate that the Explicit Temporal Ratio Effect (ETRE) – making temporal ratios explicit – yields greater patience. This result holds for gain and loss intertemporal choices as well as an explicit shipping scenario.

7 Limitations and Future Directions

All of the intertemporal choices made in this paper were hypothetical. However studies have found that people make identical choices in hypothetical and real outcomes (Johnson, Camerer, Sen, & Rymon, 2002; Bickel, Pitcock, Yi, & Angtuaco, 2009).

Further all intertemporal choices were made with on a relatively short timeframe. The ETRE could reverse in the following choice “Receive $10 in 100 days” and “Receive $15 in 120 days” is reframed as “Receive $10 in 100 days” and “Receive $15 in 1.2 times as long”.

Related to the previous point all ratios presented in this study were whole integers. Since the real world is rarely so neat as the laboratory, future work investigating how people respond to decimals in explicit ratios is an important next step for this research.

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