CYBERPSYCHOLOGY, BEHAVIOR, AND SOCIAL NETWORKING
Volume 18, Number 8, 2015

DOI: 10.1089/cyber.2014.0367

How Much Is Too Much to Pay for Internet Access? A Behavioral Economic Analysis of Internet Use

Julie Broadbent, PhD, and Michelle A. Dakki, BS[1]

Abstract

The popularity of online recreational activities, such as social networking, has dramatically increased the amount of time spent on the Internet. Excessive or inappropriate use of the Internet can result in serious adverse consequences. The current study used a behavioral economic task to determine if the amount of time spent online by problematic and nonproblematic users can be modified by price. The Internet Purchase Task was used to determine how much time undergraduate students ($N = 233$) would spend online at 13 different prices. Despite high demand for Internet access when access was free, time spent online by both problematic and nonproblematic users decreased dramatically, even at low prices. These results suggest that the amount of time spent online may be modified by having a tangible cost associated with use, whereas having free access to the Internet may encourage excessive, problematic use.

Introduction

USE OF THE INTERNET FOR RECREATIONAL PURPOSES has risen substantially in recent years due in part to the popularity of social networking sites,[1] as well as the ease by which the Internet can be accessed through mobile devices. Unfortunately, excessive recreational use of the Internet may cause detrimental effects such as poor academic performance and depression.[2–6] Problematic use of the Internet has been suggested to be an addictive behavior with similar characteristics to other addictions, including difficulty controlling the amount of time spent online and continued use despite adverse consequences.[7–10] Even individuals who are not categorized as addicts spend a substantial amount of time online, which may be detrimental.[11] Moreover, Internet use that occurs in inappropriate situations (e.g., texting while driving) suggests that users are unable or unwilling to control their use.

Recent studies within the drug addiction literature suggest that behavioral economic measures are valuable tools that can be used to assess the strength of addictive behavior, and predict treatment outcomes, by measuring the relative reinforcing efficacy (RRE) of drugs (i.e., how much an individual wants a drug or prefers it compared with other reinforcers).[12–15] RRE is determined by the amount of resources (i.e., time, money, effort) that are devoted to obtaining the drug, and it is reflected in demand for the commodity when it is free of charge (intensity of demand), the maximal amount individuals are willing to pay for the commodity (O_{max}), the price at which maximal expenditure occurs (P_{max}), and breakpoint—the first price at which demand for the commodity is zero (i.e., the first price at which there is no consumption).[12] A strong RRE is indicated by high demand, O_{max}, P_{max}, and breakpoint values.

While an inverse relationship is typically seen between price and consumption of a commodity (i.e., consumption is elastic in that consumption decreases as price increases), addicted individuals exhibit high RRE for their preferred drug, as well as decreased elasticity.[13] Most importantly, RRE provides unique and perhaps more accurate information regarding addiction severity compared with measures such as consumption, which can be altered by a number of factors (e.g., the availability of alternate reinforcers).[16] In addition, RRE is sensitive to factors that are associated with increased drug use such as stress and exposure to drug cues.[17–20] Hence, behavioral economic measures have been used to assess addiction severity to a wide variety of drugs, including alcohol, marijuana, nicotine, and opiates.[12,15,21,22]

Although excessive Internet use has been characterized as an addiction, behavioral economic measures have not been used to examine this issue. One would predict that if recreational use of the Internet were problematic and difficult for the individual to control, this would be reflected in a high RRE and high levels of use despite increases in price. In contrast, if changing the price of access can easily modify Internet use, this would suggest Internet use has a weak RRE and that its use can be controlled.

Behavioral economic measures may also provide valuable information regarding recreational Internet use because unlike drug use, which has a tangible cost associated with each bout of drug use, Internet users are not immediately

Department of Psychology, University of Michigan–Flint, Flint, Michigan.

charged each time they access the Internet; most data plans charge a fixed price for monthly use. Consequently, how much time is spent online, and its associated cost, is not readily apparent to the user. Moreover, access is often provided through shared data plans that are paid for by someone other than the user, especially when the user is a young adult. Young adults therefore have few economic constraints on their Internet use, which may promote excessive use. Behavioral economic procedures that place a tangible price on Internet access can be used to determine if the amount of time online can be modified or if demand is resistant to modification, which would indicate addictive behavior.

