



Believe it And Get Strong! The Effect of Need for Cognition on Self-Control

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Abstract

Research on self-control and need for cognition demonstrate the applicability of these constructs in many domains of our lives, including education, health, and financial decision making. Using the self-control theory, and the elaboration likelihood model and self-control strength model, we examined the effect of need for cognition (NFC) on self-control. Participants were recruited from Amazon Mechanical Turks and were placed in three groups - high NFC condition, low NFC condition, and control condition - and then asked to solve mathematical word problems to measure their self-control. We hypothesized that people in high NFC condition are more likely to exert self-control than people in the low NFC condition and the control condition. The results did not support the hypothesis. Limitations and possible areas of future research are discussed.

Keywords: Need for cognition, self-control, self-control strength model, elaboration likelihood model, ego-depletion.

Believe it And Get Strong! The Effect of Need for Cognition on Self-Control

Self-control is a unique trait that seems to affect a large domain of our lives. People with good self-control are more prominent and successful, have fewer drinking, drugs and eating disorders, make better financial and life decisions, and have better relationships (Baumeister, Gailliot, DeWall, Stillman, 2007; Hankonen, Kinnunen, Absetz, & Jallinoja, 2014; Daly, Delaney, Egan, & Baumeister, 2015; Kim, Hong, Lee, & Hyun, 2017). Good self-control also contributes to a highly satisfied close relationship by enabling people to pursue interpersonal harmony, especially in unpleasant circumstances (Baumeister et al, 2007; Tangney, Baumeister, & Boone, 2004). On the other hand, a lack of self-control results in many self-defeating behaviors such as procrastination, unhealthy lifestyle, failure in education, drug problems, eating disorders, and acts of violence and crime (King, Fleming, Monahan, & Catalano, 2011; Wolfe, Reisig, & Holtfreter, 2016). Effective self-control can help to resist the temptations for immediate gratification that derive from the short-term incentives. Thus, in this study, we are interested in investigating how self-control can be increased. Specifically, we are interested in investigating if making people believe that they have a high need for cognition increases their performance in a subsequent task that requires self-control.

Why Do People Fail to Self-Control?

The failure in self-control is a result of people's inability to resist immediate gratification (Gottfredson & Hirschi, 1990; Tangney et al., 2004; Watson & Milfont, 2017; Hofmann, Friese, & Strack, 2009). People mistakenly believe that the benefits of immediate gratification outweigh its cost. In their book, *A General Theory of Crime*, Gottfredson and Hirschi (1990) highlighted low self-control as the most prominent construct that contributes to criminal and delinquent conduct. In fact, acts of force and fraud are the most common ways to achieve the immediate material gratification (Hirschi 1969). Apart from this, Gottredson et al. (1990) highlighted the

general characteristics of a person with low self-control as having an impulsive personality, risk-taking, short-sighted, and nonverbal. Furthermore, they suggest that people lacking self-control tend to pursue activities such as smoking, drinking, use of drugs, and engaging in illicit sex behaviors because of their tendency to pursue immediate gratification over delayed gratification. In fact, self-control and no self-control lie on the two extremes on a continuum with self-control and cautious behavior on one extreme and lack of self-control and risk-taking behavior on the other.

Impact of Self-Control

Baumeister, Heatherton and Tice (1994) have consistently reiterated the impact of self-control on vast areas of our lives such as financial decision making and decision making in general, sexual violence and crime, health, and educational failure. One prominent example of failure in self-control is the global financial crisis of 2007-2008. According to Thaler and Sunstein (2008), the main reasons for the global financial crisis were the short-term incentives and human frailty. As evidenced by the 2008 financial crisis, abundant credit, low interest rates, and relaxed lending standards of financial agencies incentivized people to purchase houses that they could not afford. Traders and managers received a large part of their compensation in the form of an annual bonus and they failed to “avoid risky strategies liable to fail spectacularly every 5 to 10 years” (Jickling, 2010, pp.7). The lucrative short-term rewards enticed people and prevented them from exercising self-control, and ultimately when the housing prices fell and interest rates increased, the global financial environment was in ruins.

In one fascinating study by Levav, Danziger, and Pessó (2011), they showed that decision fatigue is largely associated with ego-depletion and self-control as predicted by the self-control strength model. They found that Israeli judges gave more lenient decisions at the start of the day and immediately after a scheduled break. In fact, favorable rulings dropped gradually from

around 65% to nearly zero within each decision session and returned to approximately 65% after a break. This shows that as people make various decisions throughout the day their willpower is depleted and are more likely to make wrong and irrational decisions.

Lack of self-control can also have negative effects on students' health and academic performance. Students who are under stress smoke more, drink more, and spend less time on studying (Oaten & Cheng, 2005), which affects their grades negatively. West and Lennox (1992) also reported that students smoked more cigarettes immediately after exams than a more neutral period. A longitudinal research reported that there was an increase in smoking level and a decrease in physical activity during exam times (Steptoe, Canaan, Wardle, Pollard, & Davies, 1996). This is a result of depletion of self-control strength because during exam times students are stressed and use up their self-control strength. Baumeister et al., (1994) provided evidence that adapting to stress consumes self-regulatory strength and results in self-regulatory breakdown. That is why students engage in bad habits to offset the stress. Students' decision-making capability diminishes, and they fail to maximize their objective gains.

Self-Control Measures

The tendency of people to give in to temptations and fail to exercise self-control was first reported by Mischel (1960) in his fascinating marshmallow experiment using children as subjects. His experiment demonstrated how children are often unable to resist immediate gratification (i.e., to eat one marshmallow now) even when they were told that they could receive a better reward (i.e., two marshmallows) if they waited for 15 minutes. Mischel demonstrated that people are poor at exerting self-control and therefore give in to temptation.

Hoffman, Baumeister, Vohs, and Forster (2012) also investigated the frequency in which people felt desires and attempted to control desires in everyday life. They conducted a large-scale experiment based on a conceptual framework integrating desire strength, conflict, the use

of self-control, and behavior enactment. Participants wore beepers for a week and were asked to report on whether they felt any desire, how strongly, whether they tried to resist the desires, and how successful they were at resisting. A total of 7,800 desires were reported and participants reported resisting two out of every five desires. Moreover, resistance (use of self-control) was often successful. Without any resistance people acted on 70% of their desires, whereas with resistance the rate dropped to 17%. This shows that people spend a good portion of their time trying to control their desires and needs every day and that effective self-control can lead to better judgement by warding off impulses.

