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Loss Aversion and Perspective Taking in the Sunk-Cost Fallacy

Veronika Rudd Tait

A dissertation submitted to the faculty of  
Brigham Young University  
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

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## ABSTRACT

### Loss Aversion and Perspective Taking in the Sunk-Cost Fallacy

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The sunk-cost fallacy (SCF) occurs when an individual makes an investment with a low probability of a payoff because an earlier investment has already been made. It is considered an error because a rational decision should not factor in now-irretrievable investments, as they do not affect current outcome likelihoods. Previous research has measured the tendency to commit the SCF by using hypothetical scenarios in which participants must choose to make a future investment or not after making an initial investment. There are many theories as to why people commit the SCF. Loss aversion, which is the preference for uncertain over certain losses, may be related to the SCF. Dual-process theory, which views decision-making in terms of a fast, automatic process called system 1 and a slow, deliberate process called system 2, may also help to explain the SCF.

In Experiment 1, participants were asked to complete a sunk-cost questionnaire in which the initial-investment types and amounts varied. They also completed an endowment-effect task as a measure of loss aversion. The SCF was committed most often when the initial investment was large compared to small and most often with money, less with time, and least with effort. There was an interaction effect in which small differences were seen in the SCF between time, effort, and money when the initial investment was small, and differences grew larger as the initial investment increased. Loss aversion displayed a non-significant negative relation with the SCF.

In Experiment 2, participants completed a sunk-cost questionnaire in which they were asked to respond as they normally would and then from the perspective of a fictional person described as a logical decision maker. In cases in which they committed the SCF, they were asked to indicate why they continued to invest. They also completed a risky-lottery loss-aversion task. As seen in Experiment 1, the SCF was more likely when initial investments were greater and occurred most when the initial investment was money, less when it was time, and least when it was effort. Loss aversion had a significant but small negative relation with SCF scores. There was no effect of perspective taking. It may be that the SCF is simply due to the over-application of the personal rule “don’t waste”, as not wanting to be wasteful was the most-common reason participants gave for why they committed the SCF.

Keywords: sunk-cost fallacy, loss aversion, perspective taking, behavioral economics, dual process theory, prospect theory, decision making

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## Loss Aversion and Perspective Taking in the Sunk-Cost Fallacy

When I graduated high school and contemplated which university to attend, I paid one prospective school a \$100 commitment fee. I later learned that a different school with an apparently equivalent quality of education had offered me a much better scholarship that would last all the way through graduation. Regardless of this new information, I chose to attend the former school because I did not want to waste my commitment fee. This choice demonstrated a commonly made, irrational decision called the sunk-cost fallacy (SCF), also known as the sunk-cost error/bias/effect/paradox, entrapment, throwing good money after bad, knee-deep in the Big Muddy, and the Concorde effect/fallacy (Navarro & Fantino, 2005; Sleesman, Conlon, McNamara, & Miles, 2012; Zeng, Zhang, Chen, Yu, & Gong, 2013).

Though these terms may have slightly different definitions, they generally refer to individuals choosing a course of action in which they previously invested time, money, or other resources over an alternative that has a higher expected future payoff (Macaskill & Hackenberg, 2012a). Doing so is considered an error because a rational decision maker should only consider current marginal costs and benefits and should neglect sunk cost, because it is irretrievable no matter which option is chosen (Navarro & Fantino, 2005; Thaler, 1980). The SCF is not to be confused with escalation or escalation of commitment, which refers to persistence in a course of action, usually in the face of failure, whereas the SCF refers to the particular impact of sunk costs on decision-making (Navarro & Fantino, 2009; see Sofis, Jarmolowicz, Hudnall, & Reed, 2015). Staw (1997) referenced escalation as the broader phenomenon, with the SCF being one of its potential sources.

## **Measuring the SCF**

Traditionally, the SCF is viewed as a single event that either occurs or does not occur (Schlosnagle, 2013). Often occurrence or non-occurrence is investigated using hypothetical scenarios in which an individual decides whether or not to continue to invest after being informed of the outcome of a previous investment (Arkes & Blumer, 1985; Arkes & Hutzler, 2000; Conlon & Wolf, 1980; Garland, 1990; Staw & Ross, 1987; Tversky & Kahneman, 1981), though it has also been measured in behavior-analytic studies (Cunha & Caldieraro, 2009; Navarro, 2008). A classic example was provided by Arkes and Blumer (1985):

Assume that you have spent \$100 on a ticket for a weekend ski trip to Michigan. Several weeks later you buy a \$50 ticket for a weekend ski trip to Wisconsin. You think you will enjoy the Wisconsin ski trip more than the Michigan ski trip. As you are putting your just-purchased Wisconsin ski trip ticket in your wallet, you notice that the Michigan ski trip and the Wisconsin ski trip are for the same weekend! It's too late to sell either ticket, and you cannot return either one. You must use one ticket and not the other. Which ski trip will you go on? (p. 126)

The authors found that 54.1% of participants, despite the indicated preference for the Wisconsin trip, chose the Michigan ski trip instead, simply because that ticket was the more expensive one. Participants were assumed to have focused on past, irrecoverable (sunk) costs regardless of the negative outcomes (i.e., going on a less enjoyable trip). The rational decision maker would have chosen the Wisconsin trip based on incremental cost and anticipated outcomes only (Fernandez, 2011).

## **A Human and Nonhuman-animal Phenomenon?**

Past studies have suggested that the SCF is unique to humans. Several researchers have claimed that, for individuals to commit the SCF, they must be able to compute the costs and

benefits associated with a particular transaction (see Gourville & Soman, 1998). Staw and Ross (1987) proposed four types of factors that may enter such computations—project-specific, psychological, social, and structural—thus affirming the notion that nonhuman animals are unable to commit the SCF. In fact, in a review of research on the Concorde Fallacy, Arkes and Ayton (1999) found no distinct instances of the fallacy in nonhuman species. Specifically, they argued that choices apparently influenced by earlier investments could be explained in terms of upcoming gains and proposed that nonhumans might not demonstrate the SCF because they do not possess human norms or rules, such as “don’t waste”.

Recently, Macaskill and Hackenberg (2013) observed that “human sunk-cost errors are often thought to reflect the misapplication of rules (e.g., ‘waste not, want not’) that encourage persistence even when it is counterproductive (e.g. Arkes & Ayton, 1999). Showing that animals other than humans are capable of such suboptimal choice patterns suggests that sunk cost decisions are not limited to humans and faulty rules” (p. 301). In fact, evidence of the SCF has been obtained using pigeons and rats (see Avila-Santibanez, Gonzalez-Montiel, Miranda-Hernandez, & Guzman-Gonzalez, 2010; Macaskill & Hackenberg 2012 a, b; Magalhães, White, Stewart, Beeby, & van der Vilet, 2012)

Several researchers have used behavior-analytic methods to investigate sunk cost in humans that are similar to those used with nonhumans (Avila, Yankelevitz, Gonzalez, & Hackenberg, 2013; Macaskill & Hackenberg 2013; Navarro & Fantino, 2007). For example, a procedure originally utilized by Navarro and Fantino (2005) with pigeons was modified so that human participants could choose to persist (continue investing) in a computer-based task or escape from it (discontinue their investment). This arrangement satisfied Navarro and Fantino’s (2005) definition of a sunk-cost decision scenario as “one in which an investment has been made

towards a goal, negative feedback concerning the investment received, and the investor can persist in the investment or abandon it in favor of a new one” (p. 2). Their study demonstrated that, just as with pigeons, reinforcement history enhanced participants’ sensitivity to the contingencies and that choice in both humans and pigeons is sensitive to global response requirements (as opposed to local features of the contingencies) and to relative rather than absolute differences in the response requirements (Macaskill & Hackenberg, 2013). The procedure revealed between-subject variability, as had hypothetical, scenario-based measures (Arkes & Blumer, 1985). This variability may be related to subjects’ prior histories in situations involving persistence (Macaskill & Hackenberg, 2013).

### **Individual Differences**

Age may play a role in whether an individual is susceptible to the SCF, which occurs less often in older adults than in younger ones (Schlosnagle, 2013; Strough, Mehta, McFall, & Schuller, 2008). Thus, when deciding whether or not to continue investing in a course of action, older adults more frequently ignore prior investments than younger adults do (Bruine de Bruin, Parker, & Fischhoff, 2007). This may reflect older adults’ relatively truncated temporal horizons (Strough, Schlosnagle, Kams, Lemaster, & Pichayayothin, 2014), or their ability to cope through rumination avoidance (Bruine de Bruin, Strough, & Parker, 2014). In one study, younger adults’ estimates of the probability of success resulting from continued investment in a product were inflated when a prior investment occurred (Arkes & Hutzler, 2000). In another study, age-related differences in the SCF were mediated by the salience of investment-related information when participants described their long-term goals. Older adults experienced less salience, and in turn, less SCF occurrences. Investment-related information was more salient for younger adults, and led to greater occurrences of the SCF (Strough, Schlosnagle, & DiDonato, 2011).

Whether education or intelligence play a role in the SCF is unclear. Some studies have found no relation between an individual's susceptibility to the SCF and cognitive ability (Stanovich & West, 2008) or level of education (Arkes & Blumer, 1985; Strough et al., 2008). Other studies have reported a modest relation (Bruine de Bruine et al., 2007). However, some researchers have shown that aptitude measures, such as the SAT, predict that persons with lower scores on such measures are more susceptible to the SCF than those with higher scores are (Larrick, Nisbett, & Morgan, 1993; Stanovich & West, 1999).

Few studies have investigated gender differences in the SCF. Fernandez (2011) found that males were more likely to commit the SCF in hypothetical scenarios than females were. She hypothesized that this was because females are generally less risk-seeking and employ different decision-making strategies than males do. However, Frisch (1993) found that women were more likely to commit the SCF, suggesting that women's choices are more affected by framing effects than men's are.

### **Potential Factors in the SCF**

Several factors potentially influence one's susceptibility to the SCF. One is the level of felt responsibility. People are more likely to engage in the SCF when they are personally responsible for the initial investment than when they are not (Staw, 1976). In workplace scenarios, persistence increases as job security increases (Fox & Staw, 1979) and decreases if coworkers who will take part in the blame for the failing project are present (Heng, Tan, & Wei, 2003). Bazerman, Beekun, and Schoorman (1982) asked participants to take on the role of a corporate vice president and, in that role, to evaluate the past performance of one of their subordinates. They also were asked to make predictions about the subordinate's future performance. All of the participants were informed that the subordinate was a regional director

of the organization and had been promoted two years earlier from the position of merchandise manager. They were also told that the subordinate's performance had been somewhat negative. In their role, half of the participants were assigned personal responsibility for the director's promotion to regional director, whereas the other half were not. Those in the former group evaluated the employee much more favorably compared to those in the latter. Whyte (1993) found that, if participants reported feeling responsible for a project's decisions, they were more vulnerable to the SCF. Similarly, Bornstein, Emler, and Chapman (1999) found that medical residents were more susceptible to the SCF when they had made a treatment decision as compared to when someone else had done so.

Persistence in light of negative feedback does not inevitably lead an individual to committing the SCF. A parent may urge a reluctant child to continue going to soccer practice in order to honor a commitment previously made to the team. This decision to support teammates would assumedly be made whether the practice sessions were expensive or not and therefore does not factor in past initial investments and does not necessarily constitute committing the SCF. Persistence generally is regarded as a commendable practice, even after failure feedback, and has been correlated positively with intrinsic motivation and self-esteem (Silverstein, 2002). However, one's way of thinking about initial investments, rather than persistence per se, may be a better predictor of committing the SCF. In a dissertation study, Fernandez (2011) used questionnaire items based on those produced by Bornstein and Chapman (1995). Participants were asked to answer items such as the following:

Becky decides to take cello lessons. After Becky buys a cello and pays \$1200 for lessons for 3 months, Becky finds she is no longer interested and wants to quit.

- A. Becky should stop attending cello lessons because it would be a waste of time and money to attend more lessons she won't enjoy. (*Normative response*)
- B. Becky should continue with the cello lessons because otherwise she will have wasted the time and money she has already spent. (*Wasteful response*)
- C. Becky should continue with the cello lessons to teach herself that next time she should be more careful about what hobbies she selects for herself. (*Learn-a-lesson response*)
- D. Becky should continue with the cello lessons because if she was foolish enough to select a hobby that she doesn't enjoy, she deserves to suffer by continuing with the cello lessons. (*Punishment response*)
- E. Becky should continue with the cello lessons because if she stops that would mean she made a bad decision in deciding to take cello lessons. If it was the right decision then, it is still the right decision. (*Consistency response*; pp. 31-32)

Fernandez (2011) found that selecting the normative response (which was equivalent to the escape response in a sunk-cost scenario) was significantly positively correlated with an analytical thinking style. Though this study provided evidence that those who commit the SCF and those who do not may have different thinking strategies, it does not indicate whether participants can recognize that committing the SCF is, in fact, irrational.

Van Putten, Zeelenberg, and van Dijk (2010) looked at differences in the SCF according to whether individuals were "action-oriented" or "state-oriented". Action-oriented individuals were described as getting over negative events quickly, and focusing on problem-solving, whereas state-oriented individuals were described as having a harder time overcoming a negative

event and more likely to ruminate on its effect on their current state. The researchers found that action-oriented participants were less susceptible to the SCF than state-oriented people were and attributed this result to the former being less likely to dwell on their past investments and more likely to stop the project and seek other opportunities for investment than state-oriented participants would be.

The amount of money initially invested may also play a role in the SCF. Garland and Newport (1991) offered participants four scenarios, two related to business (in the role of an airplane manufacturer or an owner/manager of a business) and two involving personal decisions (purchasing a vacation or a retirement property). The scenarios were manipulated to involve absolute and relative sunk costs, respectively. That is, the scenarios included high and low initial investments or high and low percentages of a total budget. The researchers found that commitment to sunk cost was influenced by the amount of the initial investment and was less likely to be a function of absolute expenditure than of the proportion of the available resources (the relative cost).