The current study had two goals: to measure the RRE of recreational Internet use in a population of students, and to determine if RRE is greater in individuals who exhibit problematic Internet use. A hypothetical scenario, the Internet Purchase Task (IPT), was devised specifically for this study based on the Alcohol Purchase Task (APT).[12,23] The APT, which determines how many drinks participants will purchase at different prices, has been used successfully to assess the RRE of alcohol.[12,23] Two validated and reliable instruments, the Internet Addiction Test (IAT) and the Internet Related Problem Scale (IRPS), were used to determine problematic Internet use.[8,24,25] It was hypothesized that RRE would be stronger for problematic users and that demand for Internet use would be more resistant to changes based on price.

Method

Participants

Participants recruited from introductory psychology classes ($N=253$) at a university in the United States received class credit for completing an online survey administered via the Web site Qualtrics between April and December 2013. Participants had to be at least 18 years old. The university's Institutional Review Board approved all procedures, and informed consent was obtained from participants. Twenty incomplete surveys were discarded, leaving a total of 233. The majority of participants were white (70%), male (54.9%), with a mean age of 20.5 years ($SD=4.02$ years), and a yearly income of $\leq$\$4,999 (56.7%).

Measures

Behavioral economic task. Following a number of questions regarding current Internet use, the RRE of Internet use was determined using the IPT. Questions on the IPT showed a high internal consistency (Cronbach's $\alpha=0.944$). The IPT asked participants to consider the following hypothetical scenario:

> You are on a 5 hour flight. The airline offers access to the Internet but charges by the hour to get access. For each of the prices below, please move the sliding bar to indicate how many hours of Internet access you would buy at each price for recreational purposes (i.e., to check your e-mail, social networking sites, movies, music etc. rather than using the Internet for school work etc.).

Each participant was then presented with 13 different prices per hour—free, \$0.50, \$1, \$1.50, \$2, \$2.50, \$3, \$4, \$5, \$7.50, \$10, \$15, and \$25—and asked how much time on the Internet they would purchase at each price from 0 to 5 hours. Demand curves (time purchased at each price) were plotted and expenditure calculated at each price. Several other indices of RRE were derived from the data. Intensity of demand was the amount of time participants stated they would spend on the Internet when access was free. O_{max} was the maximum amount of money a participant was willing to spend to access the Internet (i.e., the greatest expenditure when price per hour was multiplied by the amount of time purchased). P_{max} was the price at which O_{max} occurred (i.e., the price at which maximum expenditure occurred), and breakpoint was the first price at which participants refused to pay to access the Internet. Participants who purchased time at the highest price of \$25 were assigned \$25 as their breakpoint.

Problematic Internet use scales. The IAT consists of 20 questions scored from 0 (not applicable) to 5 (often).[7,24] The IRPS also consists of 20 questions scored from 0 (not true at all) to 10 (extremely true).[8] Total scores on the IAT and IRPS categorized participants as problematic or nonproblematic users. Participants with IAT scores <40 were categorized as nonproblematic users ($n=163$), whereas those with scores of $\geq$40 were categorized as problematic users ($n=70$) based on criteria used by Young (1998)[7] and several other studies.[24–29] Higher scores on the IRPS indicate problematic Internet use. Therefore, participants with total scores in the top and bottom quartiles on the IRPS were categorized as problematic and nonproblematic, respectively.[8]

Data analyses

Initial analyses of the behavioral economic data (SPSS Statistics for Windows v20; IBM Corp., Armonk, NY) revealed that the data were positively skewed with skew values >2 in several cases. Hence, except where noted, median values are reported, and nonparametric inferential statistical tests (Spearman correlation coefficients and median tests) were conducted.[30,31] Alpha levels were corrected to $p<0.005$ to account for increased type I family wise error rates[32] when multiple median tests were used to compare time purchased at each price by problematic and nonproblematic users.