Baumeister, Bratslavsky, Muraven, and Tice (1998) further demonstrated that willpower is a limited resource. In their famous chocolate-chip-cookies and radish experiment, they showed that people who forced themselves to eat radishes instead of chocolate chip cookies quit significantly faster on unsolvable puzzles than people who had not had to use self-control to resist the temptation to eat the cookies. Similarly, suppressing emotion led to a drop in the performance of solvable anagrams by depleting willpower. Another experiment demonstrated that by using self-control on an initial task that demanded high self-control made people more passive for the next task. Baumeister et al., (1998) used ego-depletion task and checked to see if participants watched a boring movie for longer if quitting to watch required an active response such as pressing a button down, or a passive response, such as holding the buzzer as long as they wanted to watch the movie (releasing the button would mean quitting). In fact, the results demonstrated that participants who were depleted were more likely to take a passive route than participants who were not depleted.

Need for Cognition (NFC)

Need for cognition has been found to influence a variety of human behaviors directly and indirectly including mastery of academic requirements, mental health through decreasing self-

rumination and increasing self-reflection, and predicting everyday life behaviors (Nishiguchi, Mori, & Tanno, 2018; Grass, Strobel, & Strobel, 2017; Strobel, Fleischhauer, Luong, & Strobel, 2018). People have the need to structure relevant situations in meaningful and integrated ways, which can be defined as a need to understand and make their experiences reasonable (Cohen, Stotland, & Wolfie, 1955). Cohen et al., (1955) classify NFC as a need since this need directs behavior towards a goal and causes tension when that goal is not achieved. Moreover, since the ideas of meaningfulness and integration are subject to individual differences, it can be deduced that NFC is also subjective - i.e., people have varying degrees of need for cognition.

The first ever empirical study of the need for cognition (Cohen et al., 1955) showed that individuals possessing high need for cognition enjoyed reading structured stories over ambiguous ones, whereas individuals possessing low NFC did not rate the different stories differently. Fifty-seven undergraduate students completed two parts of the experiment. First, they read either an ambiguous or not ambiguous story about a student's interview with a potential employer. Then, they rated the story on different dimensions such as enjoyment of the story, difficulty in understanding the story, energy or effort spent to make sense of the story, and so on. As part of this study, Cohen et al., (1955) constructed and validated the first need for cognition scale.

Connection between NFC and Self-Control Capacity

How exactly does having high NFC increase self-control capacity? To answer this question, the following two theoretical models will be examined in this section: The Elaboration Likelihood Model and Self-Control Strength Model.

Elaboration likelihood model of persuasion. The Elaboration Likelihood Model (ELM; Petty & Cacioppo, 1986) is a general theory of attitude change. This theory provides a general framework for categorizing, organizing, and understanding the basic processes that affect

persuasive communication. They suggested two distinct routes to persuasion called central and peripheral routes. The central processing is a result of a person's careful and thoughtful consideration of the true merits of the information presented. The peripheral processing is a result of some simple cues that are present in the persuasion context (e.g., an attractive source) rather than carefully considering presented information. These different ways of processing can help us understand the concept of NFC better. For instance, within the ELM, individuals high in NFC are hypothesized to elaborate more and deeper on information, for which they use the central processing. Individuals low in NFC are more likely to rely on simple and easy cues, for which they use the peripheral processing. The distinction between the central and peripheral routes of persuasion mirrors the distinction between fast and automatic thinking process (i.e., System 1) and slow and elaborate thinking process (i.e., System 2) proposed by Kahneman (2011). According to Kahneman (2011), self-control occurs in system 2 whereas impulsive involuntary judgements and feelings occur in system 1. Because people who have high NFC tend to use the central processing route more often than the peripheral route, people with high NFC are used to using their brain more (i.e., slow, elaborate and deliberate thinking process). Hence, their self-control capacity may be affected less by the tasks or experiences that require much willpower.

Self-control strength model. Self-control strength model suggests that self-control is like a muscle which depletes after using it. People make many decisions throughout the day and engage in effortful activities that draw and deplete on some limited resources, similar to energy, and that one deliberate action will have a detrimental impact on the other subsequent action (Baumeister, Bratslavksy, Muraven, & Tice, 1998). They showed that any act of self-control in the form of resisting temptation or an act of choice and responsibility undermines self-control in another subsequent action. They also demonstrated that the effects of ego depletion hamper

performance. Finally, in a series of four experiments, they demonstrated that ego depletion from acts of self-control interferes with people's subsequent decision making by making them more passive. The idea of self-control strength comes from the idea of limited resources. For instance, if resisting to eat cake or to think of a pink elephant makes a person prone to quit faster on difficult tasks, or frustrating puzzles, that would implement the idea that different acts of self-control rely on the same limited resource.

A recent study by DeWall et al., (2007) showed, across nine studies, that self-control depends on the availability of glucose, which is required by the brain for an effortful executive process. Based on this idea, it is possible to argue that effortful information processing relies on the same resource that fuels self-control. In fact, Schmeichel, Vohs, and Baumeister (2003) showed that effortful cognitive processing depends on the same limited resource as self-control. Across three studies, they manipulated self-control strength depletion by having some participants regulate attention or emotion. They demonstrated that compared to participants who did not perform such regulations, depleted participants performed worse at logic and reasoning, cognitive extrapolation, and a test of thoughtful reading comprehension. The results provided evidence that successful performance at complex or effortful thinking may rely on the same limited resource. By using the idea that effortful thinking and self-control rely on the same resource i.e., self-control strength, we can understand that engaging in cognitive investments, especially that requires higher NFC levels, strengthens this limited resource and promotes higher self-control.

Hypothesis

We have established that the need for cognition is an individual's tendency to engage in and enjoy effortful thinking. We have also established that people with a high need for cognition prefer detailed information about situations and dislike ambiguous information. From the

previous section, we further established that regular effortful thinking can lead to a subsequent increase in self-control strength. Based on these establishments, we hypothesize that people who are primed to believe that they have a high need for cognition are more likely to exert more self-control (i.e., people are more likely to solve more word problems when they are primed to believe that they have a high need for cognition) than those who were primed to believe that they have a low need for cognition or not primed at all. Our secondary operational definition of self-control is the total average time taken by participants to complete the survey. From this information we can infer the level of self-control because participants who are primed to believe that they have a high need for cognition are more likely to spend more time thinking about the problem than those who are primed to believe that they have a low NFC. Hence, participants who are in the high NFC condition are more likely to spend more total average time on the survey.

