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Facebook Addiction and Impulsive Decision-Making

Daniel Delaney

Eastern Illinois University

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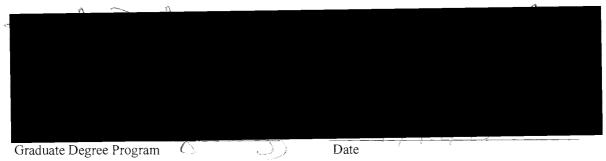Graduate Faculty Advisors Directing the Theses

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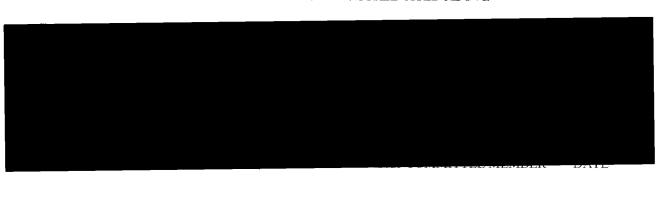
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Facebook Addiction and Impulsive Decision-Making

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Abstract

This study examined the relationship between Facebook "addiction" and impulsive decision-making. Impulsive decision-making as measured by the delay discounting task is associated with a number of addictions and other problem behaviors. We gave 152 students a paper-based packet including the Bergen Facebook Addiction Scale to measure problematic Facebook use and a delay discounting task to assess impulsivity. 16 Facebook "addicted" participants were matched to 16 control participants on demographic data to compare differences in impulsivity. Likewise, we explored whether a correlational relationship between Facebook addiction scores and impulsivity existed. We found that Facebook "addicts" discounted delayed rewards more quickly than their non-addicted controls. These findings indicate that Facebook "addicts" are more impulsive than those who are not addicted to Facebook. These results suggest that Facebook addiction shares core characteristics (impulsivity) with other kinds of addiction.

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Facebook Addiction and Impulsive Decision Making

Social media use has become increasingly commonplace over the last ten

years. Social media was defined in Merriam-Webster dictionary as "forms of electronic

communication (as Web sites for social networking and microblogging) through which

users create online communities to share information, ideas, personal messages, and other

content (as videos)" (Merriam-Webster.com). A major component of social media is the

social networking websites. Social networks were described by Johnston, Tanner, Lalla,

and Kawalksi (2009) as the concept that "society exists as a structured set of relationships

between people" (p. 24). Social networking websites such as Facebook, Twitter,

LinkedIn, and many more provide an online platform or venue for people to form

"virtual" global communities. These websites have augmented our daily lives in respect

to how we retrieve and gain information, and they have changed the nature of our

relationships with others in a incredibly short amount of time. Moreover, social media

can be accessed almost anywhere and any time through the use of our smartphones,

tablets, and laptop computers.

Specifically, Facebook has become the most popular social network website in the

world, and it is the second most popular site in the world behind Google (Wolfram Alpha

Knowledge Base, 2015). The Facebook website has an average of 580 million visits per

day, and according to the Facebook Inc. financial report for the year of 2014, Facebook

has up to 1.39 billion monthly active users as of December, 2014 (Wolfram Alpha

Knowledge Base, 2015; Facebook, Inc. 2015). Facebook's reach is extensive. But what

effect does Facebook have on our daily lives? Psychological research has begun

exploring the effects of Facebook use on the individual to determine the benefit or harm the social media website may have.

Literature Review

Research studying the nature of pathological Facebook use is still in its early stages due to the relatively quick advancement of technology and social networking sites in the last decade. Much of the research on Facebook so far has explored whether Facebook use can be associated with individual benefit or harm. For instance, Valenzuela, Halpern, and Katz (2014) found that Facebook usage accounted for rising divorce rates in the United States when controlling for demographic, economic, and psychological variables. Another example is a study by Wolniczak et al. (2013) found that those scoring higher on a Facebook dependence questionnaire were more likely to have poor sleep quality. Sleep quality was assessed by the Pittsburgh Sleep Quality Index which measures sleep quality through a number of factors such as duration of sleep, disturbance of sleep, need for sleep medication, and impacts to daytime functioning due to sleepiness and fatigue (Wolniczak et al., 2013). Facebook dependence was measured by an internet addiction scale adapted to problematic Facebook use. The measure assessed variables of Facebook dependence such as amount of time and frequency of use, efforts to reduce use, worries about use, and so forth. The study's findings show a relationship between troublesome Facebook use and poor sleep quality.

Overall, the findings from studies that evaluated whether Facebook use is beneficial or harmful have produced mixed results. With regard to the findings of studies which show possible benefits of Facebook use, Valenzuela, Park, and Kee (2009) and Johnston, Tanner, Lalla, and Kawalski (2009) found that increased Facebook use

increases social capital. Social capital is defined as the collective value in the social networks one has (Johnston et al. 2009). For instance, the more connections with others one has, the more collective knowledge, opportunities, and support there are available to that individual. Johnston et al. (2009) hypothesized that Facebook use would allow people to increase social capital due to the potential Facebook allows to manage and maintain relationships. Social capital has been associated with greater well-being. Greater well-being is specified in the Johnston et al. (2009) study as associated with "school attrition, academic performance, physical and mental health, children's intellectual development, sources of employment, juvenile delinquency and its prevention, and economic development" (p. 26).

Johnston et. al (2009) used a measure assessing the intensity of participants' Facebook use by inquiring about the number of "Facebook Friends" (online connections with other Facebook users that allows one to chat, share content–such as videos or news articles, and view each other's online profiles) one has, the amount of time one spends on Facebook, and the importance of Facebook to the participant. In addition, Johnston et al. (2009) measured social capital through a number of questionnaires which have been validated and used in other studies measuring social capital. The study found that higher intensity of Facebook use predicted higher social capital. The Johnston et al. (2009) study replicated the methods and measures of a study conducted by Ellison et al. (2007) at Michigan State University. Johnston et al. (2009) attempted to see if the Michigan State University study's findings generalized to students in South Africa. The similar findings between the studies support that the use of Facebook can help students increase their social capital which in turn can increase their well-being.

Similar to the above studies, Valenzuela, Park, and Kee (2009) found that intensity of Facebook use was found to have a positive association with the participants' scores on measures assessing civic engagement, life satisfaction, and political participation. Valenzuela et al. (2009) defines political participation as "behavior that seeks to influence government action by affecting public policymaking" (p. 879). These behaviors include voting, putting political bumper stickers on one's car, contributing money and time to political campaigns, and protesting. Civic participation is defined as "individual or collective behavior aimed at resolving problems of the community" and include donating resources and time to those in need, raising funds for charities, and active membership in an organization such as a group which aims to increase healthy lifestyles (Valenzuela et al., 2009, p. 879). As for life satisfaction, this was measured by the Satisfaction with Life Scale and included items rated on a Likert scale such as, "In most ways my life is close to my ideal", "The conditions of my life are excellent', and "I am satisfied with my life" (Valenzuela et al., 2009). The study included the same measure for intensity of Facebook use as Johnston et al. (2009). Through emailing a questionnaire to students of two universities, the study collected a participant sample size of 2,603 college students from Southwest Texas. Valenzuela et al. (2009) found an association between higher intensity of Facebook use with higher scores on measures of civic and political participation and life satisfaction.

