A behavioral economic analysis of media multitasking: Delay discounting as an underlying process of texting in the classroom

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Abstract

The purpose of the present study was to investigate the decision making process underlying texting in the classroom from a behavioral economic perspective. A sample of 136 undergraduate students completed a novel delay-discounting task that involved a hypothetical scenario in which, after receiving a text message in the classroom, they rated their likelihood of replying to a text message immediately versus waiting until the class is over to reply. The scenario presented several delays (ranged from 1 min to 75 min) under two cell-phone-policy conditions (with and without a policy that banned in-class cell phone use). Participants also completed a behavioral assessment of impulsivity with a delay-discounting task involving hypothetical monetary rewards and a self-reported assessment of the dispositional trait of impulsivity. The results show that the decrease in the likelihood of waiting to reply as a function of the delay was well described by a hyperboloid delay discounting function. The rates of discounting were greater for students who self-reported higher frequencies of texting in the classroom as well as under the condition without the cell phone policy. Finally, students who self-reported higher frequencies of texting in the classroom were more impulsive in both behavioral and self-reported measures of impulsivity. These results support the conclusion that the decision making underlying texting in the classroom can be well characterized using the delay-discounting paradigm and that texting in the classroom is fundamentally an impulsive choice. A behavioral economic approach may be a useful research tool for investigating the decision-making process underlying texting in the classroom, and possibly other forms of media multitasking.

Introduction

- **Background**
  - Multitasking leads to productivity loss, with up to 40% loss compared to single-tasking (American Psychological Association, 2006).
  - Mobile phones have made media-multitasking common, particularly among college students.
    - More than 90% report texting in class, despite many acknowledging its negative consequences (e.g., Olmsted & Terry, 2014).
  - Previous studies have identified various predictors, but the decision making mechanism underlying texting in class remains unknown.
  - From the behavioral economic perspective, texting in class can be conceptualized as an impulsive choice involving a trade-off between:
    - Smaller-sooner reward: Immediate and short social interaction via texting
    - Lager-delayed reward: Better exam grade obtained later
  - Delay discounting is linked to various impulsive/addictive behaviors.
    - Ex) Drug addiction, obesity, gambling, and texting while driving (e.g., Amlung et al., 2017; Hayashi et al., 2016)
    - cf. Delay discounting: Subjective devaluation of future rewards
  - The relation between delay discounting and texting in class has yet to be examined.
- **Purposes of this study**
  - To determine whether decision-making concerning texting in class can be characterized using the delay-discounting paradigm
  - To examine whether students who frequently text in class discount delayed opportunities to reply to a text message more steeply than those who infrequently text in class
  - To determine if students who frequently text in class are more impulsive based on behavioral and self-report measures

Method

- **Participants**
  - 136 undergraduate students from introductory psychology courses participated for course credit.
- **Procedure**
  - Participants completed online surveys hosted by Qualtrics.
  - Group assignment was based on their self-reported frequencies of sending/reading text messages and cell phone use in the classroom.
    - Ex) “How often do you send a conversation through text, email, and/or social media (e.g., Facebook) while you are in class?”
    - Likert scale: 1 (*never*) - 5 (*always*)
    - Texting in class (TIC) group: Top half, $n = 58$
    - Non-texting in class (Non-TIC) group: Bottom half, $n = 59$

Table 1. Demographic Characteristics for TIC and Non-TIC Groups

Characteristics	TIC	Non-TIC
Gender		
Male	19	27
Female	39	32
Age in years*	19.0 (1.7)	19.8 (2.5)
Years of higher education	1.2 (1.0)	1.5 (1.1)
Frequency of TIC	3.8 (0.7)	1.9 (0.6)
Frequency of in-class phone use	3.8 (0.7)	2.7 (0.7)

Note. Values are means (and standard deviations). *$p < .05$.

Results

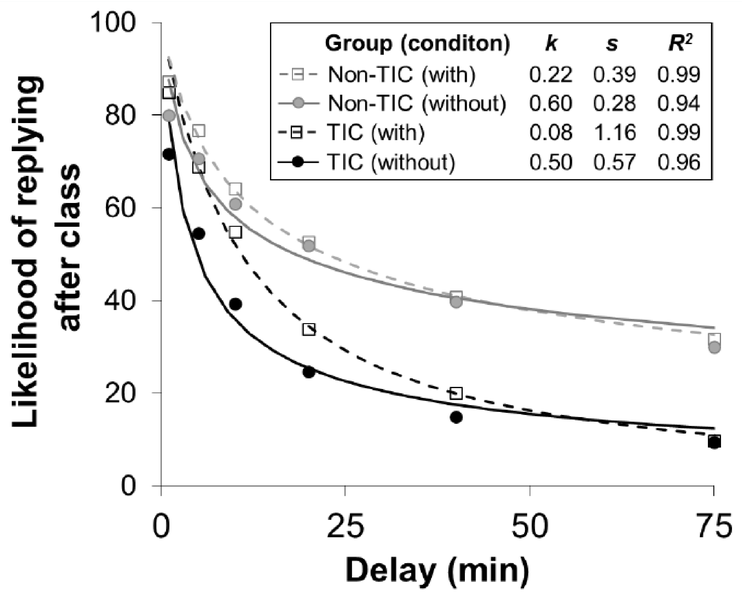

Figure 3. Likelihood of replying to a text message after class as a function of delay to the end of the class for the TIC and Non-TIC groups under the with- and without-cell-phone-policy conditions. Group mean are plotted with the hyperboloid delay-discounting function.