### **Why We Commit the SCF**

Among many potential reasons for susceptibility to the SCF, social pressure may cause one to avoid admitting that one's initial investment was a poor decision (Fox & Staw, 1979). In a study by Dietz-Uhler (1996), individuals stronger in social identity were more likely to persist in a failing project because the project endangered their positive social identity, defined as "an individual's private and unique conceptions of the self" (p. 613). MacGregor and Lichtenstein (1991) suggested that individuals focus so heavily on sunk costs that they forget why and how they usually evaluate options. Other reasons may include the need to justify a previous course of action (Brockner, 1992; Staw, 1976, 1981), including risk seeking in light of earlier losses



(Garland & Newport, 1991; Kahneman & Tversky, 1979; Thaler, 1980). Navarro (2008) concluded that the justification of one's prior decision is in conflict with normative motives, and the decision maker will be influenced by their strength of those motives relative to the prior decision.

Navarro and Fantino (2005) claimed that the SCF is sometimes caused by uncertainty, reinforcement history, or both. For example, McCain (1986) showed that participants persisted in an unprofitable, research-development project in its early stages, though, as losses added up, they reduced their investments rather than increased them. The author concluded that escalation and de-escalation of investment are learned processes in which optimal behavior occurs only when the economic realities of the situation become sufficiently clear, that is, investments decreased as it became more obvious to participants that the project was unprofitable. A similar outcome was demonstrated in a series of studies by Bragger and her associates (Bragger, Bragger, Hantula, & Kirnan, 1998; Bragger, Bragger, Hantula, Kirnan, & Kutchner, 2003) in which participants invested significantly more in a failing project when feedback about the project was ambiguous as compared to when it was unambiguous. According to Navarro (2008), "Individuals may persist in a losing course of action not because they irrationally focus on prior costs but because the changes in the contingency for the worse (in progress decisions) are not discriminable. Given appropriate information or learning, the individual will behave optimally" (pp. 8-9).

Thaler (1980, 1999) claimed that individuals set up mental accounts to keep track of their transactions and are motivated to consume the benefits so they can balance the negative value of their previous costs. Consider an example from Soman (2001) in which a man bought a \$40 ticket to a basketball game while another man was given a free ticket. On the day of the game,

there is a major snowstorm, and the roads are terrible. Thaler (1980, 1999) proposed that the man who purchased his ticket would be more likely to brave the snowstorm and go to the game as compared to the man who received the free ticket. This is because, when the first individual purchased the \$40 ticket, he may have opened a mental account called “Basketball Game” that contained the psychological value [or disutility,  $v(-\$40)$ ] of the payment. He can recover his investment and complete the transaction by attending the game. However, if he is unable to go, he will have to close the mental account with a perceived loss of \$40. It is this motivation to avoid the loss associated with losing the money that compels him to attempt to drive to the game in the poor road conditions. Related to this outcome is Heath’s (1995) finding that individuals were only likely to fall prey to the SCF when they failed to previously establish a budget or when expenses were hard to track.

Bornstein and Chapman (1995) hypothesized that individuals not only commit the SCF to avoid waste but also to learn a lesson, to punish the decision maker, or to convey the appearance of consistency. There may be times when it is advantageous to commit the SCF if it leads to better decisions in the future. For example, if one’s son decides that he no longer wants to play in a summer baseball league after several hundred dollars have been spent on equipment and fees, encouraging him to continue may make him more likely to think through future decisions (*cf.* the “Learn-a-lesson” response described earlier). Also, appearing consistent in one’s own decisions may be considered rational because of the high subjective utility associated with positive self-presentation (Bornstein, 1995).

A further explanation of the SCF is provided by dual-process theory, which asserts that there are two ways of processing information (Stanovich & West, 2000). The first uses system 1, a fast and automatic evaluation of information that quickly leads us to a solution. The second

uses system 2, a slow and deliberate evaluation requiring thoughtfulness and care. One reason individuals may commit the SCF is that they over-apply the rule “don’t waste” (Arkes, 1996). For example, imagine an individual who has purchased a ticket to see a movie. After sitting through a portion of it, she is not enjoying it and feels that her time would be better spent outside the theater. An individual applying system 1 reasoning may not want to leave the movie, as she has already paid for her ticket and would not want it to go to waste. An individual applying the more deliberate system 2 may realize that, regardless of where her future time is spent, the money lost on the movie ticket will never be returned, and future investments ought to be spent in a situation with a better chance of a good outcome.

**Prospect theory.** Suboptimal choices such as the SCF may also be explained by prospect theory, which suggests that individuals are risk seeking in the domain of losses and that sunk costs invariably place the decision maker in that domain (Whyte, 1986). The theory also emphasizes loss aversion, which is a term applied to conditions in which “losses loom larger than gains” (Kahneman & Tversky, 1979, p. 279). For Soman (2004), “Loss aversion implies that a given difference between two options will have greater impact if it is viewed (or, framed) as a difference between two disadvantages (relative to a reference point) than if it is viewed (or, framed) as a difference between two advantages. That is, advantages and disadvantages may not be mirror images” (p. 388). This is tantamount to the claim that losses have a greater influence on choice than gains do (Boyce, Wood, Banks, Clark, & Brown, 2013).

Three important points about losses provide insight into the SCF. First, people may use a “point of reference” when making decisions and consider outcomes in terms of comparative gains and losses. Thus, when an initial investment is made and there are no returns, this likely is perceived as a loss, which most people will attempt to avoid (Garland & Newport, 1991;

Kahneman & Tversky, 1979) by increasing the probability of further investment, which is the SCF (Soman, 2004). Secondly, the value function is steeper for losses than for gains. When making a choice between options that offer gain, people prefer those with certain ( $p = 1.0$ ) outcomes than those with uncertain ( $p < 1.0$ ) outcomes. Research by Molden and Hui (2011) indicated that, when individuals are motivated to pursue gains, they are more likely to disregard sunk costs compared to when they are motivated to prevent losses. Moreover, loss of a specific amount of money is more aversive than a gain of the same amount is attractive. Discontinuing the choice of an option after making an initial investment and receiving no gain creates a situation in which the loss is certain. Continuing to choose the option effectively converts what was sure into only an apparent loss, which is preferable (Garland & Newport, 1991). Lastly, in the value function of prospect theory, gains are concave and losses are convex (see Figure 1), which is to say that the more one invests, the less prominent the losses become (Garland & Newport, 1991; Kahneman & Tversky, 1979). This pattern of behavior constitutes risk aversion in the domain of gains and risk seeking in the domain of losses (Shafir, 2004). The likelihood of investment increases when the initial investment is relatively large (Heath, 1995). The theory predicts that, if an initial investment becomes aversive, it likely will increase persistence, though Navarro (2008) found that this was not true for investments of effort that resulted in boredom. A problem for the application of prospect theory to sunk costs is that it requires a situation in which recovering sunk costs is possible.

Loss aversion may be measured in two types of tasks. The first is riskless, such as in the endowment effect, which occurs when owners assign more value to the commodities they own than non-owners do (see Kahneman, Knetsch, & Thaler, 1990). Loss aversion can also be measured in a risky task involving a gamble, such as a lottery (Fehr & Goette, 2007). In this

case, people who are loss averse are likely to reject small-scale gambles that have a positive expected value but may involve losses. These two measures of loss aversion have been shown to have a significant positive correlation (Gächter, Johnson, & Herrmann, 2007).

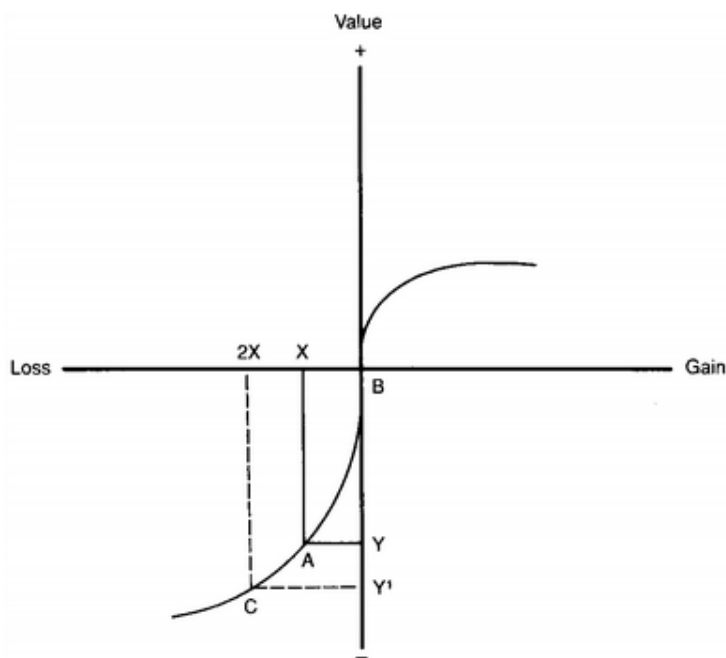


Figure 1. Prospect theory value function (from Garland, Sanderfur, & Rodgers, 1990).

### Dimensions of Sunk Cost

**Money.** Sunk costs have traditionally been categorized as investments of time, money, or effort (Arkes & Blumer, 1985). The most commonly studied is money. For example, an individual is more likely to wear an unattractive piece of clothing if it was more expensive (Zeng et al., 2013). Likewise, a company is more likely to continue an unpromising project if more money has been invested in that project compared to other projects (Garland & Newport, 1991). People are more likely to sit through a boring movie if the ticket price was at a premium (Arkes & Blumer, 1985, Strough et al., 2008). Early studies by Staw and colleagues (Staw, 1976; Staw & Fox, 1977; Staw & Ross, 1978) within an investment-decision framework investigated a range

of variables and the likelihood of renewed (or escalated) commitment to a previously chosen course of action. They found that unprofitable investments received more additional funding than profitable ones did. In a field study by Odean (1998), data were collected from a brokerage firm about all the sales and purchases by a sample of investors. Overall, investors held losing stocks a median of 124 days and held winning stocks 104 days. Investors stated that they expected the losing stocks to bounce back. However, in this sample, the unsold losing stock returned only 5% in the subsequent year, and the winning stocks that were sold later returned 11.6%. Given these and other, comparable findings, it seems reasonable to assume that committing the SCF ideally should not occur, as it may cause irretrievable future losses and therefore be avoided by decision makers (Fernandez, 2011).

**Time.** Sunk cost also can involve the currency of time. Mixed results have been reported in published studies using investments of time. One study found no difference in the rate of the SCF between initial investments of time and money, though the type of hypothetical scenario that was used was not held constant (Strough et al., 2008). Klaczynski and Cottrell (2004) combined initial-investment types of time and effort and found that participants were just as likely to commit the SCF in those scenarios as they were in those involving monetary investments. Soman (2001) compared monetary and temporal sunk costs and found that participants did not account for time in the same manner as they did money. Specifically, participants committed the SCF less when investments were temporal than when they were monetary. The author claimed that this difference was not due to increased rationality when money is involved but to difficulties in mentally accounting for time. A person may keep a mental account of losses and gains but not perceive the mental account as “in the red” because the amount of time spent is harder to track and “book”. When Soman experimentally

manipulated mental accounting by drawing attention to the monetary value of time, committing the SCF increased.

Navarro (2008) demonstrated the latter effect in four experiments in which investments of time had the same impact on behavior as investments of money. However, in one of the experiments, participants demonstrated a “reverse” sunk-cost effect in both monetary and temporal investment situations by escaping (that is, discontinuing investment) more frequently in high-investment situations compared to low-investment. These discrepant results reported by Soman (2001) and Navarro (2008) may reflect differences in how the scenarios were framed, that is, alternative descriptions of the same decision problem may elude different choices, thereby demonstrating a framing effect (Shafir, 2004).

**Effort.** The role of effort in the SCF has been studied least, perhaps because time will inevitably be spent while expending effort and may be the more salient factor. Thus, it may be appropriate to categorize only two components of sunk cost, money and time, and look at how the time is spent, whether enjoyably or not (Navarro, 2008). Essentially, this is a shift in focus from “I spent a lot of effort” to “the time I spent was effortful”. Navarro (2008) investigated situations of no investment, low-effort investment, and high-effort investment. In two similar experiments he found no difference in responses as a function of the amount of effort, though participants committed the SCF the least when no investment was made. The author noted that, in this case, the incremental cost of persisting was small. The SCF may be dependent on the level of incremental costs associated with each option.

Navarro also manipulated initial investments by characterizing them as “fun” or “boring”. The results ran counter to his hypothesis; in fact, persistence in sunk-costs was greater after a fun investment than after a boring one. The author suggested that an initial fun investment may have

led participants to believe that continuing to invest would also be fun. Overall results were inconclusive as to whether the quality of time spent—as a sunk cost—determines its impact on commitment. In a field study, Cunha & Caldieraro (2009) found that an effort-justification factor may account for sunk-cost effects involving effort. Specifically, the SCF may be a function of the perceived utility of an option relative to the opportunity cost posed by a new, different option.

**Investment type comparisons.** To date, there has only been one published study of the differences in rate of the SCF frequency across investment types with scenarios held constant. Strough et al. (2014) gave participants hypothetical scenarios in which an initial investment was made. Participants were then asked to indicate whether they would discontinue investing, invest somewhat more, or invest to the end of the project. The initial investments were manipulated by amount and type. If a participant indicated she or he would invest more when the initial investment was higher, he or she was scored as having committed the SCF for that scenario. An example of the investment-type manipulation is shown below:

*Money.* You are staying in a hotel room on vacation. [You paid \$10.95 to see a movie on pay TV. / You turn on the TV and there is a movie on.] After 5 minutes, you are bored and the movie seems pretty bad. How much longer would you continue to watch the movie?