Results

Current Internet use

Participants gained access to the Internet mainly through personal computers (46.8%) or cell phones (49.4%). Many participants accessed the Internet more than six times per day (39.5%) and spent 1–3 hours per day online (43.3%). Interestingly, many participants did not pay for access to the Internet (60.1%); someone other than the participant paid for Internet fees. Most participants (58.8%) accessed the Internet in order to use social networking sites.

Behavioral economic measures: all participants

Intensity of demand was high in the IPT (median time used when access was free was 4 hours). Moreover, 42.1% of participants chose to spend all 5 hours online when access was free. Intensity of demand was significantly correlated with the number of times participants reported accessing the Internet per day and the number of hours they spent online in their daily lives ($r=0.22$ and 0.40, respectively; $p<0.001$).

Despite high intensity of demand, once participants had to pay for access, consumption decreased rapidly (Fig. 1). Breakpoint (the first price at which participants refused to pay for Internet access) occurred at $4.00 per hour. Maximal expenditure was also relatively low (O_{max} = $4.00) and was reached at $2.00 per hour (i.e., P_{max} [price at maximal expenditure] = 2.00). Income level of participants was not significantly associated with breakpoint or P_{max} but was modestly associated with O_{max} ($r = 0.16$, $p < 0.05$).

IAT and IRPS scores: all participants

Mean scores on the IAT and IRPS scales were 31.5 ($SD = 16.71$) and 68.61 ($SD = 35.40$), respectively. Scores on the IAT and IRPS were highly correlated ($r = 0.85$, $p < 0.01$). Intensity of demand was significantly correlated with both IAT and IRPS scores ($r = 0.270$, $p < 0.001$ and $r = 0.185$, $p < 0.01$, respectively). O_{max}, P_{max}, and breakpoint were also significantly correlated with IAT and IRPS scores (O_{max} $r = 0.319$ and 0.269, respectively; $p < 0.001$; P_{max} $r = 0.248$ and 0.198, respectively; $p < 0.01$; breakpoint $r = 0.229$ and 0.211, respectively; $p < 0.01$).

Behavioral economic measures: problematic versus nonproblematic users

Additional analyses were conducted to determine if RRE differed between problematic and nonproblematic users. A shift to the right in the demand curve was observed for participants categorized as problematic users based on their IAT (Fig. 2) or IRPS (Fig. 3) scores. Median tests revealed that all behavioral economic indices were significantly higher ($p < 0.05$) for IAT problematic users (intensity of demand = 5.0, O_{max} = 6.00, P_{max} = 2.50, and breakpoint = 5.00) versus nonproblematic users (intensity of demand = 3.5, O_{max} = 3.00, P_{max} = 1.50, and breakpoint = 3.00). Problematic users purchased significantly more time compared to nonproblematic users at $1, $2, and $4 an hour ($p < 0.005$), while trends toward increased time were noted at $1.50 and $2.50 ($p < 0.01$).

Behavioral economic indices were also higher for participants who had scores in the top 25% of the IRPS (intensity of demand = 4.05, O_{max} = 6.25, P_{max} = 2.75, breakpoint = 7.50) compared with those in the bottom 25% (intensity of demand = 3.00, O_{max} = 2.50, P_{max} = 1.50, breakpoint = 2.50). However, a significant difference was only noted for O_{max} ($p < 0.05$). The difference between breakpoint just failed to reach significance ($p = 0.056$). Problematic users purchased significantly more time than nonproblematic users at $1 and $2 an hour ($p < 0.005$). Current income level did not differ between subgroups on the IAT or IRPS.