On the other hand, numerous studies have found that frequent Facebook use is associated with harmful effects. Conversely to the findings from the above studies regarding social capital, Campisi et al. (2012) found a higher incidence of upper respiratory infections associated with the more Facebook "friends" an individual

has. Again, a Facebook friend is a mutually agreed upon connection with another facebook member which allows the two parties to chat online, share content, and view each others' Facebook profiles. A Facebook profile allows for someone to post media content, pictures, contact information, updates on one's personal life, and other information. On Facebook, one can "friend" another member of Facebook which opens an avenue of connection and communication. Campisi et al. (2012) also found that over 85% of the participants reported experiencing Facebook-induced stressed. Although only correlational, this study supports the idea that the stress induced by interactions with "friends" on Facebook may in turn lead to higher rates of upper respiratory infections. Chronic stress is known to suppress the immune system and therefore have negative impacts on our health (Campisi et al., 2012).

Another study conducted by Kross et al. (2013) used an experience sampling method to assess the impacts of Facebook use. An experience sampling method is a procedure for gathering participants' answers to a number of inquiries from moment to moment over a specified period of time. While the traditional questionnaire method may ask participants to reflect on their Facebook use over, let us say, the past year; an experience sampling method randomly samples participants throughout the day to assess what their Facebook use and mood have been like in the past several hours. This method allows for more accurate "in the moment" data collection which is less swayed by participant bias. In particular, Kross et al. (2013) examined participants' frequency and amount of Facebook use and its relationship with subjective well-being. They defined subjective well-being as how one experiences the quality of their life, which was assessed by using the Satisfaction with Life Questionnaire, the Beck Depression Inventory (BDI),

and the Rosenberg Self-Esteem Scale (Kross et al., 2013). Subjective well-being and frequency of Facebook use was measured over a two week period. Participants responded to the questionnaires five times a day on their cell phones. This study revealed a decline in subjective well-being with increased use of Facebook—with increased Facebook use participants' satisfaction with their lives declined over the 2 week sampling period, and participants were more likely to report feeling worse (lower scores on BDI, Self-esteem) after periods during which they used Facebook more frequently in between the sampling time-points throughout the day.

These contradictory findings of Johnston et al. (2009); Ellison et al. (2007); and Valenzuela, Park, and Kee (2009) versus Campisi et al. (2012) and Kross et al. (2013) suggest problems with the methods used to study social networking sites– perhaps due to the fact that research on this subject is relatively new. The designs of many of the studies so far are correlational in nature and thus are unable to examine causation. In addition, the interaction between the Facebook user and website is complex. For instance, a number of specific personality factors may affect how one uses or is motivated to use Facebook. Also, there are a number of different activities (games, reading articles, chatting with friends, etc.) which one can engage in while on Facebook. Thus, researchers should examine specific contexts in which Facebook use becomes beneficial or pathological. Specifically, what are the individual differences in behavior on Facebook, as well as how one experiences Facebook lead to pathological use?

For instance, in a follow up study to Kross et al.'s (2013) findings that Facebook use leads to a decline in subjective well-being, Verduyn et al. (2015) found that

participants who used Facebook passively (as opposed to actively) were more likely to experience a decline in subjective well-being over time. Passive Facebook use is defined as when an individual will browse and scroll through Facebook content–or "consume" Facebook–with no direct interaction with another user, whereas active use is defined as when one uses Facebook by interacting with others by chatting, commenting, etc. (Verduyn et al., 2015). Verduyn et al. (2015) were thus able to identify what specific behaviors lead to a decline in subjective well-being over time with Facebook users.

Another study by Davila et al. (2012) found that it is not the frequency or amount of Facebook use, but the specific ways in which one uses Facebook which may lead to psychopathology. Davila et al. (2012) explored the associations between variables such as the amount of time and frequency of Facebook use, quality of interactions one has on Facebook, depressive behaviors such as corumination and depressive rumination, and depressive symptoms. "Quality of interactions" on Facebook was assessed by a self-report measure which asked participants on a likert scale from 1-7, "Thinking about all your interactions on Facebook, how positive are your interactions with people on Facebook?" Davila et al. (2012) explained how corumination is "excessive discussion of problems within friendships, including repeated conversations, conjecture of causes, and heightened focus on negative emotions" (p. 73). Corumination is a behavior associated with depression and was measured in this study by the Corumination Questionnaire. Depressive rumination, the tendency for those who are depressed to frequently think about their negative emotions or past experiences, was measured by the Ruminative Responses Scale. In addition, depressive symptoms were assessed by the Beck Depression Inventory-II.

The study found that amount (time/frequency) of Facebook use was not associated with depressive symptoms. However, those who had more negative interactions than positive ones on Facebook was associated with higher depressive symptoms. Furthermore, rumination and corumination was associated with lower ratings on the quality of interactions scale. Those who coruminated more often were also more likely to spend more time on Facebook–or in other words, frequently using Facebook as an outlet to complain and emotionally disclose. Those who are depressed are likely to have troubled interpersonal relationships, and that these interpersonal deficits are likely to carry over to interactions on Facebook. In addition, it may be that Facebook, by itself, is not the cause of a decline in well-being or an increase in depression. But rather, Facebook creates a venue for negative interpersonal interaction which can maintain or worsen depressive symptoms of those who are already depressed.

Similarly, Feinstein et al. (2012) explored whether depression and anxiety symptoms were associated with the quality of interactions one has on Facebook, amount of Facebook use, and participants' mood following their interactions on Facebook. Amount of Facebook use and quality of interaction was measured the same way as in the Davila et al. (2012) study. However, Feinstein et al. (2012) also asked participants after they rated the quality of their interactions to rate on a scale from 1-7 there depressed and anxious affect (asked as separate questions), "how often do you feel down or depressed (or anxious/worried) after you interact with people on Facebook?" To measure anxiety and depression, participants were also asked to complete the corresponding subscales of the short version of the Depression, Anxiety, and Stress Scale. Participants were asked to complete the questionnaire with the aforementioned

measures (Time 1) and then to complete it again at follow-up three weeks later (Time 2).

Feinstein et al. (2012) did not find that depressive symptoms were associated with amount/frequency of Facebook use. Rather, depressive symptoms were associated with self-reported "lower quality interactions" with Facebook friends. Furthermore, more severe depressive symptoms at Time 1 were associated were lower ratings of quality of Facebook friend interactions at Time 2 as well as low ratings of affect following interactions at Time 2. However, anxiety symptoms were not found to be associated with either amount of Facebook use or quality of Facebook interactions. Therefore, these findings further support the notion that it is the quality of Facebook use, not the quantity, which leads to maintenance of self-reported depressive symptoms.

Another study which looked at specific pathogenic behaviors was conducted by Feinstein et al. (2013). Social comparison is a natural behavior where people make negative or positive self-appraisals through the comparisons between oneself and others (Feinstein et al., 2013). However, those who are depressed are more like to focus on their own negative qualities and perceived inadequacies during social comparison (Feinstein et al., 2013). Facebook offers an opportunity through Facebook profiles for a person to more easily compare one's life to others—e.g., number of friends one has, career, travel, intimate relationships. Feinstein et al. (2013) found that self-reported negative social comparison on Facebook at the beginning of study increased depressive symptoms and rumination at three week follow up over and above typical "general" social comparison. Put more simply, one may be more likely to compare one's life to others and feel worse about oneself while using Facebook. A similar study by Chou and

Edge (2012) found that participants who had used Facebook more often during a given week were more likely to indicate that other people were happier than them, and that these other people had better lives. These two studies highlight that the act of social comparison on Facebook can be an emotionally harmful behavior. It seems reasonable that one will highlight the ideal aspects of one's life on one's Facebook page creating ample opportunity for others to form negative social comparisons.