*Time.* You are staying at a hotel room on vacation. [You watch the movie for 1 hour. / You watch the movie for 5 minutes.] However, you are bored and the movie seems pretty bad. How much longer would you continue to watch the movie? (pp. 91-92)

The authors found greater occurrence of the SCF for time ( $M = .90$ ,  $SD = .58$ ) than for money ( $M = .75$ ,  $SD = .47$ ),  $F(1, 425) = 19.65$ ,  $p < .01$ ,  $\eta_p^2 = .04$ .



The authors observed that monetary investments may not have been equivalent to the temporal investment—and, for this reason, they conducted an additional study in which specific amounts of money were replaced by general descriptors such as “hardly any” or “a whole lot” (p. 93). There was no main effect of investment type. However, the authors found that social versus nonsocial activities had an impact. For nonsocial activities, the SCF was more evident when money had been invested compared to time. For social activities, the SCF was more apparent when time had been invested. The authors concluded that, contrary to Soman’s (2001) suggestion that people simply track money better than time, people may be better attuned to tracking time in social contexts.

There may also be differences in the incidence of the SCF across investment types due to different value functions. For example, it may be that a person with a large amounts of one resource but little of another treats the loss of one differently than the other. If an individual views a sunk-cost situation as an option between a sure loss (discontinuing the investment) and an uncertain loss (continuing the investment), then the situation is more likely one in which the initial investment has a chance of recovery. For example, if a person continues to sit through a boring movie that he had paid \$10 to watch, he may be more likely to conclude that his money would be well spent if the movie improves (Soman, 2001). However, if the individual receives a free ticket by waiting in a long line, he may more easily recognize that an investment of time or effort, unlike money, is irretrievable regardless of future decisions and decide to leave the boring movie. If loss aversion is a factor in the SCF, initial investments of money would be more likely lead to further investments than investments of time or effort would.

## Experiment 1

Experiment 1 had three aims. The first was to investigate differences between the sunk-cost components of time, effort, and money. Hypothetical scenarios were presented with different initial investments of each. To date, no researcher has reported using this approach.

*H1: Participants will commit the SCF most often when the initial investment is expressed as money, less often when it is expressed as time, and least often when it is expressed as effort.* The

second purpose was to replicate previous findings specific to the effect of the initial-investment amount. *H2: Participants will commit the SCF most often when the initial investment is relatively large.* The third purpose was to investigate loss aversion as a predictor of the SCF.

Participants were asked to complete an endowment-effect task as a measure of loss aversion.

*H3: Loss aversion scores will be a significant predictor of the SCF, with greater loss aversion predicting more frequent occurrence of the SCF.*

## Method

### Participants

The participants were 168 undergraduate college students (mean age = 22.19,  $SD = 6.01$ , 52% male) at Brigham Young University in Provo, UT. Participants were randomly assigned to one of three initial investment-ratio conditions: 1:2 ( $N = 56$  students), 1:3 ( $N = 53$  students), or 1:5 ( $N = 59$  students).

### Materials and Procedure

**SCF questionnaire.** Participants were asked to complete a sunk-cost questionnaire and a loss-aversion task in counterbalanced order using a web-based survey software tool (Qualtrics®, Provo, UT). Those who completed both received a \$10 Amazon.com gift card. The questionnaire included 10 sunk-cost scenarios in which five scenarios were modified from

items previously used by Strough et al. (2014) and five were modified from Bornstein and Chapman's 1995 study (see Appendix A). The scenarios were those that more easily allowed the initial investment to differ as an amount of time, effort, or money, manipulations that did not appear in the original questionnaires. In addition, investment amounts were expressed as percentages, rather than the actual amounts as in the original scenarios. Questions about each scenario were presented twice, the first time after a low-initial investment had been made and the second time after a high-initial investment had been made, as seen in Strough et al. (2014). This procedure was repeated for initial investments of time, effort, and money. Thus, there was a total of six questions per scenario. Participants were randomly assigned an initial-investment ratio of 1:2 (for example, 10% and 20%), 1:3 (5% and 15%), or 1:5 (8% and 40%).

Table 1

*Number of Items Used in Each Category in the SCF Questionnaire*

	Time	Effort	Money
Low-initial investment	10	10	10
High-initial investment	10	10	10

*Note.* Participants were randomly assigned investment ratios of 1:2, 1:3, or 1:5, described as a percentage.

The total number of questions answered by each participant was 60 (see Table 1). Scores were calculated using the procedure described by Strough et al. (2014) wherein, if a participant indicated that he or she would spend a greater percentage of time, effort, or money in the high-investment scenario compared to the low-investment scenario, he or she received a score of 1 to indicate the SCF for that pair. Otherwise the score was zero. Scores were summed across all 30

pairs of low-and-high initial investments, with higher scores indicating more frequent occurrence of the SCF. Thus, the highest possible score for each initial-investment ratio was 30.

**Loss aversion task—the endowment effect.** Loss aversion was measured using an endowment-effect task introduced by Gächter et al. (2007). It involved calculating the difference between what participants were “willing to pay” (WTP) for a lamp shown on their computer screen (with a hypothetical retail price of \$29.99) and what they were “willing to accept” (WTA) to sell that object (see Appendix B). Participants used an on-screen slider to indicate their choice across a range from \$5 to \$55. The difference between the WTA and WTP (WTA–WTP) became the measure of loss aversion, with higher scores indicating greater loss aversion.

## Results

Each participant’s score was calculated for the sunk-cost questionnaire. The highest possible score was 10 for each investment type—time, effort, or money. Table 2 shows the mean SCF score and standard deviation for each initial-investment amount across initial-investment type and the number of participants assigned to each investment condition. The distributions of SCF scores for effort, time, and money were positively skewed. The skewness factor was 1.04 (SE = .19) for effort, .62 (SE = .19) for time, and .20 (SE = .19) for money. The data were transformed using a square-root transformation with 1.0 added to each score to account for scores equal to zero, though the main analyses did not change in direction or significance. Therefore, only analyses using the untransformed data are reported here.

Table 2

*Mean SCF Scores by Initial-Investment Ratio and Type in Experiment 1*

	<b>Effort</b>	<b>Time</b>	<b>Money</b>	<b>N</b>
	M( <i>SD</i> )	M( <i>SD</i> )	M( <i>SD</i> )	
<b>Ratio 1:2</b>	2.04(1.79)	2.27(1.94)	2.91(2.57)	56
<b>Ratio 1:3</b>	2.55(1.94)	3.04(1.96)	4.19(2.59)	53
<b>Ratio 1:5</b>	3.14(2.49)	3.49(2.49)	5.05(2.86)	59
<b>Total</b>	2.58(2.14)	2.94(2.20)	4.07(2.81)	168

*Note.* The maximum SCF score for each cell was 10.

Participants' mean WTP score was  $M = \$17.82$ ,  $SD = 8.71$ . The mean WTA was  $M = \$21.51$ ,  $SD = 7.79$ . Loss-aversion scores were calculated by subtracting a participant's WTP from the WTA. Results ranged from  $-\$15.68$  to  $\$40.18$ ,  $M = 3.69$ ,  $SD = 9.28$ , where higher scores indicated greater loss aversion. Thirty-four percent of the participants had a negative score, that is, they were willing to purchase the lamp at a higher price than they would sell it for. When a similar task was employed by Gächter et al. (2007), only 5 percent of participants received negative loss-aversion scores ( $WTA < WTP$ ). The authors reported that the ratio of mean WTP to mean WTA was 1.95. In the current study, the ratio was 1.21.

To test the hypotheses, a 3 X 3 (initial-investment type by initial-investment ratio) mixed-design ANCOVA was used in which SCF score was the dependent variable, the initial-investment type was a within-subject independent variable, and the initial-investment ratio was a between-subject independent variable. Loss-aversion scores were used as a covariate (see Table 3).

Table 3

*ANCOVA Table of Within-Subject Variable Initial-Investment Type and Between-Subject Variables of Initial-Investment Ratio and Loss Aversion*

Within-Subject Variable	df	<i>F</i>	$\eta_p^2$	<i>p</i>
Initial-investment Type	1.58	60.40	.269	<.001
Investment-type * Ratio	3.17	3.33	.039	.018
Error	259.61			
Between-Subject Variables	df	<i>F</i>	$\eta_p^2$	<i>p</i>
Initial-investment Ratio	2	7.93	.088	.001
Loss Aversion	1	4.13	.025	.044
Error	164			

*Note.* Interactions are indicated with an asterisk.

Mauchly's Test of Sphericity indicated that the assumption of sphericity, that is, that the variances of the differences between all combinations of groups are equal, was violated,  $\chi^2(2) = 49.84, p < .001$  (Grieve, 1984). For this reason, the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ( $\epsilon = .79$ ). Results using Huynh-Feldt estimates varied little from the Greenhouse-Geisser estimates, with no difference in direction or significance; therefore only the latter are reported. Levene's test of equality of error variances was significant for effort [ $F(2, 165) = 3.59, p = .030$ ] and time [ $F(2, 165) = 3.37, p = .037$ ] but not significant for money [ $F(2, 165) = .87, p = .422$ ]. Though the assumption of equal variances

was violated for effort and time, the  $F$ -test is generally regarded as robust against this violation (Rheinheimer, 1999).

There was a significant main effect of initial-investment type when loss aversion was held constant,  $F(1.58, 259.61) = 60.40, p < .001, \eta_p^2 = .269$ . Pairwise comparisons using Bonferroni-adjusted alpha levels of .017 per test (.05/3) were used so as to provide more conservative decision criteria than a planned-comparison approach would have. The results indicated significant differences between effort and time,  $p = .001, 95\% \text{ CI} = [.13, .59]$ , between effort and money,  $p < .001, \text{ CI} = [1.10, 1.86]$ , and between time and money,  $p < .001, \text{ CI} = [.77, 1.47]$ .

There was a significant main effect of initial-investment ratio when holding loss aversion constant,  $F(2, 164) = 7.93, p = .001, \eta_p^2 = .088$ . Post hoc comparisons were made with Bonferroni corrections and indicated no significant differences between initial-investment ratios of 1:2 and 1:3,  $p = .07, 95\% \text{ CI} = [-.05, 1.88]$  or between ratios of 1:3 and 1:5,  $p = .34, \text{ CI} = [-.32, 1.58]$ . There was a significant difference between ratios 1:2 and 1:5,  $p < .001, \text{ CI} = [.60, 2.48]$ . When SCF scores were transformed to compensate for positive skewness, the difference between initial-investment ratios of 1:2 and 1:3 also became significant,  $p = .043, 95\% \text{ CI} = [.01, .49]$ . The mean total SCF score for participants in the 1:2 condition was  $M = 7.21 (SD = 5.67)$ ,  $M = 9.77 (SD = 5.66)$  for those in the 1:3 condition, and  $M = 11.68 (SD = 7.31)$  for those in the 1:5 condition. Note that the maximum possible score was 30.

There was also a significant interaction between the initial-investment type and the initial-investment ratio when holding loss aversion constant,  $F(3.17, 259.61) = 3.33, p = .018, \eta_p^2 = .039$ . Figure 2 shows the estimated marginal means of the SCF score by initial-investment type and ratio, where the marginal mean indicates that loss aversion was held constant. The SCF

scores increased from effort, to time, to money, but this pattern became even more apparent as the initial-investment ratio increased from 1:2 to 1:3 to 1:5. There were small differences in the SCF score between investment types when the ratio was 1:2 but larger differences across investment types for ratios 1:3 and 1:5.

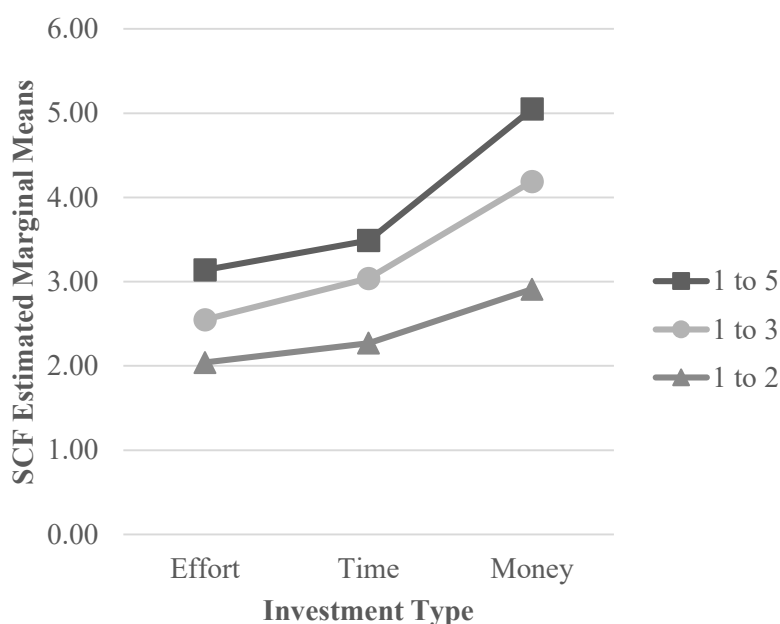


Figure 2. Estimated marginal means of the SCF score for each investment type and ratio. Loss-aversion scores were held constant at 3.69.

There was a significant main effect of loss aversion,  $F(1, 164) = 4.13, p = .044, \eta_p^2 = .025$ . However, the correlation between total SCF scores across investment type and loss-aversion scores was not significant at  $\alpha_{2\text{-tail}} = .05, r = -.13, p = .094$ . In an exploratory analysis, additional correlations were derived for SCF scores in terms of time, effort, or money, rather than the aggregate. The results indicated a non-significant negative correlation between loss aversion and SCF scores involving effort ( $r = -.09, p = .235$ ), a negative correlation with time, ( $r = -.14, p = .071$ ), and a negative correlation with money ( $r = -.12, p = .117$ ).