Method

Participants

We recruited 135 people (86 males, 48 females, and one “prefer not to answer”) to participate in this study. The participants were between the ages of 18 and 65. Of them, 82 were White, 13 were Black or African Americans, 5 were American Indian or Alaska Native, 29 were Asian, 1 was Native Hawaiian or Pacific Islander, and 5 were “other.” Additionally, 4 had completed primary/elementary education, 36 had completed secondary education, and 94 had completed higher education (bachelors and above). The participants were randomly assigned to the three groups with 43 people in the control condition, 46 high NFC condition, and 46 on the low NFC condition.

All participants were recruited using Amazon Mechanical Turk, which is a crowdsourcing website where researchers can post studies and surveys for users to complete in

exchange for compensation. All participants were paid \$1.60 as compensation for their time and effort in completing the survey experiment.

Design

The study implemented a randomized one-way three-groups design. The study was presented to the participants as an investigation of personality on creativity. The true aim of the study, which is to investigate their level of self-control, was not revealed to the participants. The independent variable was defined as the level of need for cognition (high vs low). The Thematic Apperception Test (TAT) (Morgan & Murray, 1935) was used to facilitate the manipulation of the independent variable. The independent variable was manipulated by using the statements from the need for cognition scale developed by Cacioppo, Petty, and Kao (1984) (described in the Materials section below). The dependent variable was the level of self-control participants exert during the cognitive task. It was operationally defined as the total number of mathematical word problems participants solve from the word problem set developed by Kempter, Saalbach, and Hardy (2011). The average total time participants spend on the survey from each group was also calculated, which was used as a secondary way to define the level of self-control.

To prime participants into believing they have a high need for cognition after they take the TAT, they were given a fake personality test profile that included statements from the need for cognition scale by changing “I” to “You”, as the original scales consists of 18 statements that start with “I” (e.g., a statement “I would prefer complex to simple problems” in the original scale was changed to “You would prefer complex to simple problems”), and to prime participants into believing that they have low need for cognition, the reverse statements were used (e.g., “Thinking is not my idea of fun” is changed to “Thinking is not your idea of fun”).

Materials

Task. The English translation of the mathematical problem set was adopted from the study that explored the effects of bilingualism on arithmetic word problem solving (Kemper, Saalbach, & Hardy; 2011). Their version contains 18 word-problems with and without distractors, which includes four complex comparison problems and two complex combination problems. In our study we will include a total of 10 questions with a combination of easy (e.g., “Subie had 3 euros. Then Philipp gave her 5 euros. How many euros does Sabine have now?”) and difficult questions (e.g. “Paul and Tina have 6 euros together. Tim has 4 euros. Kai and Nina have 9 euros together. Nina has 3 euros. How many euros do Paul and Kai have together?”). First, easier problems were presented and gradually the difficulty level was increased. Doing so will ensure that all participants could complete the first questions, which serves as a baseline, and make sure that they persisted with the challenging questions, which requires self-control strength. This task was shown to have satisfactorily high reliability (Cronbach’s alpha = .83 for a German version and .76 for a Turkish version).

Thematic apperception test (TAT). In order to facilitate the manipulation of the independent variable (need for cognition), to make them believe in the fake personality profile (i.e., the Barnum effect), we used the TAT developed by Henry A. Murray and Christina D. Morgan (1935) as projective tests have been shown to increase the effectiveness of the Barnum effect (i.e., a well-known phenomenon in which people tend to believe fake personality readings/profiles to be uniquely valid when they apply to almost everyone in general) better than the other types of personality tests (Snyder, Shenkel, & Lowery, 1997; Halperin, & Snyder 1979). Participants were shown three abstract pictures and were asked to answer three questions from each picture: (1) What is happening? (2) Why is this happening? (3) What will happen

next? They were also told that their answers will be assessed by the well-established algorithm created by the researchers to analyze what they wrote.

Need for cognition scale (18 items). We borrowed statements from the 18-items need for cognition scale (Cacioppo et al., 1984) and used them in the fake personality profile that is ostensibly created based on what they wrote in TAT in order to prime them into believing that they have varying needs for cognition.

Fake astrology (Barnum) profile. We also borrowed 10 statements from the 13 statement Barnum profile developed by Froer (1949) and used them in the fake personality profile (see the Procedure section below for details). These statements served as neutral or control statements for the control group of the experiment.

Procedure

The study was conducted online through a crowdsourcing marketplace called Amazon Mechanical Turk. First, participants were asked to read and understand the informed consent form which outlined all the tasks they were required to complete throughout the study, including taking a personality test, and the mathematical word problem test. Since this study required that participants did not find the true purpose of the study until the debriefing period, they were told, as a cover story, that the true purpose of the study was to investigate the differences in personality and how the differences relate to creativity.

After reading the consent form along with all the instructions for this experiment, participants were asked to click the “agree” button to indicate their consent to participate in the study. They were also required to type in “I will take this experiment seriously” in order to encourage them to take the experiments seriously.

The experimental session began with all the participants completing the TAT. After completing the TAT, the participants were randomly assigned to one of the three conditions

(high need for cognition, low need for cognition, and control). By using the statements from the need for cognition scale, the participants in the first condition were primed to believe that they have a high need for cognition (e.g., “You like to think a lot,” etc.). Similarly, by using the reverse statements from the need for cognition scale, the participants in the second condition were primed to believe that they have low need for cognition (e.g., “You don’t like to think a lot”). The participants in the control group were given statements from the Barnum profile (e.g., “You have a great need for other people to like and admire you”, “You have a tendency to be critical of yourself”). Participants were told that their responses would be analyzed using an algorithm designed for online testing purposes. The purpose of doing so was to make participants believe in the feedback they would receive. This task took approximately two to three minutes.

There was a forty-five seconds break after they were primed and during this break participants were encouraged to write as many statements as they could remember from their memory from the personality profiles given to them. We expected that doing so would make the priming effect stronger.