As for the specific negative processes that may contribute to the association of Facebook use and divorce rates (Valenzuela, Halpern, and Katz; 2014), these processes are relatively unknown. Utz and Beukeboom (2011) found that individuals in a relationship who had low self-esteem were more likely to experience jealousy and relationship distress due to Facebook use. Those who already have low self-esteem may see a romantic partner commenting on a picture of an attractive woman, then these individuals with poor self-esteem are more likely to feel jealousy. In addition, Facebook and other social networks allow for romantic partners to easily monitor each other's activity, and thus any infidelity in relationships is more likely to be revealed.

Facebook Addiction

A specific area so far with growing research is Facebook addiction–habitual problematic Facebook use. By the definition of addiction, Facebook addiction would mean a set of behavior and cognitive patterns by one's interaction with Facebook that compromise daily functioning. The main questions that this research is attempting to answer is whether Facebook "addiction" exists in the first place. Anecdotal evidence that Facebook addiction is a real occurrence can be found easily enough. For example, a character in the movie "the Social Network," which is based on the founding of

Facebook, states at one point in the movie that " it's freakishly addictive. Seriously, I'm on the thing like five times a day." However, anecdotal and fictional validation can only get one so far. This area of research explores whether Facebook "addiction" is just a bad habit, or a real behavioral addiction that follows similar addictive processes and patterns as seen in other behavioral and substance addictions.

A search of the literature reveals several studies that have begun to approach this topic. Groves, Skues & Wise (2014) explored aspects of games on Facebook that may make them addictive. Stieger, Burger, Bohn, and Voracek (2012) investigated what reasons and personality differences account for people desire to quit Facebook. The study found that next to privacy concerns, those who quit Facebook practiced abstinence from the site due to concerns with Facebook addiction. Facebook addiction was measured by an adapted version of the Internet Addiction-Test.

Hormes, Kearns, Timko (2014) explored the relationship between a number of addiction measures, the Young Internet Addiction Test, and measures assessing emotional regulation. The study modified DSM-IV-TR criteria for alcohol dependence and abuse for use in measuring Facebook addiction. For instance, criteria included difficulties cutting back on Facebook use, decreased functioning in work and daily life, strain on relationships, and so forth. The study found that those who scored higher on Facebook dependence were more likely to also experience problem drinking, difficulties regulating emotions, and to have higher scores on the Young Internet Addiction Test.

Because one who is "addicted" to Facebook has a higher chance of also experiencing alcohol dependence and internet addiction, may mean that Facebook addicts possess similar genetic predispositions and cognitive-behavioral patterns as others with

addictions. Additionally, this study shows that those with Facebook "addiction" tend to have impaired functioning in emotional regulation. Impairment in emotional regulation has been found to be a common characteristic in addiction–specifically the lower tolerance of negative emotional states and poor coping strategies (Siegel, 2015). Thus, the study's findings support the notion that Facebook addiction is a real process that occurs through similar neuro-cognitive-behavioral processes as other behavioral addictions such as gambling or general internet addiction–as well as substance addiction. In simpler terms, troublesome Facebook use might be justifiably considered an addiction in some cases rather than a mere "bad habit." Then again, this study was correlational and no firm conclusions can be drawn.

Another recently published study explored the neurocognitive effects of Facebook addiction. Turel et al.'s (2014) findings provide a number of interesting implications and future directions for Facebook addiction research. The study used fMRI technology to examine the neural processes of participants with Facebook addiction as they completed two Facebook specific go sign/ no-go task. A go sign/no-go task is a method that attempts to measure habitual-impulsive responses to certain stimuli (Turel et al., 2014). Participants are asked to either press a button as quickly as possible (in "go" trials) or withhold pressing the button ("no-go" trials) when an image of a traffic sign, or say an image of a Facebook logo or Facebook profile, pops up on the screen. Those with longer response rates are able to demonstrate inhibitory control (versus impulsive responding). This task allows for researchers to scan for impairment in the impulsive or inhibitory decision making systems in the brain as participants make decisions. In summary, the study found that individuals showed similar activation of the amygdala-

striatal brain system as those with substance addiction and gambling addiction.

Impairment in the amygdala-striatal brain system is associated with impulsive cognitive

processes and behaviors (Turel et al., 2014).

However, Turel et al. (2014) found differences between those with Facebook

addiction and those with substance or gambling addiction involving the impairment in the

prefrontal cortex regions associated with inhibition. Those who were addicted to

Facebook did not show any significant impairment in these prefrontal cortex regions of

the brain as is common in other behavioral or substance addictions. Thus, the study found

similar brain-system impairment between Facebook addiction and substance/gambling

addiction, albeit not the exact same processes and brain etiology subserving the

addiction.

With regard to the possible impulsive brain-system impairments revealed in the

Turel et al. (2014) study, a review of the literature of internet addiction uncovered one

study which examined the association between higher scores on the Internet Addiction

Test with more impulsive behavior which was measured by a delay discounting task. A

more thorough explanation of the delay discounting task and theory will be provided

below. Saville et al. (2010) found that those who scored higher on a measure assessing

internet addiction were more likely to discount delays more steeply. Thus, the study

supports the idea that those with technology addiction exhibit more impulsive decision-

making.

Delay Discounting

A delay discounting task takes a behavioral economic approach to the cognitive

processes which underlie addiction. "Behavioral economics" is a field of psychology as

well as economics which aims to better understand how people make decisions in the moment. More specifically, delay discounting is a task aiming to measure impulsive decision-making. Impulsivity can be defined as a higher preference for immediately available rewards at the expense of larger long-term rewards (Odum, 2011). For instance, a student chooses to play video games instead of study for a test, despite her long-term goal to get better grades. The piece of cake that looks good is chosen over a healthy meal. A person with alcoholism needs a drink right now, despite his desire to quit. In delay discounting, impulsivity is typically operationalized in research studies by determining a person's preferences between smaller amounts of money that are immediately available or a larger amount of money which is available only after differing lengths of time.

Naturally, we all prefer having whatever reward (e.g. money, food, sex) now rather than later. Would one prefer $500 now or $500 in 3 months? The answer to that question is probably universal: Now. However, what happens if we lower the amount of money available now: Would one prefer $450 now or $500 in three months? As rewards become more remote (the longer we have to wait for them; thus the *delay* of the reward), the less value these larger rewards have in the present moment. An example can be seen below (Figure 1):
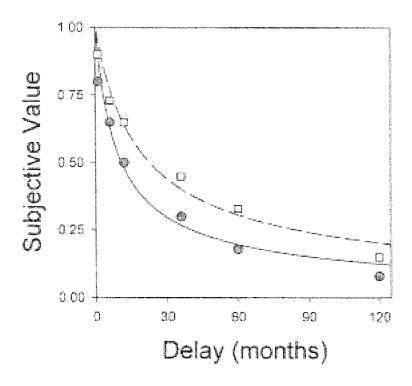
Figure 1. A graph of person 1 (squares) and person 2 (circles) and how their subjective values (or present values) of a reward ($1) becomes less valuable the longer (delay) they have to wait for the reward. Such that, person 2 values having to wait 60 months for an $1 equal to receiving 24 cents now (Myerson et al., 2001).