## Discussion

This study was the first to manipulate the three investment types of time, effort, and money using the same scenarios across all types while also manipulating the initial-investment amounts described as percentages. The first experimental hypothesis was confirmed as participants committed the SCF most often when the initial investment was money,  $M = 4.07$ , less often when it was expressed as time,  $M = 2.94$ , and least often when it was expressed as effort,  $M = 2.58$ . All pairwise differences were statistically significant. This finding is consistent with Soman's (2001) in which the investment of time produced the SCF less often than money did and provides new evidence that the investment of effort can also produce the SCF. The second hypothesis, namely, that participants would treat initial-investment ratios differently, was confirmed as participants invested more as the ratio increased from 1:2 to 1:3 to 1:5. This finding was consistent with past research in which greater initial-investment amounts led to greater frequency of the SCF (Arkes & Blumer, 1985; Garland & Newport, 1991), even when percentages were used instead of explicit amounts.

The interaction revealed by the statistical analysis demonstrated that the effect of investment type was greater as the initial-investment ratio increased. Navarro (2008) found no difference in SCF scores between low- and high-effort conditions, but the current study showed that both amount and type are important in an individual's investment decisions. A rational decision maker would be unaffected by these components, as the investment is irretrievable, whether it involved a large amount of effort or a small amount of money. It may have been more apparent to participants that time and effort investments were irretrievable compared to money, though additional research will be needed to clarify why this may be the case.

The third hypothesis, namely, that loss aversion would predict the SCF, was not confirmed. I assumed that participants invested more when the initial investment was large, because individuals are risk seeking in the domain of losses and may perceive the larger initial investment as a larger loss compared to a smaller initial investment. If it is, in fact, loss aversion that is producing the SCF, a positive relation between SCF scores and loss-aversion scores would have been apparent. It may be that loss aversion is only applicable with money, wherein participants can more easily create a mental account, and become risk-seeking in order to regain in money or utility what was invested initially as money. This would align with Soman (2001), who found that time is harder to track than money, therefore the SCF was committed less for this investment type. To further explore this, additional correlations were ran with SCF scores separated by time, effort, and money, rather than aggregated together. The results indicated a non-significant negative correlation between loss aversion and SCF scores. The results were negative whether SCF scores involved time, effort, or money. These consistently negative correlations do not necessarily discount loss aversion as the reason behind the SCF, as the loss-aversion scores obtained from the endowment effect task were unusual.

The current study may not have produced the expected relation between loss aversion and the SCF because the endowment-effect task was used as the measure of loss aversion. When the task was employed by Gächter et al. (2007), only 5 percent of participants received a negative loss-aversion score ( $WTA < WTP$ ), and the ratio of mean WTA to mean WTP was 1.95. In the current study, 32 percent of participants had a negative score, the mean WTA was 21.44 ( $SD = 8.37$ ), and the mean WTP, 17.46 ( $SD = 7.65$ ), a ratio of 1.22. Most Brigham Young University students come from a similar religious background that stresses generosity to others. This may

have enhanced the offer price for the lamp and reduced the asking price, thus reducing the WTA-to-WTP ratio. This admittedly speculative possibility may merit further research.

Participants were asked to comment on their experience and explain their decisions at the conclusion of the questionnaire and endowment effect task. Many gave reasons for addressing the investment types differently. The extent of the difference depended on the amount that was already invested. One participant commented, "I am much more likely to continue with things that I have spent money on, as opposed to energy and time, which are more renewable of [sic] resources." Many participants stated that specific scenarios impacted their decisions. For example, one participant reported that, "As for the soup, since I'm a poor college student, as long as it's not too horrible, it's still food, so I might as well eat it." Strough et al. (2014) demonstrated that specific scenarios had an effect when they found a difference in SCF scores for social and non-social scenarios. Yoder, Mancha, and Agrawal (2014) also found that particular sunk-cost situations were sometimes more important than cultural factors when comparing participants from the United States with those from India. This experiment did not explore the differential effects of scenario type.

The results of Experiment 1 prompted a supplementary experiment. Participants in Experiment 1 stated that investment amounts described as percentages were confusing. It may be that changing the description of investment amounts to more-general words such as "small", "medium", and "large" would yield different results. The unexpected results of the endowment-effect task left the question concerning the role of loss aversion in the SCF largely unanswered. I therefore sought to explore this relation using a more diverse population and with a different task, as the endowment effect may reliably appear only when participants are able to physically hold an object as the buyer or owner of it. An additional interest was to identify the reasons

participants give for committing the SCF and to investigate whether dual process theory provides a better account of the SCF than loss aversion does.

## Experiment 2

Experiment 2 targeted five experimental hypotheses. The first (*H1*) was to replicate the differences in SCF scores due to the initial-investment type that were observed in Experiment 1. The second (*H2*) was to replicate the differences in SCF scores due to the initial-investment amount. The third hypothesis focused on the relation between SCF scores and loss aversion by using a risky-gamble task as a measure of loss aversion rather than the endowment-effect task—*H3: Scores on the risky-gamble task will be positively correlated with the SCF scores.* The fourth hypothesis was directed to the reasons participants gave for why they committed the SCF. Specifically, they were asked to identify one of the following reasons for continuing to invest: loss aversion, to avoid waste, to be consistent, to learn a lesson, or for another reason the participant was asked to describe; thus, *H4: The loss-aversion option will be selected more frequently than any other.*

The last hypothesis concerned the role of perspective taking in the SCF. According to the dual-process theory, the SCF may be due to participants' failing to engage system 2 (Klaczynski & Cottrell, 2004). Amsel, Close, Sadler, & Klaczynski (2009) found that participants made an irrational decision by preferring odds of 10:100 over 1:10, which are mathematically equivalent, instead of having no preference. Many participants acknowledged that having a preference was irrational but expressed it regardless. In a study from Klaczynski (2001), participants committed the SCF significantly less often when the scenario was prefaced with the phrase, "Think about this situation from the perspective of a perfectly logical person" (p. 296). In Experiment 2, participants were asked to respond to hypothetical sunk-cost scenarios as they preferred to but

also to respond as though they were a fictional person named Sam, who was expressly described as logical. It may be that, similar to Amsel et al.'s (2009) findings, participants can recognize the logical option when they respond as another person but persist in continuing to invest when responding as themselves. The task involving Sam was meant to increase that engagement. Thus, *H5: Participants will commit the SCF less often when they answer as a fictional but logical person than when they answer according to their own preference.*

## Method

### Participants

I recruited 300 participants between the ages of 18 and 35 using Amazon Mechanical Turk (MTurk), a website wherein interested persons can complete online surveys in exchange for Amazon.com credit. This population was used rather than BYU students in order to obtain a more diverse sample than was the case in Experiment 1. The site has been shown to yield data with a reliability factor approximating that of traditional-survey methods (Buhrmester, Kwang, & Gosling, 2011). The mean age of participants was 27.07,  $SD = 4.31$ , with 61% male. Each had to be a US resident, to possess a “master’s” status with MTurk, and to have completed at least 1,000 surveys with acceptable ratings.

### Materials and Procedure

**Sunk-cost perspective-taking questionnaire.** Participants were asked to complete an SCF-perspective-taking questionnaire available online at MTurk through <https://survey.psychtasks.com>, a survey webpage created for the purposes of this experiment. The same 10 SCF scenarios were used in this survey as were used in Experiment 1, with minor changes (see Appendix C). Participants were randomly assigned to answer five of the scenarios

as they normally would and the other five scenarios as a fictional person named Sam. Each time a scenario was randomly assigned to the Sam-answer mode, it was prefaced with the following:

Sam Jones is a logical thinker who prides himself in his thoughtful decision making. He plans his actions carefully when given choices and always chooses an option with the best outcome. In the following scenario, answer as Sam would.

Participants also were randomly assigned to one of three conditions in which the initial investment amounts could be small, medium, or large. Each scenario was presented twice in succession, once with no initial investment and again with a small-, medium-, or large-initial investment, depending on the condition to which they were assigned. This procedure differed from that in Experiment 1 in which percentages were used because some participants had stated that the use of percentages made the task difficult to understand. Using the more general terms of small, medium, and large rather than percentages also more closely approximated the task employed by Strough et al. (2014) in their third study wherein investment amounts were described as “a whole lot” or “hardly any at all” (p. 93). Each scenario was presented in pairs using initial-investment types of time, effort, and money. Regardless of whether a scenario was randomly assigned to be answered as Sam or Self, the scenario was repeated for time, effort, and money, making a total of six responses to each scenario.

If a participant committed the SCF, that is, invested more when the initial investment was small, medium, or large compared to when there was no initial investment, there was a 60% chance of being asked a follow-up question. This occasionality was meant to ensure that a participant did not avoid the SCF simply to shorten the time it took to complete the survey. The follow-up question asked the participant why he or she decided to continue investing and provided the answer options of *loss aversion*, *avoid waste*, *consistency*, *learn-a-lesson*, or *other*.

Participants could only select one answer. If participants chose the “other” response, they were asked to enter their own reason for continuing to invest. Possible scores ranged from zero to three for each of the 10 scenarios, creating a potential total SCF score across all scenarios of 30.

**Risky-gamble task.** Participants were also asked to complete a risky-gamble task as a measure of loss aversion. This task was employed rather than the endowment task used in Experiment 1. It may be a more informative task, as some researchers view the endowment effect as less a measure of loss aversion and more a measure of ownership (Morewedge, Shu, Gilbert, & Wilson, 2009) or regret (Kogler, Kühberger, & Gilhofer, 2013). The risk-gamble task consisted of 10 hypothetical questions in which a gamble was presented, and the participant could choose to accept or reject it (see Table 4).

Table 4

*The Instructions and Options for the Risky-Gamble Task Modified from Gächter et al, (2007)*

Instructions: Ten hypothetical scenarios appear below. For each, please indicate whether you would “accept” the lottery for a chance of winning or “reject” it and not receive anything.	Accept	Reject
1. If the coin turns up heads, then you lose \$2; if the coin turns up tails, you win \$10.		
2. If the coin turns up heads, then you lose \$3; if the coin turns up tails, you win \$10.		
3. If the coin turns up heads, then you lose \$4; if the coin turns up tails, you win \$10.		
4. If the coin turns up heads, then you lose \$5; if the coin turns up tails, you win \$10.		
5. If the coin turns up heads, then you lose \$6; if the coin turns up tails, you win \$10.		
6. If the coin turns up heads, then you lose \$7; if the coin turns up tails, you win \$10.		
7. If the coin turns up heads, then you lose \$8; if the coin turns up tails, you win \$10.		
8. If the coin turns up heads, then you lose \$9; if the coin turns up tails, you win \$10.		
9. If the coin turns up heads, then you lose \$10; if the coin turns up tails, you win \$10.		
10. If the coin turns up heads, then you lose \$11; if the coin turns up tails, you win \$10.		

In this task, loss aversion was measured according to the maximum loss the participant was willing to accept. Each participant's score was calculated according to cumulative prospect theory (see Gächter et al., 2007). The formula,  $\lambda^{\text{risky}} = G/L$ , was used to calculate each participant's score, where  $\lambda^{\text{risky}}$  is the coefficient of loss aversion in the risky task,  $G$  is the gain outcome (in this case, it was fixed at \$10), and  $L$  is the amount of the potential loss (ranging from \$2-11).

Table 5

*Acceptance Rates of the Different Lotteries in the Risky Gamble Task and the Implied  $\lambda^{\text{risky}}$*   
(Taken from Gächter, et al., 2007)

	Implied	Implied $\lambda^{\text{risky}}$ if
Acceptable behavior (lottery-choice category)	acceptable loss	$v(x) = x$
11) Reject all lotteries	< \$2	>5
10) Accept lottery 1, reject lotteries 2-10	\$2	5.00
9) Accept lotteries 1-2, reject lotteries 3-10	\$3	3.33
8) Accept lotteries 1-3, reject lotteries 4-10	\$4	2.50
7) Accept lotteries 1-4, reject lotteries 5-10	\$5	2.00
6) Accept lotteries 1-5, reject lotteries 6-10	\$6	1.67
5) Accept lotteries 1-6, reject lotteries 7-10	\$7	1.43
4) Accept lotteries 1-7, reject lotteries 8-10	\$8	1.25
3) Accept lotteries 1-8, reject lotteries 9-10	\$9	1.11
2) Accept lotteries 1-9, reject lottery 10	\$10	1.00
1) Accept all lotteries	$\geq$ \$10	$\leq$ 91



For example, if a participant accepted all the lotteries except lotteries 9-10, he or she received a score of .91 ( $\lambda^{\text{risky}} = \$10/\$11$ , where \$10 is the gain outcome and \$11 is the implied acceptable loss), indicating low loss aversion. If a participant rejected all the lotteries, his or her score was 10.0 ( $\lambda^{\text{risky}} = \$10/\$1$ , where \$10 is the gain outcome and \$1 is the implied acceptable loss), indicating high loss aversion. The implied loss value of \$1 was chosen to avoid zero as the denominator of the fraction and to stay consistent in the pattern of possible implied acceptable losses (see Table 5). Participants were compensated with \$3.00 of Amazon credit for completing both tasks.

## Results

Each participant's score was calculated for the SCF perspective-taking questionnaire. The highest possible score was 5 for each investment type—time, effort, or money—when answering as Self or Sam. Table 6 shows the means and standard deviations for each initial investment amount, type, and perspective.