In the final section, all the participants were asked to take the mathematical word problems test (Kempton et al., 2011). A total of 10 questions ranging from easy (Subie had 3 euros. Then Philipp gave her 5 euros. How many euros does Sabine have now?) to complex (Lena has 3 euros. She is 8 years old. Karl is 2 years older than Lena. Lena has 4 euros less than Karl. Karl has 3 euros more than Timo. How many euros does Timo have?) were presented to the participants. They were told that the “End the Task” button would appear on the screen after a certain amount of time (i.e. three minutes) and that they would be allowed to terminate the task if they wished to. However, they were also encouraged to answer all the questions correctly in order to obtain more variance in the amount of time they spend on solving the problems. The total number of questions participants solved correctly was the operational definition for our

dependent variable. We determined the effect on the dependent variable by calculating both the number of questions participants solve correctly and the total average time participants spend on the survey.

Finally, participants were debriefed about the real purpose of the experiment. At this point, if they completed the survey following the guidelines in the informed consent form, then were asked to include their unique Mechanical Turk code to be paid for their commission.

Results

To test our hypothesis, we ran a one-way ANOVA to check for the effects of the manipulation in need for cognition on self-control. We did not find a significant difference among the three groups, $F(2, 132) = .23, p > .05$. We also conducted a one-way ANOVA to check if the manipulation had any effect on total time taken (another measure of self-control) to complete the survey. Again, we did not find any significant difference in the total time taken by participants to complete the survey among the three groups, $F(2, 132) = .48, p > .05$. For easier interpretation of the results, the results have been reproduced and displayed in Table 1, Table 2, Figure 1, and Figure 2.

Discussion

Using self-control theory, we established that lack of self-control results in impulsive behavior and acts of violence and crime due to a desire for immediate gratification. Furthermore, using the elaboration likelihood model of persuasion and the self-control strength model, we suggested that self-control strength is like a muscle and can be strengthened with regular practice. We also suggested that people who enjoy effortful thinking will exert more self-control in a cognitive task. Using these models, we came up with the hypothesis that people who are primed to believe that they have a high need for cognition are more likely to solve more word

problems than people who are primed to believe that they have a low need for cognition and the control group.

We did not find any support for our hypothesis. People who were primed to believe they have a high need for cognition did not solve more word problems on average than the other two groups. The elaboration likelihood model of persuasion and the self-control strength model suggest that the people in high NFC condition would solve more word problems because, first of all, if participants believe that they have a high NFC then, they would more likely pay attention to details and use the central processing route to solve word problems, and second, effortful information processing boosts the executive resource and therefore improves self-control capacity. However, our results did not confirm this prediction; participants in all groups scored similarly on the problems set on average and took a similar amount of time to complete the survey.

There were several limitations when conducting this study. First, we only recruited approximately 45 participants in each group (total of 135) because of our limited budget. Hence, it might be possible that the results did not support our hypothesis because of a small sample size. A larger sample size might have shown different results. Moreover, we were also running a higher risk of reducing the effectiveness of the random assignment, thereby introducing potential confounding variables in the study. There was also a high probability that the participants were not representative of the general population.

Another potential issue was the use of an online platform to recruit participants. Although the use of online platforms made it easier to recruit participants, there were many problems inherent in online studies. First, since there was an incentive and there was no physical interaction with the participants, there is no guarantee that the participants took this experiment seriously and that they took enough time for each section. Second, even though the recorded

responses were from different Amazon Mechanical Turk accounts, a number of responses from Asian participants from India (specifically, Chennai in India) were found to have the same exact geographical location. On top of that, the responses from these participants were suspiciously similar, such as writing the same responses for the TAT personality test, and a few responses were invalid (e.g., participants wrote, "I am a good worker. Please pay me.") Even though we filtered the data and rejected 62 participants due to the above-mentioned reasons, it was difficult to verify if there were other responses that could be from the same person or if there were "bots" contaminating the data sets. Finally, there is no way of knowing if the participants did not receive any help for the mathematical problems. For future studies, it would be advisable to run similar studies in a laboratory to ensure honest responses and prevent possible invalid or duplicate responses.

Even though the participants wrote the NFC associated with their group during the 45 seconds breaks, there is no way of telling if our manipulation did induce the intended NFC for the participants. For future studies, we would suggest researchers to make participants take a survey right after the manipulation phases in order to measure their level of NFC and to identify if the manipulation worked. We would also suggest researchers to conduct a pilot study in order to be sure the intended manipulation and intended dependent variables are being measured. Moreover, there might be better ways to manipulate NFC. Some research have demonstrated that brief mindfulness intervention can help to increase cognitive performance by reducing stress and anxiety, and making a person more focused (e.g., in a state of flow) (Beauchemin, Hutchins, & Patterson, 2008; Mrazek, Franklin, Phillips, Baird, & Schooler, 2013). It might be more effective to use some variation of mindfulness intervention to induce the high NFC condition together with the statements than simply making the participants read the statements.

Even though some research has been done to investigate the relationship between self-

control and the need for cognition there is much more that needs to be investigated. Future researchers interested in this field could investigate the cross-cultural aspects of need for cognition. Do people in collectivistic cultures exert self-control in the same way people in individualistic cultures do? Future researchers could also replicate this study in different Asian cultures to investigate and compare the findings. Finally, researchers are encouraged to use a variety of tasks to measure the level of self-control. Doing so might take us a step further to understanding the broader significance of self-control and need for cognition.

Conclusion

Self-control is a unique trait that has an effect in many domains of our lives. By learning how to increase self-control strength, people can have fewer self-defeating behaviors and are more likely to become more prominent and successful. It is important to note that self-control is a limited resource and gets depleted as we make decisions throughout the day. Hence, it is important to be able to learn how to regulate the amount of dispositional self-control strength we have.

As people with a higher level of need for cognition are more attentive to details and engage in slow, elaborate thinking, they tend to use the central processing route more than the peripheral route. This effortful cognitive processing depends on the same limited resource (i.e., self-control) that people depend on when making other decisions throughout the day (Schmeichel, et. al., 2003). Moreover, self-control is like a muscle and can be strengthened with practice. So, we can train ourselves to increase our overall level of self-control. Hence, by engaging in regular effortful thinking activities can help boost overall availability of self-control strength. This suggests that people with low dispositional NFC can improve their self-control strength by regularly engaging effortful thinking activities and in turn increase their NFC levels.

While the present study did not support our hypothesis that people who are primed to high NFC are more likely to solve more mathematical word problem sets and take more time to complete the survey as they are more likely to use effortful and deliberate thinking, it is possible that a future study with an improved experimental design may be able to find a stronger relationship between NFC and self-control.