Furthermore, as one can imagine, people differ on their preferences for immediate rewards over larger later rewards. Some folks may practice more *self-control*, or the ability to wait for the larger payout in the long run, while others put higher value on the immediate reward (Odum, 2011). The heart of delay discounting is determining how much an individual, or group of people, value smaller immediate rewards over larger delayed rewards.

The delay discounting task requires participants to choose between an immediate reward such as $50 now and a reward delayed by time such as $200 in 2 weeks. The task's choices vary in amount of money immediately available (e.g. $10 - $199) as well

as the length of delay (e.g. 1 week - 3 years). Those who are more likely to devaluate

(discount) delayed rewards and choose the smaller immediate reward demonstrate more

impulsivity. As already mentioned, everyone differs to the extent one will prefer

immediate rewards over larger rewards one has to wait for. This indicates that there are

individual differences in impulsivity. For example, person 1 may prefer being paid $120

now than having to wait one month for $200; whereas person 2 may prefer to wait the

month for the larger $200 when offered the instant $120. However, Person 2 may prefer

the immediate payout when the offer increases to $150.

In delay discounting analysis, the researcher must determine the extent each

participant devalues remote rewards (or overvalues the immediate reward). This measure

of impulsivity is also known as the *rate of discounting*, or *steepness of discounting* (Reed

et al., 2012; Odum, 2011). To find this measure of impulsivity, the researcher first

determines the present value, or subjective value, an individual gives to a larger reward

one has to wait for– a term called an *indecision point*. The indecision point is the point at

which the participant switches from preferring waiting for the larger later reward to

receiving the instant smaller reward. So, if on the delay discounting task a person

chooses to wait for $200 in 1 month instead of getting $140 now, but then chooses

getting $150 now over waiting 1 month for $200, we have found their point of indecision.

In that, they could go either way–have $145 now (the average between 140 and 150), or

wait the month for the larger $200. Thus, this person's *subjective value* of waiting 1

month for $200 is equal to getting $145 now (Reed et al., 2012; Odum, 2011). Therefore,

the researcher has then calculated that the participant's indecision point at 1 month is

$145. Indecision points could then be calculated at different delay lengths, such as 6

months, 1 year, 5 years, etc. As discussed above, the indecision points (subjective values of the delayed reward) would likely become less as the time has to wait for the reward increases. In other words, the longer one has to wait for a reward, the less value it has in the present moment.

Delay discounting is known to be a non-linear, hyperbolic function. In that, as rewards become more remote by delay, the subjective value decreases in the present. Mazur (1987) determined that the following equation fits delay discounting data most appropriately:

$$V = A/(1-kD)$$

In the above equation, V is the point where the value of the immediate reward is equal to the amount (A) of the larger later reward at (D) the length of delay. This subjective value (V) is also known as the aforementioned *indifference point*. The variable k is the rate at which an individual no longer is willing to wait for a delayed rewards (Odum, 2011). For instance, *person 1* may find that receiving 150 dollars now is equal to receiving 200 dollars in 4 weeks, while *person 2* may find that receiving 100 dollars now is equal to receiving 200 dollars in 4 weeks. Thus, *person 2* discounts delayed rewards more steeply. The larger the k value, the steeper the discounting (devaluation of delayed rewards). Therefore, k can be used as a measure of impulsive decision-making—with impulsivity defined as the preference of smaller immediate rewards over larger delayed rewards (Odum, 2011).

Because k values are not normally distributed, many forms of statistical analysis are not appropriate. Myerson, Green, Warusawitharana (2001) proposed calculating the Area Under the Curve (AUC) for making statistical inferences and summarizing the

amount of discounting for each participant.   If a researcher were to graph the indecision

points of a participant at each delay, he or she would have a visual representation of the

steepness of their discounting (X axis: length of delay, Y axis: subjective amount).   For

example, Saville et al. (2010) compared differences in discounting between internet

addicts and controls (see Figure 2).   The hyperbolic line (see above equation) that best

fits the data of each group is the "discounting line."
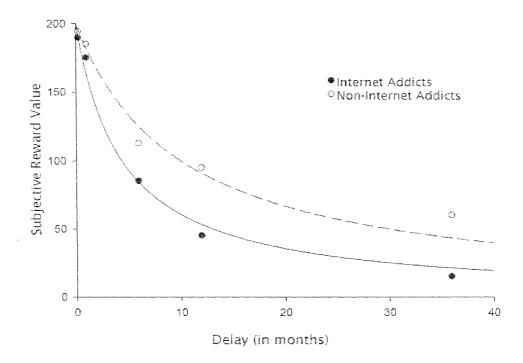
Figure 2. Subjective reward value as a function of delay for Internet addicts (closed

circles) and non-Internet addicts (open circles). The data points represent group

medians, and the curves represent the best-fitting hyperbolic functions.

For AUC, the discounting line just connects each consecutive indecision point at

each delay.   The AUC is derived by calculating the area under the discounting line for

each participant (see Figure 3 for detail).   AUC is found to be a robust nontheoretical

method for comparing rates of discounting.   AUC is considered "non" or "atheoretical"

because one can derive AUC without making any assumptions that the data fits the

proposed hyperbolic function (Myerson, Green, Warusawitharana; 2001). When deriving

the k value, one assumes that the data fits to the hyperbolic equation. However, if a

participant response pattern were irregular, the k value would be skewed or invalid. AUC

is a valid measure that summarizes the extent to which someone discounts delayed

rewards, without assuming the data fits to any theoretical constructs (Myerson, Green,

Warusawitharana; 2001). Also, AUC values are normally distributed from a value of 0

(maximum discounting) to 1 (no discounting) which allows for more powerful parametric

tests to be conducted for comparison purposes (see Myerson, Green, Warusawitharana;

2001 for a more detailed explanation of AUC).
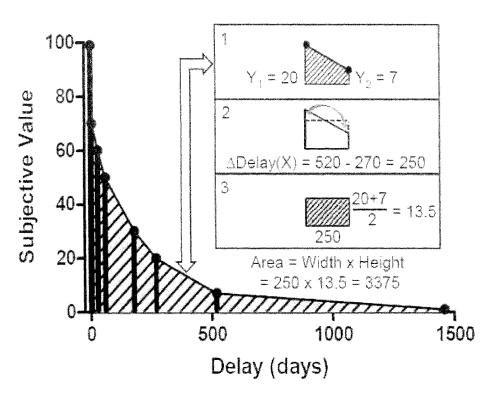

Figure 3. A graphical representation of how AUC is derived by generating a
series of trapezoids under the discounting curve, and calculating the sum of the
total trapezoids' areas. Inset details this process (Reed et al., 2012).

Numerous research studies have associated delay discounting with substance and behavioral addiction (Koffarnus and Bickel, 2014). A steeper discounting of delays (higher preference for immediate reward) has been associated with gambling addiction (Callan, Olson, and Shead; 2011), alcohol addiction (MacKillop et al., 2010; Petry, 2001; Bidwell et al., 2013), nicotine dependence (Amlung and MacKillop, 2014), being less likely to engage in health behaviors (Melanko and Larkin, 2013), and obesity (Hendrickson and Rasmussen, 2013). Stanger et al. (2012) found that adolescents in substance abuse treatment for marijuana use who discounted delayed rewards more steeply were more likely to have poorer outcomes (relapse and frequent use) at follow-up. Thus, the delay discounting task appears to be a robust measure of the mechanism of impulsiveness in addiction, and may even have predictive validity.