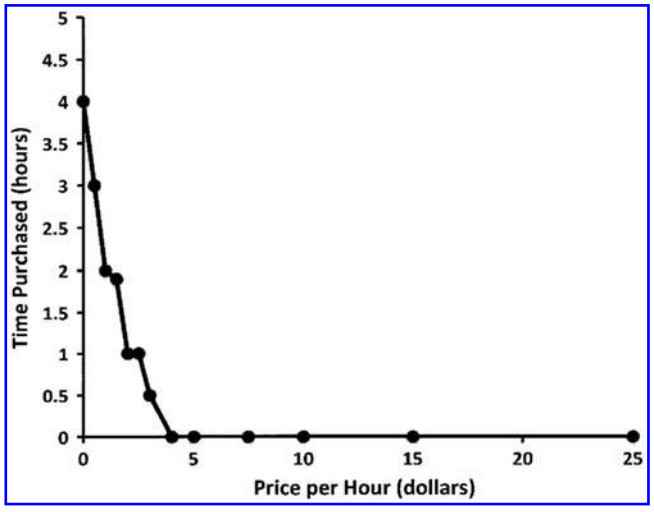

FIG. 1. Median time purchased at each price for all participants in the sample ($N = 233$).

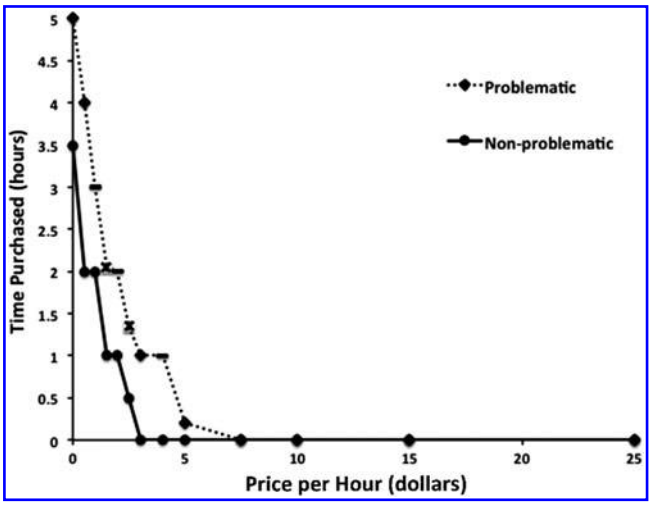

FIG. 2. Median time purchased at each price by users categorized as problematic ($n = 70$) or nonproblematic ($n = 163$) by total Internet Addiction Test scores. ''–'' and ''×'' symbols in the problematic user curve indicate differences in time purchased at that price by problematic and nonproblematic users ($p < 0.005$ and $p < 0.01$, respectively).

Discussion

The current study measured the RRE of recreational Internet use in undergraduate students. Despite high intensity

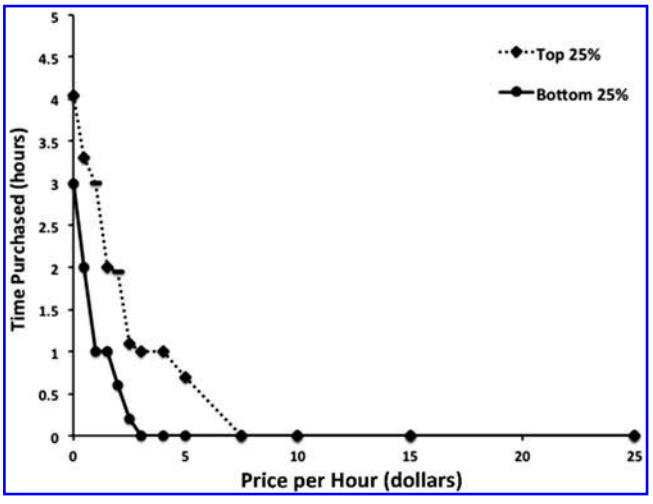

FIG. 3. Median time purchased at each price by users who had total Internet Related Problem Scale scores in the top and bottom quartile. Significant differences in time purchased at a price by problematic and nonproblematic users are denoted by the symbol ''–'' on the problematic user curve ($p < 0.005$).