References

- Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (1998). Ego-depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology, 74*, 1252–1265. <http://dx.doi.org/10.1037/0022-3514.74.5.1252>
- Baumeister, R. F., Gailliot, M., DeWall, C. N., & Oaten, M. (2006). Self-Regulation and Personality: How Interventions Increase Regulatory Success, and How Depletion Moderates the Effects of Traits on Behavior. *Journal of Personality, 74*(6), 1773–1801. <https://doi.org/10.1111/j.1467-6494.2006.00428.x>
- Baumeister, R. F., Vohs, K. D., & Tice, D. M. (2007). The strength model of self-control. *Current Directions in Psychological Science, 16*(6), 351–355. <https://doi.org/10.1111/j.1467-8721.2007.00534.x>
- Baumeister, R., Heatherton, T., & Tice, D. (1994). *Losing control: How and why people fail at self-regulation*. San Diego: Academic Press
- Beauchemin, J., Hutchins, T. L., & Patterson, F. (2008). Mindfulness meditation may lessen anxiety, promote social skills, and improve academic performance among adolescents with learning disabilities. *Complementary Health Practice Review, 13*, 34-45. <https://doi.org/10.1177%2F1533210107311624>
- Cacioppo, J. T., & Petty, R. E. (1982). The need for cognition. *Journal of Personality and Social Psychology, 42*(1), 116–131. <https://doi.org/10.1037/0022-3514.42.1.116>
- Cacioppo, J. T., Pett, R. E., & Stoltenberg, C. D. (1985). Processes of social influence: The Elaboration Likelihood model of persuasion. In P. C. Kendall (Ed.), *Advances in cognitive-behavioral research and therapy, Vol. 4*. (pp. 215–274). San Diego, CA: Academic Press. Retrieved from

- <https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,shib&db=psych&AN=1985-97241-006&site=ehost-live>
- Cacioppo, J. T., Petty, R. E., & Kao, C. F. (1984). The efficient assessment of need for cognition. *Journal of Personality Assessment*, *48*(3), 306–307.
https://doi.org/10.1207/s15327752jpa4803_13
- Cass Sunstein and Richard Thaler (2008). Human Frailty Caused This Crisis. *Financial Times*.
<https://www.ft.com/content/ac2839ac-b015-11dd-a795-0000779fd18c>
- Cohen, A. R., Stotland, E., & Wolfe, D. M. (1955). An experimental investigation of need for cognition. *The Journal of Abnormal and Social Psychology*, *51*(2), 291–294.
<https://doi.org/10.1037/h0042761>
- Daly, M., Delaney, L., Egan, M., & Baumeister, R. (2015). Childhood self-control and unemployment throughout the life span: Evidence from two british cohort studies. *Psychological Science*, *26*(6), 709-23. doi:10.1177/0956797615569001
- Dewall, C. N., Baumeister, R. F., Stillman, T. F., & Gailliot, M. T. (2007). Violence restrained: Effects of self-regulation and its depletion on aggression. *Journal of Experimental Social Psychology*, *43*(1), 62–76. <https://doi.org/10.1016/j.jesp.2005.12.005>
- Elias, S., & Loomis, R. (2002). Utilizing need for cognition and perceived self-efficacy to predict academic performance. *Journal of Applied Social Psychology*, *32*, 1687-1702.
<https://doi.org/10.1111/j.1559-1816.2002.tb02770.x>
- Forer, B. R. (1949). The fallacy of personal validation: a classroom demonstration of gullibility. *The Journal of Abnormal and Social Psychology*, *44*(1), 118–123.
<https://doi.org/10.1037/h0059240>
- Grass, J., Strobel, A., & Strobel, A. (2017). Cognitive investments in academic success: The role of need for cognition at university. *Frontiers in Psychology*, *8*. Retrieved from

<https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,shib&db=psyh&AN=2017-26352-001&site=ehost-live>

- Halperin, K. M., & Snyder, C. R. (1979). Effects of enhanced psychological test feedback on treatment outcome: Therapeutic implications of the Barnum effect. *Journal of Consulting and Clinical Psychology, 47*(1), 140–146. <https://doi.org/10.1037/0022-006X.47.1.140>
- Hankonen, N., Kinnunen, M., Absetz, P., & Jallinoja, P. (2014). Why do people high in self-control eat more healthily? Social cognitions as mediators. *Annals of Behavioral Medicine, 47*(2), 242–248. <https://doi.org/10.1007/s12160-013-9535-1>
- Hofmann, W., Friese, M., & Strack, F. (2009). Impulse and Self-Control from a Dual-Systems Perspective. *Perspectives on Psychological Science, 4*(2), 162-176. Retrieved January 10, 2020, from www.jstor.org/stable/40212310
- Kahneman, Daniel (2011). *Thinking Fast and Slow*. New York: Farrar, Straus and Giroux
- Kempert, S., Saalbach, H., & Hardy, I. (2011). Mathematical Word Problems With and Without Distractors (English Translations). *PsycTESTS*. [https://doi.org/Full text; 999906362_full_001.pdf](https://doi.org/Full%20text;999906362_full_001.pdf)
- Kim, J., Hong, H., Lee, J., & Hyun, M.-H. (2017). Effects of time perspective and self-control on procrastination and Internet addiction. *Journal of Behavioral Addictions, 6*(2), 229–236. <https://doi.org/10.1556/2006.6.2017.017>
- King, K. M., Fleming, C. B., Monahan, K. C., & Catalano, R. F. (2011). Changes in self-control problems and attention problems during middle school predict alcohol, tobacco, and marijuana use during high school. *Psychology of Addictive Behaviors, 25*(1), 69–79. <https://doi.org/10.1037/a0021958>