A delay discounting task has several advantages to other tasks that measure impulsivity. As Odum (2011) highlights in her review of delay discounting research, a delay discounting task allows researchers to test subjects on the construct of impulsivity without it being apparent of what they're being tested on. On self-report measures, one's subjective experience—how one views oneself or how they want others to view them—can sway how they respond. Conversely, the delay discounting task has no right or wrong answers, and what response is deemed more socially appropriate is less apparent to the participant (Odum, 2011). Therefore, delay discounting is more objective. Likewise, most self-report measures ask participants to reflect and think back on their personal experience. The delay discounting task allows researchers to examine how one would actually makes decisions.

Odum (2011) also brings up the argument against delay discounting that, because participants only make choices between hypothetical amounts of money, the task does not reflect real life decision-making where one has to live with the consequences of one's choices. However, several studies have been done comparing the task when using hypothetical money and real money (Odum, 2011). These studies found no significant difference in participants' response patterns in the hypothetical-reward delay discounting task group and the real-reward delay discounting task group. Thus, the task represents people's actual decision-making patterns with actual reward.

Current Study/Importance of Research

As previously mentioned, Facebook use has become ubiquitous and has quickly changed the ways in which we interact with each other. However, we have only just begun to research the positive and negative effects that Facebook may have.

This study attempts to explore the specific mechanisms of Facebook addiction, as well as explore whether troublesome Facebook use may even be considered a behavioral addiction. Research so far has found broad associations between Facebook use and interpersonal and mental health problems. As more studies are conducted and published, specific behaviors exhibited on Facebook as well as specific individual differences are revealing in what ways Facebook use may become pathological. However, measuring problematic Facebook use has been shown to be inconsistent across studies.

Although delay discounting has been associated with multiple substance and behavioral addictions, discounting of delayed rewards–a task measuring impulsive decision-making–has yet to be associated with those who exhibit habitual Facebook use. This study intends to explore whether those who report being more addicted to

Facebook tend to discount delayed rewards more steeply, and therefore might be expected to make decisions more impulsively.

Due to recent research showing that those who are more addicted to the internet in general, as well as other substance and behavioral addiction, tend to discount delayed rewards more steeply, the following hypothesis is made:

Those who score higher on a Facebook addiction scale are more likely to discount delayed rewards more steeply.

The findings of this study would serve to further the research of Facebook addiction in a number of ways. For one, if participants who score higher on Facebook dependency do or do not make decisions more impulsively—a characteristic found across addiction—we can infer whether problematic Facebook use is either closer to an addiction or a mere "bad habit." Likewise, this research could further support the findings by Turel et al. (2014) that those addicted to Facebook show impairment in their amgydala-striatal brain system—and thus make decisions more impulsively. In addition, the findings of this study may either provide further convergent validity for the Bergen Facebook Addiction Scale or reveal the need to develop a more robust measure.

Method

Participants

The study was conducted at Eastern Illinois University with students from an introductory psychology course who participated in the study for course credit. In addition, some of the participants volunteered to participate in the study for an assignment in a senior "capstone" course.

A total of 152 participants took part in the study. 130 of the students were from the introductory psychology course, while the other 22 were from the Senior "capstone" course. However, after data was excluded because of irregular responding patterns, 92 participants were left for analyses. This method will be described in full below.

The average age of the total sample of 92 participants was 20 years old. 53% of the sample was female, while the remaining 47% was male. The average grade point average of the sample was 2.98 on a 4.0 scale.

After data collection was completed, a systematic method was used to determine what data should be excluded from analysis. Some participants did not fully complete the delay discounting task, and therefore their data was excluded. Furthermore, some participants may have obviously circled choices randomly such as switching back and forth each choice between the immediate and delayed reward. Other participants may have completed the delay discounting task, but due to a lack of either motivation, attention, or an understanding of directions, these participants may have completed the task in a way that their data could not be analyzed. For instance: a participant may have responded that they would prefer to have $100 immediately instead of waiting 1 week for $200. However, at the delay 1 year, they may have answered that they prefer to not only wait 1 year to receive $200 instead of get $100 immediately, but also prefer to wait longer for the larger sum than to receive $110, $120, even $150 immediately. This example shows abnormal answering patterns. Why would someone not be able to wait 1 week for the larger sum, but at 1 year suddenly become more patient? In theoretical terms, this abnormal answering pattern would not align with the hyperbolic decay. In

that, delayed values become subjectively less valuable in the present as a function of length of delay. As used in the Saville et al. (2010) study, Johnson and Bickel (2008) developed a two-step algorithm to determine what data to exclude due to irregular discounting. The first step states that an indifference point (value that a person switches from the delayed reward to immediate reward) should not be more than 20% of the larger delayed reward–or $40 dollars in this study–than the indifference point at the delay before it. So, a participant's data would be excluded if their indifference point at 6 months is $100, and then there indifference point at 1 year is $150. The second step of the algorithm suggests that the final indifference point (at delay three years) should be smaller than the first indifference point by 10% or greater of the larger delayed reward. Therefore, in this study the final indifference point should be $\geq$ $20 less than the first indifference point. However, in this study the second step of the algorithm was not used for several reasons. A large portion of the sample (14 participants) exhibited zero to very little discounting over the delay periods. While a large portion of the sample may have just not understood the directions, it may also be that this is what a fair number of the participants actually preferred. To cut out too much of the data because is does not strictly follow the theorized way someone should answer may be unethical. In that, one would be ignoring a large section of the data and their realistic preferences. Furthermore, one could still calculate AUC and k values that would be valid in showing less impulsive discounting. Also, the researchers were looking to answer the question whether those who scored lower on the Bergen Facebook Addiction Scale showed less steep discounting over delays. After excluding the data due to the factors mentioned above, a total of 92 participants were left for analyses.

Next, participants were matched through the following procedure. A separate Excel spreadsheet was made that combined Facebook addiction scores and demographic data for each participant. Then, participants were sorted by their Facebook addiction scores to identify the 16 participants with the most self-reported problematic Facebook use on the BFAS. Andreassen et al. (2012) suggested that those who score an 18 or higher on the Bergen Facebook Addiction (see "Measures" section) could be considered "addicted" to Facebook. However, Andreassen et al. (2012) did not support why this cutoff score was made. Thus, the participants with the 16 highest scores were chosen for the analysis to be in the Facebook "addicted" group. However, the mean score for the Facebook "addicted" group was 20.94, and all participants were higher than the cutoff of a BFAS score of 18. It should still be noted that future research on the BFAS could reveal that some of these participants may not be considered Facebook "addicted," and that these participants just had more problematic use. Each of these 16 Facebook dependent participants was matched with a corresponding participant from a pool of 30 participants with a BFAS score of 11 or lower. Participants with a score of 12 or higher on the BFAS were not included for matching to ensure that those with minimal issues with Facebook use were being matched to those in the problematic Facebook use group. First, participants were matched on gender. Secondly, participants were matched to someone the same age or no more than 1 year difference. Due to the limited number of participants, two pairs had an age difference of 2 years. After the above two criteria were met, participants were matched to the closest grade point average. Group demographic information and BFAS scores are included in Table 1.