The distributions of scores by initial-investment type and whether participants answered as Self or as Sam were positively skewed, ranging from a skewness of .15 ( $SE = .14$ ) in the Self-Money condition to 1.23 ( $SE = .14$ ) in the Self-Effort condition. Transforming the data did not change the direction or significance of the analyses; therefore only the untransformed data are reported.

Table 6

*Means and Standard Deviations of SCF scores for Each Initial-Investment Type, Perspective, and Initial-Investment Amount*

Investment Amount	Investment Type	Self $M(SD)$	Sam $M(SD)$
Small $N = 85$	Effort	.53(.73)	.44(.66)
	Time	.54(.88)	.34(.55)
	Money	1.76(1.38)	1.56(1.41)
	Total	2.84(2.44)	2.34(2.17)
Medium $N = 142$	Effort	.89(1.03)	.91(1.00)
	Time	.93(.99)	.98(1.10)
	Money	2.05(1.41)	2.06(1.60)
	Total	3.87(2.89)	3.94(3.04)
Large $N = 73$	Effort	1.32(1.25)	1.04(.90)
	Time	1.36(1.16)	1.30(1.13)
	Money	2.42(1.54)	2.44(1.53)
	Total	5.10(3.48)	4.78(2.99)

Each participant's loss-aversion score was calculated using the method described previously. Scores ranged from .91 to 10.00,  $M = 2.88$ ,  $SD = 2.11$ . Of the participants, 3.67% were risk-neutral; they accepted all lotteries with a non-negative expected value and rejected the last lottery in which the expected value was negative. Gächter et al. (2007) reported that 12.58% of their participants were risk-neutral. In the current study, 1.33% of participants accepted all the gambles, which gave them a score of  $< .91$ , indicating risk-seeking behavior, whereas Gächter et al. (2007) reported that 16.56 % of their participants did so. Additionally, 6.33% of the

participants in the current study received the highest possible score in which even positive expected values were rejected. Gächter et al. (2007) reported that 1.84% of participants did so. Most participants (88.67%) accepted between one and eight lotteries, indicating moderate loss aversion, whereas Gächter et al. (2007) found that 70.86% of their participants did so. It should be noted that there were only six lotteries in the Gächter et al. study, and monetary values were listed in euros instead of US dollars.

Table 7

*ANCOVA Results with Within-Subject Variables of Investment Type and Perspective and Between-Subject Variables of Investment Amount and Loss Aversion*

Within-Subject Variables	df	<i>F</i>	$\eta_p^2$	<i>p</i>
Investment Type	1.33	129.90	.305	<.001
Investment type * amount	2.66	.55	.004	.631
Error	394.20			
Perspective	1	.72	.002	.395
Error	296.00			
Between-Subject Variables	df	<i>F</i>	$\eta_p^2$	<i>p</i>
Investment Amount	2	21.20	.125	<.001
Loss Aversion	1	6.90	.023	.009
Error	296			

*Note.* Interactions are indicated with an asterisk.

To investigate hypotheses 1, 2, 3, and 5, a 3 X 3 X 2 (initial-investment type by initial investment amount by perspective) mixed-design ANCOVA was used in which SCF score was the dependent variable, perspective and the initial-investment type were within-subject

independent variables, and the initial-investment amount was a between-subject independent variable. Loss-aversion scores were used as a covariate (see Table 7).

Table 8

*Results of Levene's Test of Equality of Error Variances*

<u>Investment Type</u>	<u>Perspective</u>	<u>F</u>	<u>df1</u>	<u>df2</u>	<u>p</u>
Effort	Self	9.20	2	297	<.001
	Sam	4.79	2	297	.009
Time	Self	3.94	2	297	.020
	Sam	14.17	2	297	<.001
Money	Self	1.11	2	297	.33
	Sam	.95	2	297	.390

Mauchly's Test of Sphericity indicated that the assumption of sphericity was violated for the investment type,  $\chi^2(2) = 205.53, p < .001$ , and the investment type-perspective interaction,  $\chi^2(2) = 41.76, p < .001$ . For this reason, the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ( $\epsilon = .67$  and  $\epsilon = .88$  respectively). Results using Huynh-Feldt estimates varied little from those with Greenhouse-Geisser, with no difference in direction or significance; therefore, only the latter are reported. Levene's test of equality of error variances was significant for all conditions except when the investment type was money for the Self or Sam conditions (see Table 8). Normality transformations did not correct this, which may be because there were unequal group sizes. Participants were randomly assigned to small, medium, or large initial-investment amount conditions. Eighty-five participants had been assigned to the small condition, 142 to the medium, and 73 to the large. As noted previously,

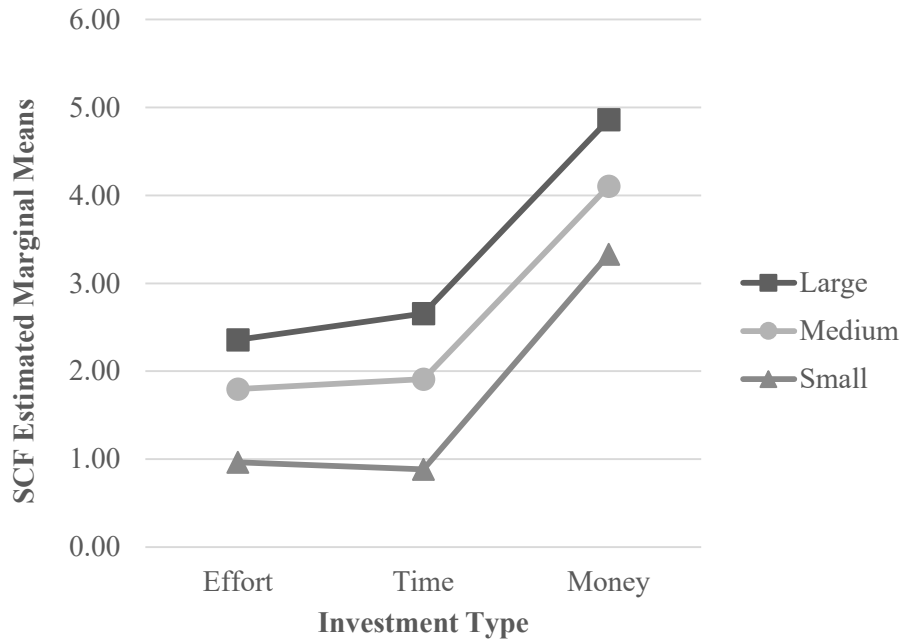
though this violation of the assumption of equal variances is a limitation, the  $F$ -test is generally considered robust (Rheinheimer, 1999).

The main effect of initial-investment type was significant when holding loss aversion constant,  $F(1.33, 394.20) = 129.90, p < .001, \eta_p^2 = .305$ . Bonferroni adjusted pairwise comparisons indicated significance differences between effort and money,  $p < .001, 95\% \text{ CI} = [1.04, 1.35]$  and between time and money,  $p < .001, \text{ CI} = [.98, 1.30]$  but not between effort and time,  $p = .208, \text{ CI} = [-.13, .02]$ . Participants committed the SCF most often when the initial investment was money compared to time or effort.

The main effect of initial-investment amount was significant when loss aversion was held constant,  $F(2, 296) = 21.20, p < .001, \eta_p^2 = .125$ . Bonferroni pairwise comparisons indicated significant differences between initial investment amounts of small and medium,  $p < .001, 95\% \text{ CI} = [.20, .72]$ , between small and large,  $p < .001, \text{ CI} = [.50, 1.11]$ , and between medium and large,  $p = .007, \text{ CI} = [.07, .62]$ .

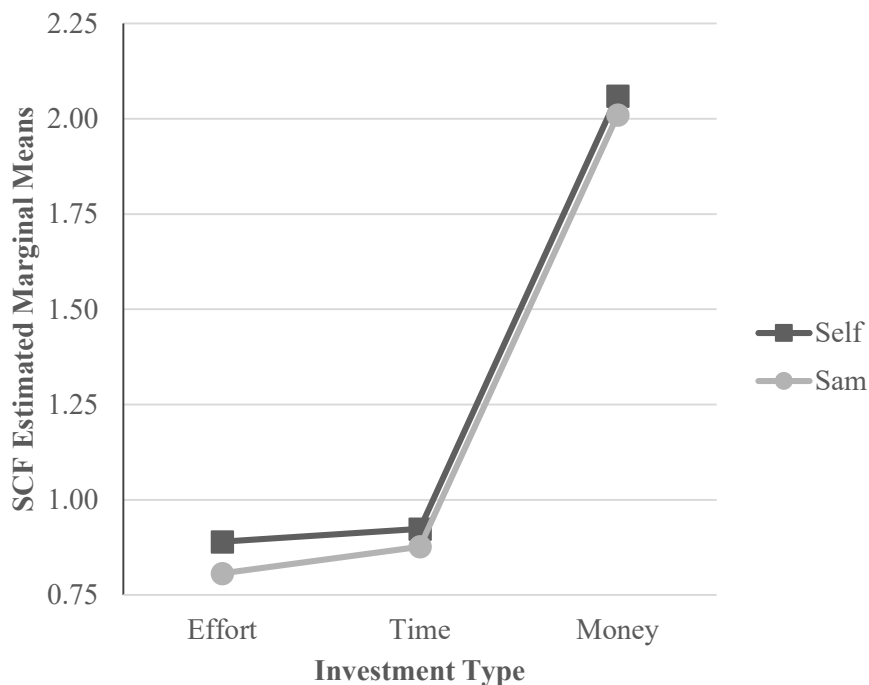
There was no significant interaction effect between the initial-investment amount and type with loss aversion held constant,  $F(2.66, 394.20) = .55, p = .631, \eta_p^2 = .004$  (see Figure 3).

There was a significant main effect of loss aversion,  $F(1, 296) = 6.90, p = .009, \eta_p^2 = .023$ . Total SCF scores across investment type and perspective were correlated with loss-aversion scores, which was significant at  $\alpha_{2 \text{ tail}} = .05, r = -.12, p = .042$ . Again in an exploratory analysis, correlations were conducted between loss aversion using the risky-gamble scores and SCF scores separated by investment type. The correlation between loss aversion and effort was  $r = -.07, p = .242$ , loss aversion and time was  $r = -.10, p = .073$ , and loss aversion with money was  $r = -.12, p = .037$ .



*Figure 3.* Estimated marginal means for the SCF for each investment type and ratio. Loss-aversion scores were held constant at 2.88.

Holding loss aversion constant, the main effect of perspective was not significant,  $F(1, 296.00) = .73, p = .395, \eta_p^2 = .002$ . The difference when answering as Self as compared to answering as Sam was .08 for effort, and for time and money was .05. As seen in Figure 4, when answering as Sam, the expected mean was consistently less than when answering as Self. However, the effect was small and not significant.



*Figure 4.* Estimated marginal means of the SCF across investment type and perspective, holding loss aversion scores constant at 2.88.

Each participant's stated reasons for continuing to invest after having committed the SCF were recorded and totaled according to whether he or she was answering as Sam or Self. It was assumed that the reason a participant gave for continuing to invest did not differ according to the investment type or amount; therefore the tallies were not separated according to those variables. All scores were added across participants and appear in Table 9. The most common reason was to avoid waste—roughly half of the tallies. Loss aversion was less commonly selected, but substantially more often than the remaining three reasons. Participants gave similar reasons when answering as Self as when answering as Sam.

Table 9

*Total Frequency of Specific Reasons for Committing the SCF from Each Perspective**(Percentages Appear in Parentheses)*

	Loss Aversion	Waste	Consistency	Learn-a-Lesson	Other
Self	223(29.46)	421(55.61)	31(4.01)	60(7.93)	22(2.93)
Sam	205(28.24)	391(53.86)	49(6.75)	55(7.58)	26(3.58)

If individuals become more risk-seeking in the domain of monetary losses more than ones of time or effort, then loss aversion would be the most popular reason given for committing the SCF when the initial investment is money. If individuals are simply more accustomed to applying the rule “don’t waste” to money more than investments of time or effort, then avoiding waste would be a more common reason for committing the SCF when the investment was money compared to time or effort. This idea was further explored by separating the reasons given for continuing to invest by investment type (see Table 10).



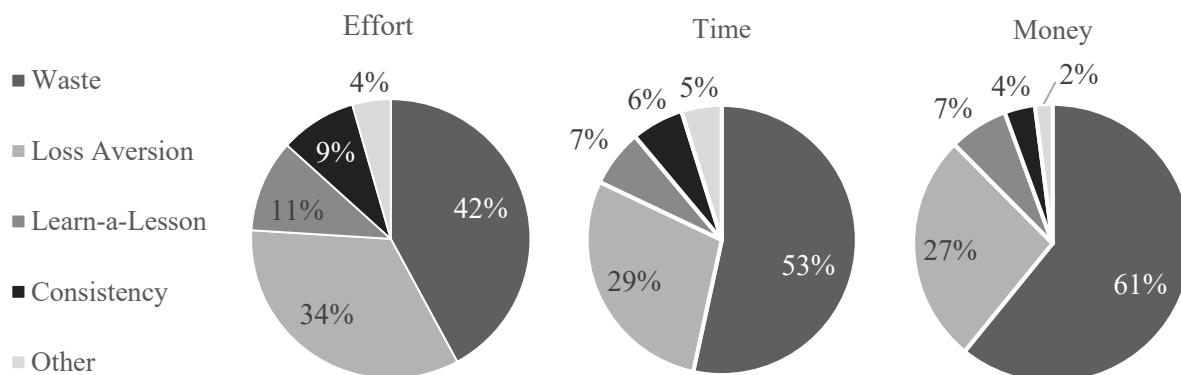
Table 10

*Total Frequency of Specific Reasons for Committing the SCF from Each Perspective and Investment Type (Percentages Appear in Parentheses)*

	Self			Sam			
	<u>Effort</u>	<u>Time</u>	<u>Money</u>	<u>Effort</u>	<u>Time</u>	<u>Money</u>	<u>M(SD)</u>
Loss Aversion	66(35.7)	54(30.0)	103(26.3)	51(32.1)	47(27.3)	107(27.1)	9.7(3.6)
Waste	79(42.7)	97(53.9)	245(62.5)	66(41.5)	91(52.9)	234(59.2)	52.1(8.5)
Consistency	13(7.0)	10(5.6)	8(2.0)	17(10.7)	12(7.0)	20(5.1)	6.2(2.8)
Learn-a-Lesson	21(11.4)	10(5.6)	29(7.4)	16(10.1)	14(8.1)	25(6.3)	8.1(2.2)
Other	6(3.2)	9(5.0)	7(1.8)	9(5.7)	8(4.7)	9(2.3)	3.8(1.6)
Total	185(100)	180(100)	392(100)	159(100)	172(100)	395(100)	

*Note.* The means and standard deviations displayed in the last column are in percentages.