- Morgan, C. D., & Murray, H. A. (1935). A method for investigating fantasies: the thematic apperception test. *Archives of Neurology & Psychiatry*, *34*, 289–306.
<https://doi.org/10.1001/archneurpsyc.1935.02250200049005>
- Mrazek, M. D., Franklin, M. S., Phillips, D. T., Baird, B., & Schooler, J. W. (2013). Mindfulness training improves working memory capacity and GRE performance while reducing mind wandering. *Psychological Science*, *24*(5), 776–781.
<https://doi.org/10.1177/0956797612459659>
- Nishiguchi, Y., Mori, M., & Tanno, Y. (2018). Need for cognition promotes adaptive style of self-focusing with the mediation of effortful control. *Japanese Psychological Research*, *60*(1), 54–61. <https://doi.org/10.1111/jpr.12167>
- Quinn, P. D., & Fromme, K. (2010). Self-regulation as a protective factor against risky drinking and sexual behavior. *Psychology of Addictive Behaviors*, *24*(3), 376–385.
<https://doi.org/10.1037/a0018547>
- Quinn, P. D., & Fromme, K. (2010). Self-regulation as a protective factor against risky drinking and sexual behavior. *Psychology of Addictive Behaviors*, *24*(3), 376–385.
<https://doi.org/10.1037/a0018547>
- Schmeichel, B. J., Vohs, K. D., & Baumeister, R. F. (2003). Intellectual performance and ego depletion: Role of the self in logical reasoning and other information processing. *Journal of Personality and Social Psychology*, *85*(1), 33–46. <https://doi.org/10.1037/0022-3514.85.1.33>
- Snyder, C., Shenkel, R., & Lowery, C. (1977). Acceptance of personality interpretations: The "barnum effect" and beyond. *Journal of Consulting and Clinical Psychology*, *45*(1), 104–114. doi:10.1037//0022-006X.45.1.104

- Strobel, A., Fleischhauer, M., Luong, C., & Strobel, A. (2018). Predicting everyday life behavior by direct and indirect measures of need for cognition. *Journal of Individual Differences*, 39(2), 107–114. <https://doi.org/10.1027/1614-0001/a000255>
- Tangney, J. P., Baumeister, R. F., & Boone, A. L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality*, 72(2), 271–324. <https://doi.org/10.1111/j.0022-3506.2004.00263.x>
- Watson, S. J., & Milfont, T. L. (2017). A short-term longitudinal examination of the associations between self-control, delay of gratification and temporal considerations. *Personality & Individual Differences*, 106, 57–60. <https://doi.org/10.1016/j.paid.2016.10.023>
- Wolfe, S. E., Reisig, M. D., & Holtfreter, K. (2016). Low self-control and crime in late adulthood. *Research on Aging*, 38(7), 767–790.
<https://doi.org/10.1177/0164027515604722>

Author Note

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Table 1.

Descriptive Statistics for The Effect of Need for Cognition on Number of Problems Solved

	Mean	Standard Deviation (SD)
High Need for Cognition	6.70	2.32
Low Need for Cognition	6.40	2.22
Control Condition	6.67	2.67

Table 2.

Descriptive Statistics for The Total Time Taken (in minutes) to Complete the Survey

	Mean (in minutes)	Standard Deviation (SD) (in minutes)
High Need for Cognition	14.83	6.24
Low Need for Cognition	14.08	6.41
Control Condition	13.57	5.47