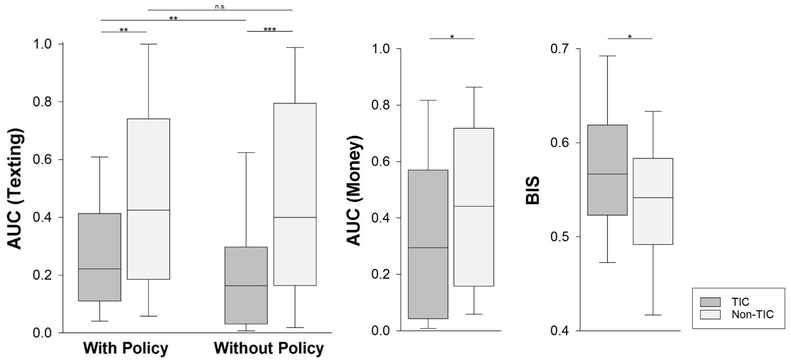

Figure 4. Box plots of area under the curve (AUC) of individual participants in the delay discounting task with the hypothetical texting scenario under the with-and without-cell-phone-policy conditions (left panel) and AUC of individual participants in the delay discounting task with hypothetical monetary rewards and the BIS score (middle and right panels). Each box represents the interquartile range (25th and 75th percentile) and the horizontal line within the box indicates the median value. Bottom and top bars of the whisker indicate the 10th and 90th percentiles, respectively $^{**}p < .01$.$^{***}p < .001$. $^{n.s.}$ $p > .05$.

Table 2. Spearman Correlation Coefficients of Demographic information, Delay Discounting Measures, and the BIS Score

	1	2	3	4	5	6	7	8	9
1. Age in years	-								
2. Gender (F = 0; M = 1)	.32**	-							
3. Years of higher education	.67***	.10	-						
4. TIC frequency	-.18*	-.14	-.17	-					
5. Phone use frequency	-.18	-.13	-.17	.70**	-				
6. AUC (texting) w/ policy	.06	.01	.00	-.23*	-.20*	-			
7. AUC (texting) w/o policy	.07	.08	-.02	-.29**	-.28**	.69**	-		
8. AUC (money)	-.10	.06	-.01	-.13	-.12	-.01	.13	-	
9. BIS	-.03	.09	-.05	.26**	.31**	-.19*	-.11	-.09	

Note. *$p < .05$. **$p < .01$. ***$p < .001$.

Method (continued)

- **Delay discounting task with hypothetical texting scenarios**
  - Two scenarios: with and without cell phone policy banning texting
    Imagine that your significant other (or your best friend) has just sent a text message saying, “text me asap” while you are in class. The syllabus states no cell phone use is allowed, and the professor strictly enforces the policy. You are sitting in the back of a small classroom (20 students in the class). If the class will end in X minute(s), indicate how likely you are to reply after class (rating: 100) versus replying now (rating: 0).
  - The participants dragged the slider bar to indicate their likelihood of waiting until class ends.
  - Delay: 1, 5, 10, 20, 40, and 75 minutes

Figure 1. Screen shot of the task

- **Behavioral impulsivity measure**
  - Delay discounting task adapted from Rachlin et al. (1991)
  - Participants chose between smaller hypothetical money available immediately versus larger money available after a delay.
    - Smaller money: The amount raged from $1 to $1,000 (total 30 amounts).
    - Larger money: The amount was always $1,000, but its delay ranged from 1 week to 10 years (total 7 delays).
- **Self-reported impulsivity measure**
  - Barratt Impulsiveness Scale (BIS-11; Patton et al., 1995)
  - Comprised of 30 questions organized into three subscales:
    - Attentional Impulsivity, Motor Impulsivity, and Non-Planning
  - Higher scores indicated higher levels of impulsivity.
- **Data analysis**
  - The hyperboloid discounting function was fitted to group mean data using least squares nonlinear regression.
    - V: Likelihood of replying to a text message after class as determined by the subjective value of opportunities to reply after class
    - A: Likelihood of replying when there is no delay to the end of the class
    - D: The delay to the end of the class
    - k: Parameter that reflects the rate of discounting
    - s: Parameter that reflects the sensitivity to delay
    - This function predicts preference reversals

$$V = \frac{A}{(1 + kD)^s},$$

Figure 2. The hyperboloid discounting function

  - Area Under the Curve (AUC)
    - A descriptive, non-theoretical measure used to compare delay discounting for hypothetical texting and monetary tasks
  - Statistical analyses
    - Mann-Whitney *U* tests (TIC vs. Non-TIC groups)
    - Wilcoxon signed-rank test (with vs. without policy conditions)

Discussion

- **Summary/Implication of the findings**
  - Decrease in the likelihood as a function of delay was well described by the hyperboloid delay-discounting function.
    - Opportunities to text in the classroom is subject to delay discounting.
  - TIC group was more vulnerable to impulsive choice to text in absence of no phone use class policy.
  - The TIC group displayed greater delay discounting with hypothetical money and higher levels of self-reported impulsivity.
- **Preference reversal as underlying mechanism**
  - In class: Value of text > Value of good grade
  - Out of class: Value of text < Value of good grade
- **Future direction**
  - Investigating whether the delay discounting task with texting can be used to predict actual texting behavior
  - Determining whether rates of discounting in this study correlate with other relevant measures, such as texting/cellphone dependency

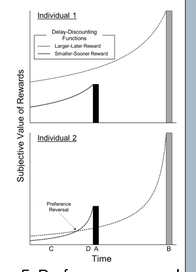

Figure 5. Preference reversal