Note in Table 10 that there were small differences between Self and Sam, ranging from a difference of .5% when selecting the “other” in the money condition, to 3.7% when selecting the “consistency” response for effort. For this reason, Self and Sam tallies were averaged to create Figure 5, which more clearly exhibits the different types of reasons given for committing the SCF across investment type. Note that “learn-a-lesson”, “consistency”, and “other” made up 11% of the tallies or fewer, regardless of investment type. Interestingly, the “loss-aversion” response provided 34% of the tallies when the initial investment was effort but less for time (29%) and money (27%). This pattern was the opposite for the “waste” response, which made up 42% of the tallies in effort but was greater for time (53%) and even greater for money (61%).



*Figure 5.* Pie charts of tallies in percentages of the reasons participants gave for committing the SCF across investment type.

### Discussion

Experiment 2 yielded results similar to those of Experiment 1 in terms of the effects of investment type and amount. One participant with large differences in SCF scores between the three different types stated, “Time is always being lost and cannot be regained, energy is constantly being repleted [sic] and money is not something to waste or take lightly as it’s hard to come by.” The effects of investment type were evident in both experiments and across investment amounts whether described in terms of a percentage or in more general terms, specifically, as small, medium, or large. This finding supported H2 in predicting that participants would commit the SCF more often when the initial investment was large compared to small or medium. In Experiment 1 there was no difference between the initial-investment ratios of 1:3 and 1:5, but there were significant differences between all initial-investment amounts in Experiment 2. It may be that participants were better able to distinguish differences between “medium” and “large” investments than between ratios of 1:3 and 1:5. Moreover, the interaction between investment type and initial-investment amount was only significant in Experiment 1. Perhaps participants in Experiment 2 perceived that a small amount of effort was

equal to a small amount of time but, in Experiment 1, that 10% of an individual's effort is not the same as 10% of an individual's time. Overall, the joint results gave compelling evidence for H1 and H2.

The results of Experiment 2 did not support H3 because the magnitude of the relation was weak and in a direction opposite of what was predicted. Exploratory analyses indicated this was the case for time, effort, and money. Interestingly, a negative correlation between SCF scores and loss-aversion scores was also found in Experiment 1. The loss-aversion task using the endowment effect in Experiment 1 failed to replicate the task it was based on (see Gächter et al., 2007) and was replaced with the risky-gamble task in Experiment 2, which also drew from a more diverse population.

The risky-gamble task produced a greater percentage of loss-averse individuals than Gächter et al. reported, but the differences may have been due to the increased number of lotteries and the fact that gamble amounts were expressed in US dollars rather than euros. Other important differences between the two loss aversion tasks used here and those from Gächter et al. is that they used participants living in Germany, Austria, or Switzerland, collected from a car manufacturer rather than US college-age participants used in the current experiment. In their study, participants were able to own and/or sell a miniature model car and received the outcome of one randomly selected lottery from the risky-gamble task. In the current study, participants did not actually buy or sell an item, and did not receive the outcome of one of the lotteries. Had participants experienced these in actuality instead of hypothetically, the results may have aligned more closely with Gächter et al. (2007).

The lack of evidence that loss aversion induces the SCF was even more pronounced as participants most often reported committing the SCF to avoid waste rather than loss. The results

were similar to those of Bornstein and Chapman (1995) and Fernandez (2011) whose participants rated waste avoidance higher than learn-a-lesson and learn-a-lesson higher than consistency. However, those researchers included a punishment response and did not include loss aversion. As one participant stated concerning the documentary-film scenario, “If I paid for the rental why not finish it? Otherwise if it were free why not just give up now? I feel like I'd be wasting money if I gave up after paying a fee.” However, one participant, when describing his experience with an investment of money stated, “It’s better to see a project to completion and risk it not being as good rather than suffering monetary loss.” This response indicates that the participant became risk-seeking in light of previous losses.

Experiment 2 was the first of its kind to include perspective taking when exposed to SCF scenarios. It was assumed that, if the SCF is explained by the dual-process theory, having participants adopt the Sam perspective would engage system 2, a slower and more thoughtful avenue of decision-making. Participants would have committed the SCF more often when answering as they normally would as not wasting is the system 1 default option. Sam would have recognized that the scenarios over-apply this rule, because the initial investment is lost regardless of future action. There was a consistent pattern in which the SCF occurred less frequently when answering as Sam, consistent with results from Klaczynski (2001), but the difference was not statistically significant. Participants commented that a more detailed description of Sam was needed in order to answer like he would have and that switching back and forth between answering as themselves and Sam was confusing. One mentioned that knowing about Sam’s financial condition would have been helpful. Many participants stated that they considered themselves similar to Sam, so their answers were similar. Additional research is needed in order to clarify the role of the dual-process theory in the SCF.

## General Discussion

The primary objectives of the present study were to (a) assess differences in the SCF between the sunk-cost components of time, effort, and money by manipulating previously established measures (Bornstein & Chapman, 1995; Strough et al., 2014), (b) replicate previous findings of the effect of the initial-investment amount on the SCF (Garland & Newport, 1991), (c) investigate the relation between the SCF and loss aversion, (d) explore the reasons given by participants for committing the SCF, and (e) study the role of perspective taking in decision making. Table 11 summarizes the outcomes of Experiment 1 and 2 in relation to these objectives.

Prior studies have shown differences in SCF scores according to investment type. Strough et al. (2008) found no difference between time and money, Klaczynski and Cottrell (2004) combined time with effort and found no difference between those investment types and money, and Soman (2001) found that SCF scores were lower for time than money. Strough et al. (2014) used a method similar to the one used in the current study by holding scenarios constant and describing time and money investment amounts as “hardly any” and “a whole lot”. They found no significant main effect between the two, though the SCF occurred more for money in nonsocial activities and more for time in social activities. The current experiments held scenarios constant while manipulating time, effort, and money. These three different types of investments were made comparable by describing each in terms of percentages in Experiment 1 and as a “small”, “medium”, or “large” in Experiment 2.

Table 11

*Hypotheses and Outcomes of Experiments 1 and 2*

Hypothesis	Experiment 1		Experiment 2	
	Outcome and Main Effect	Post Hoc Analyses	Outcome and Main Effect	Post Hoc Analyses
The SCF scores will be highest when the initial investment is expressed as money, less often when it is expressed as time, and least often when it is expressed as effort.	Supported $F = 60.40$ , $p < .001$ , $\eta_p^2 = .269$ .	Mean SCF score for effort was $M = 2.6$ , time was $M = 2.9$ , and money was $M = 4.1$ . All differences were significant at $\alpha = .05$ .	Supported $F = 129.90$ , $p < .001$ , $\eta_p^2 = .305$ .	Mean SCF score for effort was $M = 1.7$ , time was $M = 1.8$ , and money was $M = 4.1$ . There were significance differences between effort and money, $p < .001$ , and time and money, $p < .001$ .
The SCF scores will be highest when the initial investment is relatively large.	Supported $F = 7.93$ , $p = .001$ , $\eta_p^2 = .088$ .	Mean SCF score for a ratio of 1:2 was $M = 7.2$ , 1:3 was $M = 9.8$ , and 1:5 was $M = 11.7$ . There was a significant difference between ratios 1:2 and 1:5, $p < .001$ .	Supported $F = 21.20$ , $p < .001$ , $\eta_p^2 = .125$ .	Mean SCF score for the small condition was $M = 5.2$ , medium was $M = 7.8$ , and large was $M = 9.9$ . All differences were significant at $\alpha = .05$ .
Loss-aversion scores will be a significant predictor of the SCF scores, with greater loss aversion predicting higher SCF scores.	Not supported $F = 4.13$ , $p = .044$ , $\eta_p^2 = .025$ .	The correlation was negative and not significant, $r = -.13$ , $p = .094$ , $N = 168$ .	Not supported $F = 6.90$ , $p = .009$ , $\eta_p^2 = .023$ .	The correlation was negative and significant, $r = -.12$ , $p = .042$ , $N = 300$ .
When prompted to state why the SCF was committed, the loss-aversion option will be selected more frequently than any other.	NA	NA	Not supported  The waste response was cited 54.8% of the time, loss aversion response was 28.9%.	NA
The SCF will be committed less often when participants answer as a fictional, logical character than when they answer according to their own preference.	NA	NA	Not supported  $F = .73$ , $p = .395$ , $\eta_p^2 = .002$ .	The difference when answering as oneself as compared to answering as Sam was .08 for effort, and for time and money .05. No differences were significant.

To date, no studies have compared all three investment types using two different methods that yielded the same results. When holding scenarios constant and manipulating time, effort, and money, the SCF is committed most often for money, then time, then effort. This study did not account for social versus nonsocial activities.

The SCF is more likely to occur if the initial investment is relatively large. Garland and Newport (1991) suggested that decision makers frame SCF scenarios as a choice between a sure loss of the initial investment versus persistence, where persistence has some chance of recovery as well as a higher chance of additional loss. This leads individuals to become more risk-seeking in hopes of an unlikely recovery, rather than accepting the certain loss of sunk costs. Kahneman and Tversky's (1981) proposed a convex value function for loss, that is, the more one invests, the less prominent the losses become. This led Garland and Newport (1991) to suggest that greater initial-investment amounts would lead to higher SCF scores. They demonstrated in two experiments using absolute and relative amounts of initial investments that the SCF was a function of the proportion of allotted resources. Additionally, Arkes and Blumer (1985) reported similar results, namely, that the more a participant paid for season theater tickets the more plays they attended.

The results of the current experiments also provided evidence that the probability of committing the SCF increases with greater initial investments. Experiment 1 demonstrated this same effect using initial-investment ratios of 1:2, 1:3, and 1:5 presented as a percentage of one's time, effort, or money. If participants invested more when the initial investment was larger, they were scored as having committed the SCF. The results indicated that the SCF score rose as the ratio increased. Experiment 2 used a similar procedure, except that amounts were described as

“small”, “medium”, or “large” instead of as percentages. The SCF scores increased as amount increased.

Garland and Newport (1991) used prospect theory to guide their predictions for the effect of relative sunk-cost amounts. Prospect theory and, specifically, loss aversion have been invoked previously to explain the SCF (Arkes & Blumer, 1985; Soman, 2004; Thaler, 1980). The purpose of the current research was to determine whether there is a positive relation between loss aversion and the SCF and, if so, to thereby provide additional evidence for prospect theory. Experiment 1 used the endowment effect as a measure of loss aversion. When describing the discrepancy between WTA and WTP as a manifestation of loss aversion, Kahneman, Knetsch, and Thaler (1990) stated that “An implication of this asymmetry is that if a good is evaluated as a loss when it is given up and as a gain when it is acquired, loss aversion will, on average, induce a higher dollar value for owners than for potential buyers, reducing the set of mutually acceptable trades” (p. 1328).

The participants in Experiment 1 were shown a picture of a lamp, and asked what their WTP and WTA values would be. There was a non-significant negative relation between loss-aversion scores (WTA-WTP) and SCF scores. Experiment 2 used a risky-gamble task as a measure of loss aversion. The more gambles with a positive expected value that were rejected, the more loss averse an individual was judged to be. Now there was a significant negative correlation between loss-aversion scores and SCF scores. Thus, the results of these two experiments did not support the hypothesis. In fact, they suggested that participants who were loss averse were less prone to commit the SCF.

The hypothesis that predicted the SCF would be greater with investments of money than time or effort also was based on prospect theory. It was assumed that a monetary investment



would be viewed as a loss more often than investments of time or effort would be because people generally do not track time or effort in the same ways they track money, and so might more easily recognize time and effort as irretrievable sunk investments (Soman, 2001). Prospect theory applied to the SCF assumes that individuals view the initial investment as a loss, which becomes a certain loss when discontinuing to invest and a loss with at least a small chance of recovery with continued investments (Garland & Newport, 1991). I assumed that investments of time and effort would be viewed as investments with no chance of recovery, regardless of future action. This prediction was correct in that monetary investments more often led to the SCF than time or effort did, but SCF scores were negatively correlated with loss-aversion scores for both loss aversion tasks. More baffling is that, when the correlations were separated by investment type, money was still negative and even significant ( $r = -.12, p = .037$ ) in Experiment 2.

It may be that participants were more likely to commit the SCF for monetary investments compared to time or effort because they are more accustomed to applying the rule “don’t waste” to situations involving money or physical goods than those involving time or effort. This may explain why the SCF was more likely to occur with monetary investments, even though evidence for loss aversion was sparse. In Experiment 2, participants were asked why they continued to invest if they had committed the SCF. This was an additional way of investigating loss aversion as the primary factor in the SCF. Other options included to avoid waste, to learn a lesson, to appear consistent, or for some other reason the participant was asked to indicate. The most common reason given was to avoid waste (see Table 10 and figure 5). However, this reason may have been a veiled version of loss aversion, especially given that participants were prone to cite the rule “don’t waste” when investments were monetary. The results for time and effort may have reflected the fact that participants were less practiced in avoiding wasted time and

especially unaccustomed to avoiding wasted effort. That is, the differences in SCF scores across investment types in Experiments 1 and 2 may be better explained as a misapplication of the rule “don’t waste” than could be considered tantamount to loss aversion.