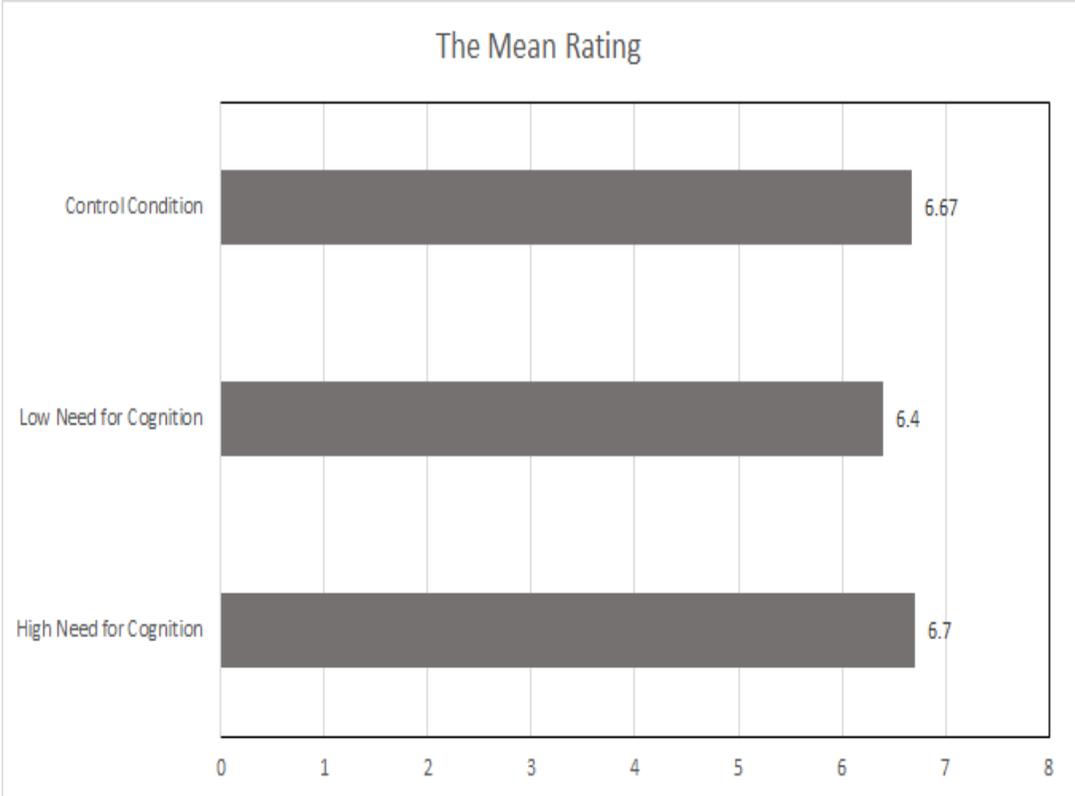


Figure 1. The Effect of Need for Cognition on Number of Problems Solved

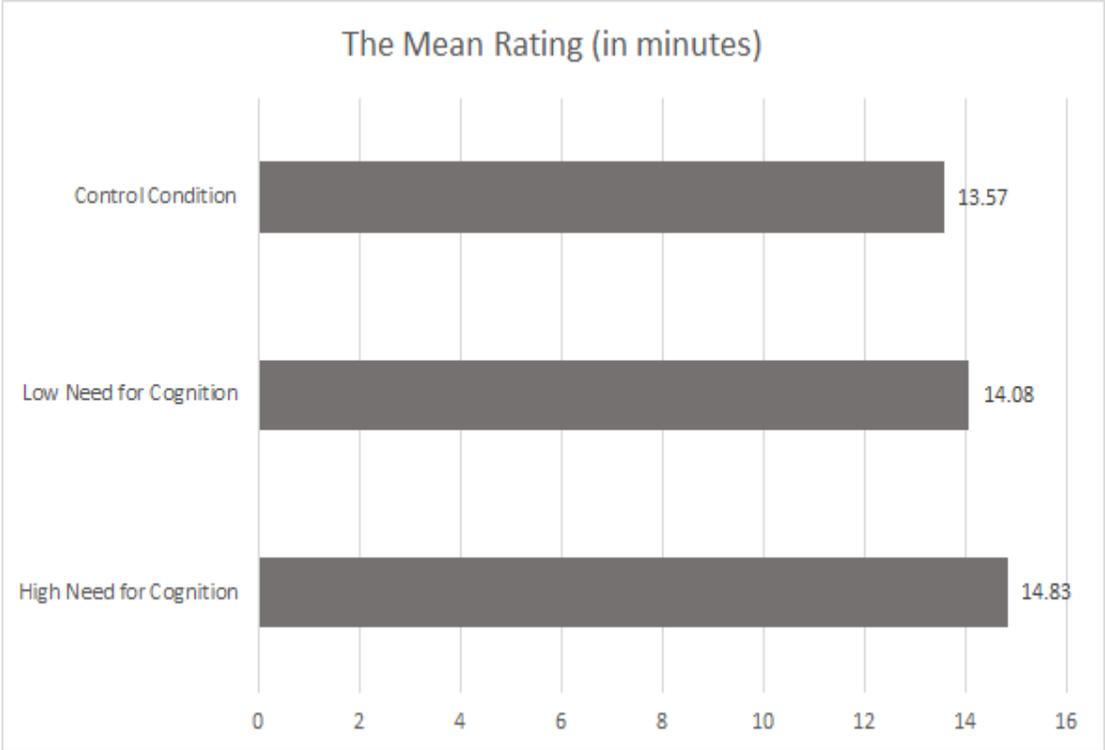


Figure 2. The Total Time Taken to Complete the Word Problem Set

Appendix A

Informed Consent Form

You are invited to be a participant in a research project that investigates the relationship between people's personalities and their effect on creativity to be conducted at Soka University of America during the spring semester. This study involved a web-based experiment, and you will be asked to take a personality test, complete a mathematical word problems test, and answer one question survey. The principal investigator for this study is Dr. Seiji Takaku and the co-investigator is Arjab Dhakal.

Please take time to complete the experiment.

- You are unable to complete the survey using a mobile phone.
- Please read and follow instructions, responding directly to questions asked.
- Your responses will be treated anonymously.
- You will be paid \$1.60 upon completion of the survey.
- You are ineligible for payment if you do not complete the survey.
- Please allow up to 7 working days for the payment.
- Your participation in this study is completely voluntary, and you may stop at anytime. If you withdraw from the experiment you will not be paid.
- The experiment should take approximately 12 minutes.

As a token of appreciation, you will receive a compensation of \$1.60 upon satisfactory completion of the survey. Please note that we will be unable to compensate you if you do not complete the survey in full or your answers reflect an inability to follow instructions.

At the end of the experiment, we will review your responses and you will be paid the specified amount posted. If you have further questions about this project, feel free to contact Dr. Seiji Takaku at stakaku@soka.edu or (+1 949-480-4058). If you have questions about your rights as a research participant, please contact the **Soka University Institutional Review Board at sua_irb@soka.edu or (+1 949-480-4387).**

This study (IRB Project ID: 19F15) was approved by Soka University's IRB on January 27, 2020. This approval will end on May 25, 2020.

If you have read and understand the information provided on this page, please type that you will take this experiment seriously and whether you consent to participate in this study in the box provided below. If you consent to participate, you are not waiving any legal claims, rights or remedies associated with your participation in this research study.

I will take this experiment seriously.

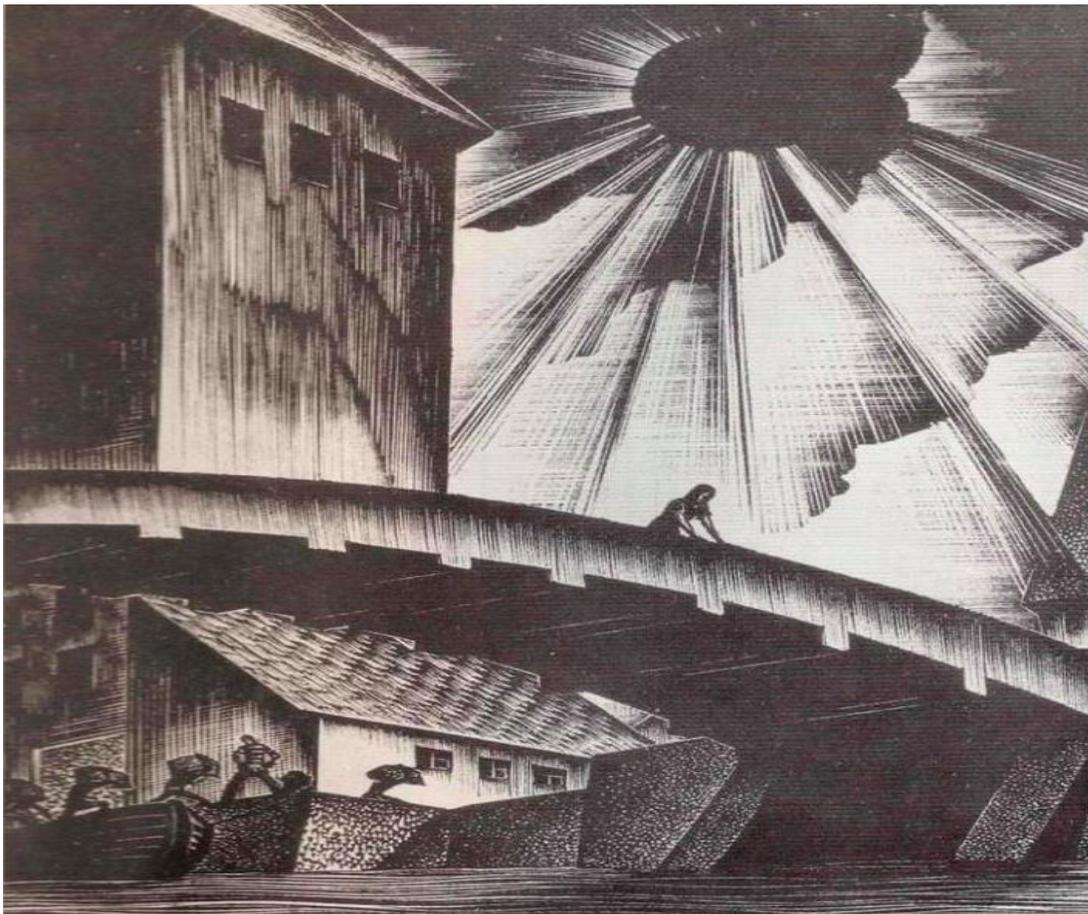
I consent

I do not consent

Appendix B

Thematic Apperception Test

Instruction: Please write three sentences for each picture you see below. You can be imaginative, but you can also try to portray what the scenario is like, what led to the situation depicted in the picture, and what the characters might be thinking, feeling, and wishing. You can answer the following questions for each of the pictures below. (1) What is happening? (2) Why is this happening? (3) What will happen next?