of demand, the amount of time purchased decreased dramatically as price increased. This decrease in demand at low prices suggests that the RRE of Internet use is relatively weak, even in problematic users. Although problematic use of the Internet has been characterized as a behavioral addiction by some authors, the rapid decline in Internet use once participants had to pay for Internet access suggests they may be able to control their Internet use easily, at least over short periods. While participants met the criterion for problematic Internet use used by a number of authors,[7,24–29] it is possible that participants with IAT scores of $\geq$70, who are categorized as the most severely affected, may exhibit more inelastic behavior. Unfortunately, only five participants had scores that fell into that category. Another possibility is that the hypothetical flight was too short to show inelastic demand. However, the amount of time participants reported spending online in their daily lives (which corresponds with previous studies[3,4,6]), and the high intensity of demand in the IPT, suggest that 5 hours should have been sufficient to observe inelastic behavior at the lowest prices.

Most participants had low yearly incomes and may have felt they could not afford to pay a high price for Internet access. However, demand of problematic users decreased sharply even at very low prices. Moreover, income level did not differ between problematic and nonproblematic users, was not associated with breakpoint or P_{max}, and was only modestly associated with O_{max}, suggesting income level had little influence on Internet use. This is perhaps not surprising, as many participants reported that someone else paid for their Internet access. Most likely, these participants had Internet access through a family plan and had few financial restrictions on the amount of time they could spend online. Impulsivity is strongly associated with problematic Internet use, and having unrestricted access may permit uncontrolled impulsive use of the Internet.[33,34] The current results suggest that imposing a tangible cost for Internet use could provide a cognitive control on impulsive use.

The current study used a hypothetical scenario to assess RRE. While similar scenarios have been reported to accurately predict behavior measured in laboratory experiments,[12,18,19,22,23,35,36] and intensity of demand in the current study was significantly associated with the participants' Internet use in their daily lives, laboratory-based studies should be conducted to verify the present findings. Laboratory studies will also provide further evidence of the validity of the IPT. Initial evidence of the validity of the IPT is evident in the significant correlations observed between intensity of demand, the actual number of hours participants reported being online, and two validated scales of problematic Internet use. The relatively modest correlations observed between intensity of demand and scores on the IAT and IRPS are not surprising given that the IAT and IRPS measure not only level of Internet use but also problems associated with use, whereas intensity of demand only reflects level of use.

Several recent imaging studies have reported some commonalities in the neural bases of drug and behavioral addictions. For example, both drug and Internet addiction are associated with variation in the serotonin transporter, structural differences in gray and white matter in the prefrontal cortex, and differences in dopaminergic systems in the dorsal striatum and other regions.[37–39] Comparisons between Internet addiction and alcohol use disorder in response inhibition tasks have also revealed similar activity in frontal, central, and parietal regions.[40] While these studies suggest some overlap in the neurobiological processes underlying drug and behavioral addictions, it is important to note that many Internet addiction studies focus on excessive video gaming, and different types of problematic Internet use may be associated with discrete neurobiological processes.[37,40] Indeed, in light of the current results that suggest, unlike addictive drugs, recreational Internet use primarily associated with the use of social networking sites has a weak RRE, one may expect to observe differences in the neural processes underlying this specific use of the Internet and drug addiction.

In summary, although a large number of people are choosing to spend an excessive amount of time online, the current results suggest that imposing a tangible cost on Internet use may deter the use of even high demand users, at least over short periods. Limiting recreational use of the Internet may be advantageous in light of the detrimental effects of excessive use, or use in dangerous situations.[10,41–43]

Acknowledgments

The authors thank Dr. Terrence Horgan, Devin Adams, and Jennifer Heaton for providing constructive feedback on the study or on the manuscript.

Author Disclosure Statement

No competing financial interests exist.