Haller and Schwabe (2014) reported that those participants who committed the SCF demonstrated reduced activity in the orbitofrontal cortex and the ventromedial prefrontal cortex. These brain regions are thought to be involved in estimating expected value or utility. The authors also found a correlation between SCF scores and those on a questionnaire related to the appearance of being wasteful. Specifically, those most concerned about appearing wasteful were more likely to commit the SCF. They also exhibited increased activity in the dorsolateral prefrontal cortex, an area associated with rule-governed behavior, giving evidence that the SCF may best be explained as a misapplication of the rule “don’t waste”, rather than as participants becoming risk-seeking in light of losses.

Klaczynski and Cottrell (2004) described the SCF in terms of dual-process theory in which system 1 gives an automatic irrational response. They encouraged participants to override system 1 by providing them with written arguments describing why the SCF was irrational. This manipulation reduced SCF scores. The current study also attempted to encourage participants to use system 2 by answering scenarios as a fictional but logical person named Sam, while, in addition, answering them as they normally would. SCF scores decreased across all investment types when answering as Sam; however, none of the differences was significant. Bornstein and Chapman (1995) also used perspective-taking in SCF scenarios wherein participants were assigned to take the perspective of the decision maker or as someone who was advising the decision maker and portrayed as a hypothetical other. The researchers found no difference as a function of perspectives.

The study that most closely resembles perspective taking in the Experiment 2 was reported by Klaczynski (2001). Participants were asked to answer sunk-cost scenarios as they normally would and also as a “perfectly logical person”. The author found that this frame reduced SCF occurrences, but the effect of the frame was larger for other judgment and decision-making tasks. It may be that participants in my study simply did not have the resources to override system 1 in these scenarios. They also may not have understood the normative response, as many stated that their thinking was similar to Sam’s, but yet they committed the SCF in both perspectives. If individuals become more capable of overriding system 1 as they age, a future study could investigate how framing the SCF differs with younger and older participants, assuming that the ability to assign the normative response to Sam may come later in life.

### **Limitations, Implications, and Future Directions**

There were limitations of the current study that should be considered in future research. In Experiment 1, the effects of initial-investment type and amount aligned with previous research findings. However, some participants reported that describing investment amounts in terms of percentages was confusing. This concern was addressed in Experiment 2, which replaced percentages by the general descriptors of “small”, “medium”, or “large”. This allowed resources of time, effort, and money to be evaluated on similar scales and yielded comparable results to those of Experiment 1.

When participants in Experiment 2 were asked to indicate why they had continued to invest after committing the SCF, the most common response was to avoid waste. Some participants commented that the answer options were confusing, specifically, loss aversion. This may have been because it was similar to the “don’t waste” response but also included a risk-

seeking component. This may be further evidence that loss aversion does not explain the SCF in all circumstances. For example, if an individual made a flavorless bad batch of soup (such as was described by items 31-36 in Appendix A and items 16-18 in Appendix C), there is no risk in continuing to eat the soup, as it is clear the soup is not going to improve with each serving. Further research could explore whether loss aversion is correlated more with scenarios in which continuing to invest has a small chance of leading to a positive outcome, and if this risk-seeking reasoning is stated by participants. It may also be beneficial to ask participants to describe their decision-making process for each scenario and to code responses after the fact.

Participants in Experiment 2 were asked to respond to five scenarios as they normally would (Self) and to five as Sam. Each scenario was randomly selected to be answered as Self or Sam. Some participants commented that it was confusing to switch back and forth. Future research may benefit from randomly assigning participants to one perspective or the other and not to both. Alternatively, researchers could present Self-scenarios as a block, followed by the Sam-scenarios, or vice versa.

Certain implications of my findings may be important. First, the SCF is more likely to occur with relatively large investments. This may be an important consideration for large-scale investors and leaders, as illogical decision making by policy makers may have particularly damaging effects (for examples, see Arkes and Blumer, 1985). Second, the SCF is most likely to occur when the initial investment is money. This finding may be useful for inclusion in programs designed to teach rational decision making, wherein an emphasis can be placed on how past investments of all types and amounts should have no effect on future decisions. Also, because participants most often justified the SCF as avoiding waste, such programs may well stress when the rule “don’t waste” is applicable versus when it is not.

Perhaps it would be valuable to create environments that capitalize on decision making fallacies rather than try to reduce them (Thaler & Sunstein, 2008). For example, Volpp et al. (2008) used deposit contracts to help participants lose weight. This was a monetary investment made by each participant that was lost if his or her weight goal was not achieved. Deposit contracts such as this rely on the SCF. My findings suggest such contracts would be most successful when the investment is monetary and large.

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## Appendix A

## Study 1 SCF questionnaire

1. You started reading a novel by a best-selling author. You have spent (10%, 5%, or 8%) of your time reading, however, the novel just doesn't seem to be written in a way that grabs your attention. Whenever you read the novel, your mind wanders. Which option will you choose?
  - a) Stop reading the novel immediately
  - b) Read 25 more pages
  - c) Read 50 more pages
  - d) Read 75 more pages
  - e) Finish reading the novel
2. You started reading a novel by a best-selling author. You have spent (20%, 15% or 40%) of your time reading, however, the novel just doesn't seem to be written in a way that grabs your attention. Whenever you read the novel, your mind wanders. Which option will you choose?
  - a) Stop reading the novel immediately
  - b) Read 25 more pages
  - c) Read 50 more pages
  - d) Read 75 more pages
  - e) Finish reading the novel
3. You started reading a novel by a best-selling author, which for this straightforward book took only (10%, 5%, or 8%) of your energy. However, the novel just doesn't seem to be written in a way that grabs your attention. Whenever you read the novel, your mind wanders. Which option will you choose?
  - a) Stop reading the novel immediately
  - b) Read 25 more pages
  - c) Read 50 more pages
  - d) Read 75 more pages
  - e) Finish reading the novel
4. You started reading a novel by a best-selling author, which for this book took (20%, 15% or 40%) of concentrated energy. However, the novel just doesn't seem to be written in a way that grabs your attention. Whenever you read the novel, your mind wanders. Which option will you choose?
  - a) Stop reading the novel immediately
  - b) Read 25 more pages
  - c) Read 50 more pages
  - d) Read 75 more pages
  - e) Finish reading the novel
5. You started reading a novel by a best-selling author that cost you (10%, 5%, or 8%) of your money. However, the novel just doesn't seem to be written in a way that grabs your attention. Whenever you read the novel, your mind wanders. Which option will you choose?
  - a) Stop reading the novel immediately
  - b) Read 25 more pages
  - c) Read 50 more pages
  - d) Read 75 more pages
  - e) Finish reading the novel
6. You started reading a novel by a best-selling author that cost you (20%, 15% or 40%) of your money. However, the novel just doesn't seem to be written in a way that grabs your attention. Whenever you read the novel, your mind wanders. Which option will you choose?
  - a) Stop reading the novel immediately
  - b) Read 25 more pages
  - c) Read 50 more pages
  - d) Read 75 more pages
  - e) Finish reading the novel
7. You decide to learn how to play the cello. You have spent (20%, 10%, or 15%) of your time to practicing diligently, and you find you are no

- longer interested and contemplate quitting. Which option will you choose?
- Discontinue from practicing immediately
  - Practice for 2 more weeks
  - Practice for 3 more weeks
  - Practice for 4 more weeks
  - Continue to practice without thought of quitting
8. You decide to learn how to play the cello. You have spent (40%, 30%, or 75%) of your time practicing diligently, and you find you are no longer interested and contemplate quitting. Which option will you choose?
- Discontinue from practicing immediately
  - Practice for 2 more weeks
  - Practice for 3 more weeks
  - Practice for 4 more weeks
  - Continue to practice without thought of quitting
9. You decide to take cello lessons. Each lesson takes (20%, 10%, or 15%) of your energy and you find you are no longer interested and contemplate quitting. Which option will you choose?
- Discontinue from practicing immediately
  - Practice for 2 more weeks
  - Practice for 3 more weeks
  - Practice for 4 more weeks
  - Continue to practice without thought of quitting
10. You decide to take cello lessons. Each lesson takes (40%, 30%, or 75%) of your energy and you find you are no longer interested and contemplate quitting. Which option will you choose?
- Discontinue from practicing immediately
  - Practice for 2 more weeks
  - Practice for 3 more weeks
  - Practice for 4 more weeks
  - Continue to practice without thought of quitting
11. You decide to take cello lessons. After you buy a cello and pay (20%, 10%, or 15%) of your money for lessons, you find you are no longer interested and contemplate quitting. Which option will you choose?
- Discontinue from practicing immediately
  - Practice for 2 more weeks
  - Practice for 3 more weeks
  - Practice for 4 more weeks
  - Continue to practice without thought of quitting
12. You decide to take cello lessons. After you buy a cello and pay (40%, 30%, or 75%) of your money for lessons, you find you are no longer interested and contemplate quitting. Which option will you choose?
- Discontinue from practicing immediately
  - Practice for 2 more weeks
  - Practice for 3 more weeks
  - Practice for 4 more weeks
  - Continue to practice without thought of quitting
13. You select a school group project. After you and your group members spent (30%, 15, or 18%) of your time on it, you discover a better project for the assignment. Which option will you choose?
- Discard the current project
  - Continue with the project for 1 more week
  - Continue with the project for 2 more weeks
  - Continue with the project for 3 more weeks

- e) Continue the project until it is complete
14. You select a school group project. After you and your group members spent (60%, 45%, or 90%) of your time on it, you discover a better project for the assignment. Which option will you choose?
- Discard the current project
  - Continue with the project for 1 more week
  - Continue with the project for 2 more weeks
  - Continue with the project for 3 more weeks
  - Continue the project until it is complete
15. You select a school group project. After you and your group members work on it for a week with only (30%, 15, or 18%) energy, you discover a better project for the assignment. Which option will you choose?
- Discard the current project
  - Continue with the project for 1 more week
  - Continue with the project for 2 more weeks
  - Continue with the project for 3 more weeks
  - Continue the project until it is complete
16. You select a school group project. After you and your group members work on it for a week with (60%, 45%, or 90%) energy, you discover a better project for the assignment. Which option will you choose?
- Discard the current project
  - Continue with the project for 1 more week
  - Continue with the project for 2 more weeks
- d) Continue with the project for 3 more weeks
- e) Continue the project until it is complete
17. You select a school group project. After you and your group members buy supplies with (30%, 15, or 18%) of your money, you discover a better project for the assignment. Which option will you choose?
- Discard the current project
  - Continue with the project for 1 more week
  - Continue with the project for 2 more weeks
  - Continue with the project for 3 more weeks
  - Continue the project until it is complete
18. You select a school group project. After you and your group members buy supplies with (60%, 45%, or 90%) of your money, you discover a better project for the assignment. Which option will you choose?
- Discard the current project
  - Continue with the project for 1 more week
  - Continue with the project for 2 more weeks
  - Continue with the project for 3 more weeks
  - Continue the project until it is complete
19. You find a documentary film that appears interesting and you begin to watch it. After spending (10%, 5%, or 7%) of your time you realize you are not enjoying it. Which option will you choose?
- Stop watching entirely
  - Watch for 10 more minutes
  - Watch for 15 more minutes
  - Watch for 20 more minutes

- e) Watch until the end
20. You find a documentary film that appears interesting and you begin to watch it. After spending (20%, 15% or 35%) of your time you realize you are not enjoying it. Which option will you choose?
- Stop watching entirely
  - Watch for 10 more minutes
  - Watch for 15 more minutes
  - Watch for 20 more minutes
  - Watch until the end
21. You find a documentary film that appears interesting and you begin to watch it. During the film you find it takes just (10%, 5%, or 7%) of your energy to understand and you realize you are not enjoying it. Which option will you choose?
- Stop watching entirely
  - Watch for 10 more minutes
  - Watch for 15 more minutes
  - Watch for 20 more minutes
  - Watch until the end
22. You find a documentary film that appears interesting and you begin to watch it. During the film you find it takes (20%, 15% or 35%) of your energy to understand and you realize you are not enjoying it. Which option will you choose?
- Stop watching entirely
  - Watch for 10 more minutes
  - Watch for 15 more minutes
  - Watch for 20 more minutes
  - Watch until the end
23. You find a documentary film that appears interesting and pay (10%, 5%, or 7%) of your money to watch it. During the film you realize you are not enjoying it. Which option will you choose?
- Stop watching entirely
  - Watch for 10 more minutes
  - Watch for 15 more minutes
  - Watch for 20 more minutes
  - Watch until the end
24. You find a documentary film that appears interesting and pay (20%, 15% or 35%) of your money to watch it. During the film you realize you are not enjoying it. Which option will you choose?
- Stop watching entirely
  - Watch for 10 more minutes
  - Watch for 15 more minutes
  - Watch for 20 more minutes
  - Watch until the end
25. You spent (8%, 6%, or 6%) of your time driving to a state park for a hike. When you arrive, it has turned cold and rainy. You do not really want to hike in these conditions. Which option will you choose?
- Do not attempt the hike
  - Complete 1/3 of the hike
  - Complete 1/2 of the hike
  - Complete 2/3 of the hike
  - Complete the entire hike
26. You spent (16%, 18%, or 30%) of your time driving to a state park for a hike. When you arrive, it has turned cold and rainy. You do not really want to hike in these conditions. Which option will you choose?
- Do not attempt the hike
  - Complete 1/3 of the hike
  - Complete 1/2 of the hike
  - Complete 2/3 of the hike
  - Complete the entire hike
27. You drive on calm roads that require only (8%, 6%, or 6%) of your energy in driving to a state park for a hike. When you arrive, it has turned cold and rainy. You do not really want to hike in these