- 1.
- 2.
- 3.



1.

2.

3.



- 1.
- 2.
- 3.

Appendix C

GIF Loading Screen

PLEASE WAIT WHILE YOUR TEST IS BEING ANALYZED.



Appendix D

NFC Priming Statements

Based on previous test, we have identified certain aspects of your personality. Please read all the statements attentively.

Statements to prime participants into high NFC condition

1. You would prefer complex to simple problems.
2. You like to have the responsibility of handling a situation that requires a lot of thinking.
3. You find satisfaction in deliberating hard and for long hours
4. The idea of relying on thought to make your way to the top appeals to you.
5. You really enjoy a task that involves coming up with new solutions to problems.
6. You prefer your life to be filled with puzzles that I must solve.
7. The notion of thinking abstractly is appealing to you.
8. You would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.
9. You usually end up deliberating about issues even when they do not affect you personally.

Reverse Statements to prime participants into low NFC condition

1. Thinking is not your idea of fun.
2. You would rather do something that requires little thought than something that is sure to challenge your thinking abilities.
3. You try to anticipate and avoid situations where there is a likely chance that you will have to think in depth about something.
4. You only think as hard as you have to.
5. You prefer to think about small, daily projects to long-term ones.
6. You like tasks that require little thought once you've learned them.
7. Learning new ways to think doesn't excite you very much.

8. You feel relief rather than satisfaction after completing a task that required a lot of mental effort.
9. It's enough for you that something gets the job done; You don't care how or why it works.

Fake Astrology (Barnum) profile to prime participants into control condition

1. You have a great need for other people to like and admire you.
2. You have a tendency to be critical of yourself.
3. You have a great deal of unused capacity which you have not turned to your advantage.
4. While you have some personality weaknesses, you are generally able to compensate for them.
5. Your sexual adjustment has presented problems for you.
6. Disciplined and self-controlled outside, you tend to be worrisome and insecure inside.
7. At times you have serious doubts as to whether you have made the right decision or done the right thing.
8. You prefer a certain amount of change and variety and become dissatisfied when hemmed in by restrictions and limitations.
9. You pride yourself as an independent thinker and do not accept others' statements without satisfactory proof
10. You have found it unwise to be too frank in revealing yourself to others.

Appendix E

Word Problems with and without Distractors

Please try to answer as many questions as possible correctly. After 5 minutes, the “End The Task” button will appear and you will have the right to terminate the task if you wish to do so.

1. Sabine had 3 euros. Then Philipp gave her 5 euros. How many euros does Sabine have now?
2. Julia has 2 crayons. Then Tobi gave her some crayons. Now Julia has 9 crayons. How many crayons did Tobi give her?
3. At first Maria had some marbles. Then she gave 2 marbles to Hans. Now Maria has 6 marbles. How many marbles did Maria have at first?
4. Meike has 5 marbles. She is 11 years old. Tom has 8 marbles. He is 4 years older than Meike. How many marbles does Tom have more than Meike?
5. Julia is 5 years old. She weighs 25 kilos. Tobi is 4 years older than Julia. He weighs 45 kilos. How old is Tobi?
6. Maria has 9 marbles. She gets 12 euros pocket money. Maria had 4 marbles more than Hans. Hans gets 10 euros pocket money. How many marbles does Hans have?
7. Meike has 2 euros. Tim has 5 euros more than Meike. How many euros do Meike and Tim have together?
8. Claudia has 5 playing balls. She has 5 playing balls less than Thomas. Thomas has 2 playing balls more than Oliver. How many playing balls does Oliver have?
9. Paul and Tina have 6 euros together. Tim has 4 euros. Kai and Nina have 9 euros together. Nina has 3 euros. How many euros do Paul and Kai have together?
10. Kai and Lena have 6 drops together. Lena has 4 drops. Both children are 12 years old. Karl and Sabine have 9 drops together. Sabine has 3 drops. Karl and Sabine are 2 years younger than the others. How many drops have Kai and Karl together?

Appendix F

Demographic Questions

Finally, please answer the following questions. Keep in mind that all of your answers will be kept anonymous.

Age:

Gender:

Sex:

Highest Education Level:

Appendix G

Debriefing Statement

Thank you for participating in this study! We hope you enjoyed the experiment. This form provides background about our research to help you learn more about why we are doing this study.

You have just participated in a research study conducted at Soka University of America by Professor Seiji Takaku, the principal investigator, and Arjab Dhakal, the co-investigator. You were told that the purpose of this study was to understand the effects of personality on creativity. In actuality, we were interested in the effects of perceived need for cognition on self-control strength. Each participant was asked to take the thematic apperception test and then was told that based on the findings he/she has certain personality characteristics. Regardless of what the participants wrote in the thematic apperception test, they were told in random that they have high or low need for cognition. The true purpose of this study was to see how this manipulation would affect how long participants would work on a task that requires a high level of self-control to complete.

We expect to do follow-up experiments that will continue into future semesters. Because of this, it is important that you do NOT talk (or type or discuss, etc.) about this project. The main reason for this is that your comments could influence the expectations, and therefore, the performance of a future participant, which would bias our data. Failure to comply with this request may have severe repercussions with regards to the accuracy of the data. Your comments could compromise months of hard work preparing for this experiment.

Thank you for understanding and we hope you will support our research by keeping your knowledge of this study confidential.

If you have any questions about the research, please contact Arjab Dhakal at adhakal@soka.edu or Seiji Takaku at stakaku@soka.edu. If, as a result of your participation in this study, you experienced any adverse reaction, please contact Soka University of America IRB at sua_irb@soka.edu.