References

1. Pew Research Center. (2014) Social networking fact sheet. www.pewinternet.org/fact-sheets/social-networking-fact-sheet/ (accessed Jun. 29, 2014).
2. Spada MM. An overview of problematic Internet use. Addictive Behaviors 2014; 39:3–6.
3. Junco R. Too much face and not enough books: the relationship between multiple indices of Facebook use and academic performance. Computers in Human Behavior 2012; 28:187–198.
4. Do YK, Shin E, Bautista MA, et al. The associations between self-reported sleep duration and adolescent health outcomes: what is the role of time spent on Internet use? Sleep Medicine 2013; 14:195–200.
5. Young KS, Rogers RC. The relationship between depression and Internet addiction. CyberPsychology & Behavior 1998; 1:25–28.
6. Kittinger R, Correia CJ, Irons JG. Relationship between Facebook use and problematic Internet use among college students. Cyberpsychology, Behavior, & Social Networking 2012; 15:324–327.
7. Young KS. (1998) *Caught in the net: how to recognize the signs of Internet addiction—and a winning strategy for recovery.* New York: John Wiley.
8. Armstrong L, Phillips JG, Saling LL. Potential determinants of heavier Internet usage. International Journal of Human–Computer Studies 2000; 53:537–550.
9. Weinstein A, Lejoyeux M. Internet addiction or excessive Internet use. American Journal of Drug & Alcohol Abuse 2010; 36:277–283.
10. Greydanus DE, Greydanus MM. Internet use, misuse, and addiction in adolescents: current issues and challenges. International Journal of Adolescent Medicine & Health 2012; 24:283–289.