Table 1

Demographic Information for Facebook Addicted and Non-Facebook Addicted Participants

	Facebook Addicted	Non-Facebook Addicted
N	16	16
Gender		
Women	12	12
Men	4	4
Average Age	19.88	19.63
Grade Point Average	2.83	3.09
Score on BFAS	20.94	9.13

Measures and Procedure

Participants were given a packet including an informed consent form, a demographic questionnaire (age, gender, current grade-point average), the Bergen Facebook Addiction Scale, and a delay discounting task that included a corresponding short paragraph of instructions (see below). In addition, verbal instructions were given to clarify the written directions for completing the delay discounting task. After the packet was completed and turned in, the participants were given a debriefing form that explained the purpose of the study. The participants were also given an opportunity to ask questions concerning the study and their participation in it. This whole process took ten to twenty minutes to complete.

A noted difficulty in studying Facebook addiction is the lack of consistent measures addressing problematic Facebook use throughout the literature. Several studies looking at problematic Facebook use used an adapted version of the Internet Addiction Test, while Hormes, Kearns, Timko (2014) used an adapted DSM-IV-TR criteria for

alcohol dependence. Recently, Andreassen et al. (2012) developed the Bergen Facebook Addiction Scale (BFAS). The six-item scale is face valid and assesses six commonly accepted core aspects of addiction: tolerance, withdrawal, mood modification, salience, relapse, and conflict (see *Appendix A*). Participants respond to each question on a Likert scale from 1: "very rarely" to 5: "very often." The scales reliability and validity was assessed with a sample of 423 students (Andreassen et al., 2012). When comparing scores on the BFAS with personality factors as measured by the NEO-Five Factor Inventory, higher scores on the Facebook Addiction Scale were found to be associated with higher scores on Neuroticism and Extraversion, and negatively associated with Conscientiousness. The scale demonstrated convergent validity with other Facebook problem use scales and addiction scales such as the Addictive Tendencies Scale, the Facebook Attitudes Scale, and the Online Sociability Scale. Furthermore, those who scored higher on the BFAS were found to have delayed bedtime and rising times. (Andreassen et al., 2012). The alpha coefficient was found to be .83, and a test-retest reliability coefficient equals .82. While a relatively new scale, the BFAS appears to be a valid and reliable measure for Facebook addiction that can be applied to future research of pathological Facebook use (Andreassen et al., 2012).

After participants completed the informed consent form but before they began completing the different measures, participants were given verbal instructions concerning the delay discounting task. The researcher clarified that the participants would be asked to make a decision between a series of choices between different amounts of money–a smaller varying amount of money available immediately and one larger amount after various lengths of time. Participants were asked to make a series of 20 choices between

smaller immediate rewards and a larger delayed reward of 200 dollars that they would

have to wait for at the following time lengths: 1 week, 1 month, 6 months, 1 year, and 3

years. Thus, there were a total of 100 choices. The immediate reward amounts were in

the left column and were listed as follows: 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110,

120, 140, 150, 160, 170, 180, 190, 198, 199. An example portion of the delay

discounting task is given below:

Would you prefer to be given…(Please choose one answer for each question)

1.	$10 now	or	$200 in 1 week
2.	$20 now	or	$200 in 1 week
3.	$30 now	or	$200 in 1 week
4.	$40 now	or	$200 in 1 week

The above example would continue until "$199 now or $200 in 1 week." Then the

delay would increase so that is was the same series of decisions except "$10 now or $200

in *1 month*" and so forth.

Participants were informed that they would not actually be receiving any money.

Likewise, the researcher emphasized that there were no right or wrong answers–just what

the participant preferred. Participants were given the opportunity to ask questions if they

were confused or unsure of how to complete the delay discounting task.

Also, the researcher instructed the participants that they could complete the delay

discounting task by just indicating where they would switch from choosing the larger

later reward to the immediately available reward. To give a case example: the participant

would see the choice between $10 now or $200 in one week, and chooses (by circling) waiting for the $200. Also, they may prefer the $200 in one week compared to having $20 now, then $30 now, and then $40 now. However, when they came across the choice between $50 now or $200 in one week, they switch to prefer getting $50 now. After this point where they had switched, they would be allowed to continue to the next series of choices at the 1 month delay, instead of continuing onto the choices "$60 now or $200 in 1 week," "$70 now or $200 in one week," and so forth. These directions were given to shorten the task.

In addition, after the Bergen Facebook Addiction Scale but before the delay discounting task, these written instructions were given:

> On the next few pages, you will be asked to make a series of choices between two hypothetical amounts of money. One amount could be obtained immediately; the other amount would be available after a certain period of time. For example, you might be asked to choose in between:

> $70 now   or $200 in two weeks

> There are no right or wrong answers. We are simply interested in the option you prefer, so please make your choices as honestly and as accurately as possible. Do not rush through this survey, randomly choose your answers, or flip back and forth between sheets.

This set of instructions was the same used in the Saville et al. (2010) study for the delay discounting task. In addition, the same delay discounting task used by Saville et al. (2010) was also used in this study. In other studies, this task can differ in the number and length of delays, as well as the amount of money available after the delay. For instance, Bidwell et al. (2013) used a larger later reward of $100 available after 1 day, 2 days, 30 days, 180 days, and 365 days. Likewise, the immediate reward values may also be different in other delay discounting task. However, because Saville et al. (2013) looked

at internet addiction and delay discounting, which is similar to Facebook addiction, we decided to use the same delay discounting task to keep the measure standardized for comparison purposes.

Next, area under the curve (AUC) values, k values, and non-linear regression calculations were performed for each participant on Microsoft Excel. This process followed the procedure outlined by Reed, Kaplan, and Brewer (2012). Several practice and trial runs were first put through the Excel calculator procedure to ensure valid results. AUC and k values needed to be calculated for every single participant for later correlational analysis between Facebook scores and delay discounting values.

Results

First, we conducted paired-samples t-tests on the participants' age and GPA to determine if matching on the demographic data was successful. All participants were able to be matched with someone of the same gender, and therefore statistical analysis on this variable was unnecessary. At an alpha level of .05, no significant difference was found between the Facebook addicted and non-Facebook addicted groups in respect to age, $t(15) = .94, p = .36$ (two-tailed). However, at an alpha level of .05, the GPAs of those who were addicted to Facebook ($M = 2.83, SD = .71$) were found to be significantly lower than those not addicted to Facebook ($M = 3.09, SD = .50$), $t(15)= -2.73, p = .015$ (two-tailed). While statistically significant, the difference between the groups' mean GPAs was only .26 out of a 4.00 scale. In addition, a dependent t-test was conducted on the Bergen Facebook Addiction Scale scores to find out if the two groups were statistically different. The Facebook addicted group ($M = 20.94, SD = 1.53$) was found to have statistically significant higher BFAS scores than the non-addicted group (M

= 9.13, *SD* = 1.54), *t*(15) = 26.85, *p* < .001 (one-tailed). Taking all of the above into account, matching was deemed successful.

As mentioned above, the *k* values, AUC, and the percent of variance accounted for by the hyperbolic equation (R^2) was determined for each participant (see Table 2 for further analysis).

Next, we explored the differences in the discounting of delayed rewards between high and low scorers on the BFAS. First, possible differences between groups in *k* values were investigated. Because *k* values are not normally distributed, a Wilcoxon signed-ranks test was conducted to determine differences in impulsivity. In 15 out of 16 cases, the derived k values of those with problematic Facebook use were greater than the derived *k* values of those without problematic Facebook use. At an alpha level of .05, the mean rank of those addicted to Facebook (9.00) was significantly higher than those not addicted to Facebook (8.47), *z* = -3.05, *p* = .001 (one-tailed).