11. Choi JS, Park SM, Roh MS, et al. Dysfunctional inhibitory control and impulsivity in Internet addiction. Psychiatry Research 2014; 215:424–428.
12. Murphy JG, MacKillop J. Relative reinforcing efficacy of alcohol among college student drinkers. Experimental & Clinical Psychopharmacology 2006; 14:219–227.
13. Bickel WK, Johnson MW, Koffarnus MN, et al. The behavioral economics of substance use disorders: reinforcement pathologies and their repair. Annual Review of Clinical Psychology 2014; 10:641–677.
14. Dennhardt AA, Yurasek AM, Murphy JG. Changes in delay discounting and substance reward value following a brief alcohol and drug use intervention. Journal of Experimental Analysis of Behavior 2015; 103:125–140.
15. Worley MJ, Shoptaw SJ, Bickel WK, et al. Using behavioral economics to predict opioid use during prescription opioid dependence treatment. Drug & Alcohol Dependence 2015; 148:62–68.
16. Bertholet N, Murphy JG, Daeppen J-B. The alcohol purchase task in young men from the general population. Drug & Alcohol Dependence 2015; 146:39–44.
17. Amlung M, MacKillop J. Understanding the effects of stress and alcohol cues on motivation for alcohol via behavioral economics. Alcoholism: Clinical & Experimental Research 2014; 38:1780–1789.
18. Mackillop J, O'Hagen S, Lisman SA, et al. Behavioral economic analysis of cue-elicited craving for alcohol. Addiction 2010; 105:1599–1607.
19. Mackillop J, Brown CL, Stojek MK, et al. Behavioral economic analysis of withdrawal- and cue-elicited craving for tobacco: an initial investigation. Nicotine & Tobacco Research 2012; 14:1426–1434.
20. Owens MM, Ray LA, MacKillop J. Behavioral economic analysis of stress effects on acute motivation for alcohol. Journal of Experimental Analysis of Behavior 2015; 103:77–86.
21. Collins RL, Vincent PC, Yu J, et al. A behavioral economic approach to assessing demand for marijuana. Experimental & Clinical Psychopharmacology 2014; 22:211–221.
22. Murphy JG, MacKillop J, Tidey JW, et al. Validity of a demand curve measure of nicotine reinforcement with adolescent smokers. Drug & Alcohol Dependence 2011; 113: 207–214.
23. Murphy JG, MacKillop J, Skidmore JR, et al. Reliability and validity of a demand curve measure of alcohol reinforcement. Experimental & Clinical Psychopharmacology 2009; 17:396–404.
24. Widyanto L, McMurran M. The psychometric properties of the Internet Addiction Test. CyberPsychology & Behavior 2004; 7:443–450.
25. Widyanto L, Griffiths MD, Brunsden V. A psychometric comparison of the Internet Addiction Test, the Internet-Related Problem Scale, and self-diagnosis. Cyberpsychology, Behavior, & Social Networking 2011; 14:141–149.
26. Barke A, Nyenhuis N, Kroner-Herwig B. The German version of the Internet Addiction Test: a validation study. Cyberpsychology, Behavior, & Social Networking 2012; 15:534–542.
27. Faraci P, Craparo G, Messina R, et al. Internet Addiction Test (IAT): which is the best factorial solution? Journal of Medical Internet Research 2013; 15:e225.
28. Guertler D, Rumpf HJ, Bischof A, et al. Assessment of problematic Internet use by the Compulsive Internet Use Scale and the Internet Addiction Test: a sample of problematic and pathological gamblers. European Addiction Research 2014; 20:75–81.
29. Kim SJ, Park D, Ryu S, et al. Usefulness of Young's Internet Addiction Test for clinical populations. Nordic Journal of Psychiatry 2013; 67:393–399.
30. Kim H. Statistical notes for clinical researchers: assessing normal distribution (2) using skewness and kurtosis. Restorative Dentistry & Endodontics 2013; 38:52–54.
31. Siegel S. (1956) *Nonparametric statistics for the behavioral sciences.* New York: McGraw-Hill.
32. Munzel U, Tamhane AC. Nonparametric multiple comparisons in repeated measures designs for data with ties. Biometrical Journal 2002; 44:762–779.
33. Yau YHC, Potenza MN, White MA. Problematic Internet use, mental health and impulse control in an online survey of adults. Journal of Behavioral Addiction 2013; 2:72.
34. Zhou Z, Zhu H, Li C, et al. Internet addictive individuals share impulsivity and executive dysfunction with alcohol-dependent patients. Frontiers in Behavioral Neuroscience 2014; 8:288.
35. Johnson MW, Bickel WK. Within-subject comparison of real and hypothetical money rewards in delay discounting. Journal of Experimental Analysis of Behavior 2002; 77:129–146.
36. Amlung M, MacKillop J. Further evidence of close correspondence for alcohol demand decision making for hypothetical and incentivized rewards. Behavioral Processes 2015; 113:187–191.
37. Leeman RF, Potenza MN. A targeted review of the neurobiology and genetics of behavioral addictions: an emerging area of research. Canadian Journal of Psychiatry 2013; 58:260–273.
38. Zhu Y, Zhang H, Tian M. Molecular and functional imaging of Internet addiction. BioMed Research International 2015; 2015:1–9.
39. Brand M, Young KS, Laier C. Prefrontal control and Internet addiction: a theoretical model and review of neuropsychological and neuroimaging findings. Frontiers in Human Neuroscience 2014; 8:1–13.
40. Luijten M, Machielsen MWJ, Veltman DJ, et al. Systematic review of ERP and fMRI studies investigating inhibitory control and error processing in people with substance dependence and behavioral addictions. Journal of Psychiatry Neuroscience 2014; 39:149–169.
41. Orlowske LL, Luyben PD. Risky behavior: cell phone use while driving. Journal of Prevention & Intervention in the Community 2009; 37:221–229.
42. Ellis Y, Daniels B, Jauregui A. The effect of multitasking on the grade performance of business students. Research in Higher Education Journal 2010; 8:1–10.
43. Harman BA, Sato T. Cell phone use and grade point average among undergraduate university students. College Student Journal 2011; 45:544–549.

Address correspondence to:
Dr. Julie Broadbent
Department of Psychology
University of Michigan–Flint
303 East Kearsley Street
Flint, MI 48502

E-mail: broadben@umflint.edu

This article has been cited by:

1. Peter G. Roma, Derek D. Reed, Florence D. DiGennaro Reed, Steven R. Hursh. 2017. Progress of and Prospects for Hypothetical Purchase Task Questionnaires in Consumer Behavior Analysis and Public Policy. *The Behavior Analyst* **80**. . [CrossRef]