AUC was then compared between the paired Facebook addicts and non-Facebook addicts. As discussed above, calculating the area under the discounting curve has a number of advantages in statistical analysis and interpretation as compared to *k* values. AUC values are normally distributed from 0 to 1, and thus more powerful parametric tests can be conducted. Lower AUC values denote more impulsive decision-making. Furthermore, some participants' answering patterns may not fit well with the hyperbolic model of discounting—which was evident in this sample. However, AUC values are non-theoretical, and a measure of impulsivity can be derived without assuming the data fits to any specific model.

Table 2

The Derived k *value, Percent of the Variance Accounted for by the Hyperbolic Equation* (R^2), *and the Area Under the Curve (AUC) for Participants in the Facebook Addicted (FA) and Non-Facebook Addicted (NFA) Groups*

	k	R^2	AUC
	Facebook addicted (FA)		
FA1	.040	.16	.15
FA2	.038	.90	.09
FA3	.039	.77	.21
FA4	.038	.99	.10
FA5	.010	.14	.33
FA6	.004	<.01	.46
FA7	.002	<.01	.58
FA8	.064	.75	.06
FA9	.190	.92	.07
FA10	.002	.11	.57
FA11	.013	<.01	.39
FA12	.015	.88	.13
FA13	.180	.89	.05
FA14	.002	.68	.54
FA15	.330	<.01	.12
FA16	.070	.74	.09
	Non-Facebook addicted (NFA)		
NFA1	.072	.96	.09
NFA2	.008	.88	.20
NFA3	.001	.82	.61
NFA4	.000	<.01	.92
NFA5	.003	<.01	.51
NFA6	.000	<.01	.92
NFA7	.001	.82	.74
NFA8	.020	.93	.20
NFA9	.001	.34	.64
NFA10	.001	.75	.62
NFA11	.000	<.01	.99
NFA12	.006	.50	.40
NFA13	.003	<.01	.51
NFA14	.000	<.01	.99
NFA15	.000	<.01	.99
NFA16	.002	<.01	.56

Note: Participant FA1 was matched with participant NFA1, participant FA2 was matched with participant NFA2, and so forth

A dependent t-test was conducted on AUC values. At an alpha level of .05, the AUC of those who report little problems due to Facebook use ($M = .63$, $SD = .31$) was found to be significantly higher than those who report substantial problems due to Facebook use ($M = .25$, $SD = .20$), $t(15) = 5.47$, $p < .001$ (one-tailed). Therefore, Facebook addicts exhibited a greater discounting of delayed rewards.

Additionally, the median indecision points were determined for each group for analysis and comparison of delay discounting. As one can see in Figure 4, those with Facebook addiction were found to discount delayed rewards much more steeply than those without Facebook addiction. Regression analysis of the overall median indecision points reveals that the hyperbolic function fit the data for the high BFAS scorers well, $R^2 = .92$. That is, 92 percent of the data was accounted for by the hyperbolic model. As for the non-Facebook addicted group, the hyperbolic model did not fit the data ideally, yet still accounted for the majority of the variance ($R^2 = .79$).
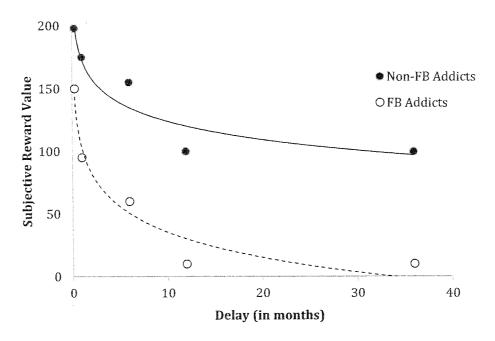

Figure 4. Subjective reward value as a function of delay for Facebook addicts (open circles) and non-Facebook addicts (closed circles). The data points represent group medians, and the curves represent the best-fitting hyperbolic functions.

Non-linear regression analysis was also conducted for each individual participant. For the Facebook addicted group, 9 out of 16 participants had an R^2 value of .68 or higher (see Table 2). As for the non-addicted to Facebook group, only 6 out of 16 of the participants had an R^2 value of .68 or higher (see Table 2). In many cases, the hyperbolic function did not account for the answering patterns of the participants. More specifically, 5 out of the 16 participants did not show any discounting of the delayed reward over the delays, and the hyperbolic decay would thus not match these participants' data at all. This fact will be examined further in the discussion section. Furthermore, to determine whether the groups differed statistically in R^2 values, a Wilcoxon signed-ranks test was conducted on R^2 values. There was found to be no significant difference between the groups, $z = -1.09$, $p = .28$ (two-tailed).

Besides analysis of the paired participants, the relationship between BFAS scores and delay discounting was explored in the full data set of 92 participants. Correlational analysis was conducted on BFAS scores and AUC values. At an alpha level of .05, there was a significant relationship between BFAS score and AUC values, $r(90) = -.30$, $p = .002$ (one-tailed). People who have higher Facebook addiction scores tend to have lower AUC values, or more impulsive decision-making. BFAS scores accounted for 9% of the variance in AUC scores.

Correlational analysis was not conducted on k values because these are not normally distributed.

Discussion

The purpose of the present study was to explore the relationship between Facebook addiction and impulsivity–a core trait of addiction. Delay discounting is a

measure of impulsivity, and steeper discounting of delayed rewards is associated with a number of behavioral and substance addictions. Facebook addiction was measured by the Bergen Facebook Addiction Scale which assesses aspects of Facebook dependence and effects on daily functioning (Andreassen et al., 2012).

All in all, the 16 participants who reported higher dependence to Facebook and more problems as a result of use tended to more steeply discount delayed rewards as compared to their non-addicted controls. Furthermore, a relationship between Facebook addiction scores and impulsivity (as measured by faster discounting) was observed in the overall sample of 92 participants.

While the correlational analysis yielded statistically significant results, Facebook addiction scores accounted for only a small portion of the variance in delay discounting. Facebook addiction scores only accounted for 9% of the variance of AUC values. This finding is understandable due to the number of variables that play into impulsivity. One can imagine age having an affect on level of impulsivity, as well as the existence of other addictions in the sample besides Facebook addiction. Furthermore, other conditions may also have an effect on delay discounting scores such as ADHD or other learning disabilities.

Although not a large difference, those with higher scores on the BFAS (Facebook addiction) were found to have significantly lower grade point averages than those who scored lower on the Facebook addiction measure. This finding sheds light on the flaws in the matching procedure, and the need to sample an even larger pool of participants to increase the likelihood of more exact pairing between Facebook addicts and controls. Conversely, the observed significant difference in GPA's is not too

surprising. One could expect that those who have more problematic Facebook use are likely spending more time on Facebook than paying attention in class, studying, or completing course work. In addition to controlling confounding variables such as GPA, age, and gender; other demographic or background information to match participants on would have been useful to control for variables such as other substance use and personality differences.

Another problem that arose in the study was the amount of participants' data that needed to be excluded as a result of either incomplete survey packets, a lack of motivation to follow directions, or a misunderstanding of instructions. Several fixes could increase rates of valid responding. For instance, monetary incentives instead of course credit could increase motivation and attention. Likewise, small testing groups could have also increased participants' ability to pay attention and feel comfortable to ask questions about how to complete the task. Also, the data came mostly from an introductory psychology course. Sampling from more intermediate and upper level courses may have provided more motivated and focused students. Finally, using computer software for the delay discounting task may have also increased valid responding due to the ability to have only one choice be presented at a time, instead of participants being overwhelmed by a large packet with numerous questions and choices to be made.

Another issue in the data inclusion/exclusion procedure was the decision to include data where participants showed no discounting of delayed rewards over the delay periods. Statistical analysis and visual inspection of the distribution of data revealed that those who showed no discounting tended to have lower scores on the BFAS. However,

by including these participants the data was more likely to not fit the hyperbolic function

(i.e. low R^2 values). In addition, because a complete lack of discounting is considered to

be irregular, some data could have been included where the participant was just circling

the last choice on every page instead of taking their time to seriously consider their

choices. On the other hand, excluding such a large portion of data due to their answering

patterns not fitting the proposed model may be cherry picking the data that only met our

assumptions of delay discounting. In other words, by throwing out so much data from

the sample, we may not have gotten a realistic sample to explore Facebook addiction and

delay discounting.

As far the researcher knows, this is the first study to examine Facebook

"addiction" and delay discounting. Impulsive decision making, by itself, does not deem

problematic Facebook use an addiction. Yet, those who have higher scores on the BFAS

(higher Facebook addiction) do share a common characteristic of those with other

chemical and behavioral addictions. Steep delay discounting, or a preference for smaller

immediate rewards instead of investing in the larger payout in the future, has been an

observed behavior across addiction (Koffarnus and Bickel, 2014). In this study, those

with Facebook "addiction" exhibited the addictive trait of impairment in impulsive

decision-making. This finding thus strengthens the hypothesis that Facebook addiction is

closer to a real addiction and not just a bad habit.

The results of this study build upon the findings from a limited number of studies

on Facebook addiction. Turel et al. (2014) found that those with Facebook addiction also

made more impulsive decisions on a "go sign/no-go" task which measures habitual

impulsive responses to trigger stimuli such as a Facebook logo. Turel et al. (2014) also

found that during the go sign/no-go task that participants showed higher activity in the amygdala-striatal brain system as measured by an fMRI. The amygdala-striatal brain system has been found to be the brain system associated with impulsivity (Turel et al. 2014). Thus, Facebook "addicts" showed similar over-activation of the impulsive brain system as other people with substance or behavioral addiction. Through this current study, we found that participants also demonstrated impulsive decision making on another type of task, in turn further supporting Turel et al.'s (2014) findings.

Moreover, the findings of this study further add to the findings of Hormes, Kearns, Timko (2014). Hormes, Kearns, Timko (2014) found that those who had higher scores on Facebook addiction were also more likely to have impairment in emotional regulation, problem drinking, and higher scores on the Young Internet Addiction Test. The relationship between Facebook addiction, problem drinking, and internet addiction demonstrates that all addictions may share core traits and neurobiology that predispose one to addiction. The current study may shed some light on the correlation of Facebook addiction with other problematic use as explained by the shared characteristic of impulsivity. In addition, that Facebook addicts have been shown to demonstrate both impairment in emotional regulation–another key trait of addiction as highlighted in a review of the research of emotional regulation and addiction by Siegel (2015)–and impulsivity further supports the argument that Facebook addiction is a valid addiction.

In fact, emotional dysregulation and impulsivity are likely closely connected in the constellation of addictive traits. Impulsivity can even be viewed as a part of emotional dysregulation. To clarify, impulsivity can be thought of as an action to relieve the tension created by stress or another negative emotional state. In fact, emotional

distress is cited as the number one reason for substance relapse (Siegel, 2015). Through this current study, we may have illuminated the other half of this relationship between emotional dysregulation and impulsivity. Future studies on Facebook addiction will need to further explore this relationship and addictive neurocognitive processes.

The findings of this study were similar to Saville et al. (2010) findings of general internet addiction and delay discounting. Yet, one difference in the results between this study and the findings of Saville et al. (2010) is that we found a significant difference in the k values between Facebook addicts and non-addicts ($p = .001$), while they did not find a significant difference in the k values between internet addicts and non-addicts ($p = .07$). In contrast, Saville et al. (2010) were more stringent in their data inclusion criteria, and had much more participants' data that fit the hyperbolic model. Another difference in the analysis between the two studies, is that this current study included correlational analysis between discounting values and Facebook addiction scores in the complete sample. Saville et al. (2012) only analysed the data from the matched participants. This further analysis allowed another look at the relationship between Facebook addiction and delay discounting.

Saville et al. (2010) explored general internet addiction which can include anything from online gambling, pornography, shopping, gaming, and social media. Whereas, this current study looked at one specific corner of the internet, Facebook. Due to the variety of activities one can engage in on the internet, this study brings up the notion that perhaps internet addiction could be split into subtypes (e.g. social media, pornography, gaming).

This study differed from other studies in the measure used for assessing Facebook addiction. Turel et. al (2014) used a modified version of a questionnaire that originally measured online video gaming addiction, while Hormes, Kearns, Timko (2014) used a modified version of the DSM-IV-TR criteria for alcohol dependence. For this study, the author wanted to use a measure that was made specifically for Facebook addiction. The Bergen Facebook Addiction Scale was developed by Andreassen et al. (2012). While the scale demonstrated decent reliability and correlated with other scales measuring addiction, the scale is relatively new and in need of further validation. Because those who scored higher on the BFAS were found to also discount delayed rewards more impulsively, the findings of this current study add to the usefulness of this measure. This current study provided convergent validity for the Bergen Facebook Addiction Scale. The BFAS appears to accurately assess pathological Facebook use.

Although the findings of this study added to a limited area of research, a number of questions still need to be examined. Likewise, this current study could have been improved in several ways. As touched upon earlier, similar studies could strengthen the methodology in several ways. For instance, using computer software for testing purposes, more incentives for participants, clearer delay discounting task instructions, and smaller testing groups could all have helped in obtaining more valid data. Sampling a larger participant pool would have helped in the matching process and strengthening the power of statistical analysis. As evident in the correlational analysis, more variables could have been controlled in the matching procedure as well as the overall correlational analysis. For example, pre-existing issues such as problem drinking could have been controlled for.

In addition, this study could have included other measures of Facebook addiction and general addiction, such as the modified measures used in the other studies, to further compare measures and explore the relationships between them. Future studies could also include measures to examine the relationship between impulsivity, Facebook addiction, and the regulation of emotion. Besides a delay discounting measure, other decision-making tasks could be included in future studies to further explore possible impairment in those addicted to Facebook. Whether those addicted to Facebook show differences in answering patterns on the Iowa gambling task or a probability discounting task would be interesting to find out if Facebook addicts show higher risk-taking.

In summary, this study found that those who score higher on a measure of Facebook addiction tend to make decisions more impulsively than controls who have very little problem Facebook use. These findings support the idea that Facebook addiction is a real addiction that exhibits similar pathological neurocognitive traits as those of other addictions.

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Appendix

Appendix A.

Questions on the Bergen Facebook Addiction Scale

1. Spent a lot of time thinking about Facebook or planned use of Facebook?

2. Felt an urge to use Facebook more and more?

3. Used Facebook in order to forget about personal problems?

4. Tried to cut down on the use of Facebook without success?

5. Become restless or troubled if you have become prohibited from using Facebook?

6. Use Facebook so much that it has had a negative impact on your job/studies?

Note: These items are rated on a Likert scale from 1: "very rarely" to 5: "very often."