- conditions. Which option will you choose?
- Do not attempt the hike
  - Complete 1/3 of the hike
  - Complete 1/2 of the hike
  - Complete 2/3 of the hike
  - Complete the entire hike
28. You drive in heavy traffic requiring (16%, 18%, or 30%) of your energy driving to a state park for a hike. When you arrive, it has turned cold and rainy. You do not really want to hike in these conditions. Which option will you choose?
- Do not attempt the hike
  - Complete 1/3 of the hike
  - Complete 1/2 of the hike
  - Complete 2/3 of the hike
  - Complete the entire hike
29. You spent (8%, 6%, or 6%) of your money online purchasing tickets to a state park for a hike. When you arrive, it has turned cold and rainy. You do not really want to hike in these conditions. Which option will you choose?
- Do not attempt the hike
  - Complete 1/3 of the hike
  - Complete 1/2 of the hike
  - Complete 2/3 of the hike
  - Complete the entire hike
30. You spent (16%, 18%, or 30%) of your money online purchasing tickets to a state park for a hike. When you arrive, it has turned cold and rainy. You do not really want to hike in these conditions. Which option will you choose?
- Do not attempt the hike
  - Complete 1/3 of the hike
  - Complete 1/2 of the hike
  - Complete 2/3 of the hike
  - Complete the entire hike
31. You spent (9%, 4%, or 8%) of your time preparing a large batch of soup using a new recipe. As you finish, you find that you do not really like the soup. Even after adding spices you do not like the taste. Which option will you choose?
- Do not eat any more servings of soup
  - Eat at least 1 more serving of soup
  - Eat at least 3 more servings of soup
  - Eat at least 5 more servings of soup
  - Finish eating all of the servings of soup
32. You spent (18%, 12%, or 40%) of your time preparing a large batch of soup using a new recipe. As you finish, you find that you do not really like the soup. Even after adding spices you do not like the taste. Which option will you choose?
- Do not eat any more servings of soup
  - Eat at least 1 more serving of soup
  - Eat at least 3 more servings of soup
  - Eat at least 5 more servings of soup
  - Finish eating all of the servings of soup
33. You prepare a large batch of soup using a new recipe. The recipe is easy to follow requiring only (9%, 4%, or 8%) of your energy. As you finish, you find that you do not really like the soup. Even after adding spices you do not like the taste. Which option will you choose?
- Do not eat any more servings of soup
  - Eat at least 1 more serving of soup
  - Eat at least 3 more servings of soup
  - Eat at least 5 more servings of soup
  - Finish eating all of the servings of soup
34. You prepare a large batch of soup using a new recipe. The recipe is complicated and requires (18%, 12%, or 40%) of concentrated energy to follow. As you finish, you find that you do not really

- like the soup. Even after adding spices you do not like the taste. Which option will you choose?
- Do not eat any more servings of soup
  - Eat at least 1 more serving of soup
  - Eat at least 3 more servings of soup
  - Eat at least 5 more servings of soup
  - Finish eating all of the servings of soup
35. You spent (9%, 4%, or 8%) of your money on ingredients to make a large batch of soup using a new recipe. As you finish, you find that you do not really like the soup. Even after adding spices you do not like the taste. Which option will you choose?
- Do not eat any more servings of soup
  - Eat at least 1 more serving of soup
  - Eat at least 3 more servings of soup
  - Eat at least 5 more servings of soup
  - Finish eating all of the servings of soup
36. You spent (18%, 12%, or 40%) of your money on ingredients to make a large batch of soup using a new recipe. As you finish, you find that you do not really like the soup. Even after adding spices you do not like the taste. Which option will you choose?
- Do not eat any more servings of soup
  - Eat at least 1 more serving of soup
  - Eat at least 3 more servings of soup
  - Eat at least 5 more servings of soup
  - Finish eating all of the servings of soup
37. You are writing to your best friend, detailing a story that happened to you recently. You have spent (5%, 4%, or 3%) of your time when you realize that if you had told the story another way it would have been funnier and easier to understand. Which option will you choose?
- Stop writing the letter immediately and start over
  - Write for 10 more minutes
  - Write for 15 more minutes
  - Write for 20 more minutes
  - Finish the entire letter
38. You are writing to your best friend, detailing a story that happened to you recently. You have spent (10%, 12%, or 15%) of your time when you realize that if you had told the story another way it would have been funnier and easier to understand. Which option will you choose?
- Stop writing the letter immediately and start over
  - Write for 10 more minutes
  - Write for 15 more minutes
  - Write for 20 more minutes
  - Finish the entire letter
39. You are writing to your best friend, detailing a story that happened to you recently. Writing is a very easy activity for you requiring only (5%, 4%, or 3%) of your energy, but you realize that if you had told the story another way it would have been funnier and easier to understand. Which option will you choose?
- Stop writing the letter immediately and start over
  - Write for 10 more minutes
  - Write for 15 more minutes
  - Write for 20 more minutes
  - Finish the entire letter
40. You are writing to your best friend, detailing a story that happened to you recently. Writing is a very effortful activity for you requiring (10%, 12%, or 15%) of your energy, but you realize that if you had told the story another way it would have been funnier and easier to

- understand. Which option will you choose?
- Stop writing the letter immediately and start over
  - Write for 10 more minutes
  - Write for 15 more minutes
  - Write for 20 more minutes
  - Finish the entire letter
41. You are writing to your best friend, detailing a story that happened to you recently. You spent (5%, 4%, or 3%) of your money on the stationary you're using and realize that if you had told the story another way it would have been funnier and easier to understand. Which option will you choose?
- Stop writing the letter immediately and start over
  - Write for 10 more minutes
  - Write for 15 more minutes
  - Write for 20 more minutes
  - Finish the entire letter
42. You are writing to your best friend, detailing a story that happened to you recently. You spent (10%, 12%, or 15%) of your money on the stationary you're using and realize that if you had told the story another way it would have been funnier and easier to understand. Which option will you choose?
- Stop writing the letter immediately and start over
  - Write for 10 more minutes
  - Write for 15 more minutes
  - Write for 20 more minutes
  - Finish the entire letter
43. As a private in the Army, you plan a way to inventory weapons for your commanding officer. After working on it for (30%, 15%, or 18%) of your time, you figure out a new method that will work better. Which option will you choose?
- Immediately discontinue your current method of inventory
  - Continue with the current method for 1 more week
  - Continue with the current method for 2 more weeks
  - Continue with the current method for 3 more weeks
  - Continue with the current method without thought of changing
44. As a private in the Army, you plan a way to inventory weapons for your commanding officer. After working on it for (60%, 45%, or 90%) of your time, you figure out a new method that will work better. Which option will you choose?
- Immediately discontinue your current method of inventory
  - Continue with the current method for 1 more week
  - Continue with the current method for 2 more weeks
  - Continue with the current method for 3 more weeks
  - Continue with the current method without thought of changing
45. As a private in the Army, you plan a way to inventory weapons for your commanding officer. After working on it with only (30%, 15%, or 18%) of your energy, you figure out a new method that will work better. Which option will you choose?
- Immediately discontinue your current method of inventory
  - Continue with the current method for 1 more week
  - Continue with the current method for 2 more weeks
  - Continue with the current method for 3 more weeks
  - Continue with the current method without thought of changing

46. As a private in the Army, you plan a way to inventory weapons for your commanding officer. After working on it with (60%, 45%, or 90%) of your energy, you figure out a new method that will work better. Which option will you choose?
- Immediately discontinue your current method of inventory
  - Continue with the current method for 1 more week
  - Continue with the current method for 2 more weeks
  - Continue with the current method for 3 more weeks
  - Continue with the current method without thought of changing
47. As a private in the Army, you plan a way to inventory weapons for your commanding officer. Your plan so far has cost (30%, 15%, or 18%) of your money. After working on it, you figure out a new method that will work better. Which option will you choose?
- Immediately discontinue your current method of inventory
  - Continue with the current method for 1 more week
  - Continue with the current method for 2 more weeks
  - Continue with the current method for 3 more weeks
  - Continue with the current method without thought of changing
48. As a private in the Army, you plan a way to inventory weapons for your commanding officer. Your plan so far has cost (60%, 45%, or 90%) of your money. After working on it, you figure out a new method that will work better. Which option will you choose?
- Immediately discontinue your current method of inventory
  - Continue with the current method for 1 more week
  - Continue with the current method for 2 more weeks
  - Continue with the current method for 3 more weeks
  - Continue with the current method without thought of changing
49. You join a recreational soccer team. After have given (25%, 10%, or 15%) of your time to practices, you decide you would rather play softball. Which option will you choose?
- Do not take attend anymore practices
  - Attend 1 more practice
  - Attend 2 more practices
  - Attend 3 more practices
  - Attend all the remaining practices
50. You join a recreational soccer team. After you have given (50%, 30%, or 75%) of your time to practices, you decide you would rather play softball. Which option will you choose?
- Do not take attend anymore practices
  - Attend 1 more practice
  - Attend 2 more practices
  - Attend 3 more practices
  - Attend all the remaining practices
51. You join a recreational soccer team. You spend (25%, 10%, or 15%) of your energy in practices, but you decide you would rather play softball. Which option will you choose?
- Do not take attend anymore practices
  - Attend 1 more practice
  - Attend 2 more practices
  - Attend 3 more practices
  - Attend all the remaining practices
52. You join a recreational soccer team. You spend (50%, 30%, or 75%) of your energy in practices, but you decide you



- would rather play softball. Which option will you choose?
- Do not take attend anymore practices
  - Attend 1 more practice
  - Attend 2 more practices
  - Attend 3 more practices
  - Attend all the remaining practices
53. You join a recreational soccer team. After you spend (25%, 10%, or 15%) of your money to join and buy soccer equipment, you decide you would rather play softball. Which option will you choose?
- Do not take attend anymore practices
  - Attend 1 more practice
  - Attend 2 more practices
  - Attend 3 more practices
  - Attend all the remaining practices
54. You join a recreational soccer team. After you spent (50%, 30%, or 75%) of your money to join and buy soccer equipment, you decide you would rather play softball. Which option will you choose?
- Do not take attend anymore practices
  - Attend 1 more practice
  - Attend 2 more practices
  - Attend 3 more practices
  - Attend all the remaining practices
55. You are trying to lose weight and increase your level of fitness. You signed up for a 15-week fitness and weight loss program. After spending (30%, 15%, or 18%) of your time in the program, you still have not lost any weight and your fitness level seems the same. You are beginning to get discouraged. Which option will you choose?
- Do not attend any more weeks
  - Attend 1 more week
  - Attend 2 more weeks
  - Attend 3 more weeks
- e) Attend all of the remaining weeks
56. You are trying to lose weight and increase your level of fitness. You signed up for a 15-week fitness and weight loss program. After spending (60%, 45%, or 90%) of your time in the program, you still have not lost any weight and your fitness level seems the same. You are beginning to get discouraged. Which option will you choose?
- Do not attend any more weeks
  - Attend 1 more week
  - Attend 2 more weeks
  - Attend 3 more weeks
  - Attend all of the remaining weeks
57. You are trying to lose weight and increase your level of fitness. You signed up for a 15-week fitness and weight loss program. After you spent (30%, 15%, or 18%) of your energy in the program, you still have not lost any weight and your fitness level seems the same. You are beginning to get discouraged. Which option will you choose?
- Do not attend any more weeks
  - Attend 1 more week
  - Attend 2 more weeks
  - Attend 3 more weeks
  - Attend all of the remaining weeks
58. You are trying to lose weight and increase your level of fitness. You signed up for a 15-week fitness and weight loss program. After you spent (60%, 45%, or 90%) of your energy in the program, you still have not lost any weight and your fitness level seems the same. You are beginning to get discouraged. Which option will you choose?
- Do not attend any more weeks
  - Attend 1 more week

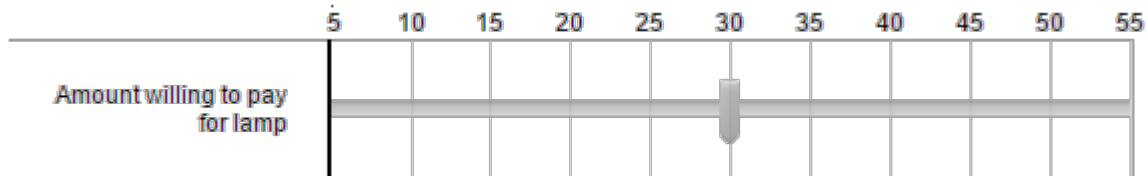
- c) Attend 2 more weeks
  - d) Attend 3 more weeks
  - e) Attend all of the remaining weeks
59. You are trying to lose weight and increase your level of fitness. You paid (30%, 15%, or 18%) of your money for a 15-week fitness and weight loss program. After following the program, you still have not lost any weight and your fitness level seems the same. You are beginning to get discouraged. Which option will you choose?
- a) Do not attend any more weeks
  - b) Attend 1 more week
  - c) Attend 2 more weeks
  - d) Attend 3 more weeks
60. You are trying to lose weight and increase your level of fitness. You paid (60%, 45%, or 90%) of your money for a 15-week fitness and weight loss program. After following the program, you still have not lost any weight and your fitness level seems the same. You are beginning to get discouraged. Which option will you choose?
- a) Do not attend any more weeks
  - b) Attend 1 more week
  - c) Attend 2 more weeks
  - d) Attend 3 more weeks
  - e) Attend all of the remaining weeks

## Appendix B

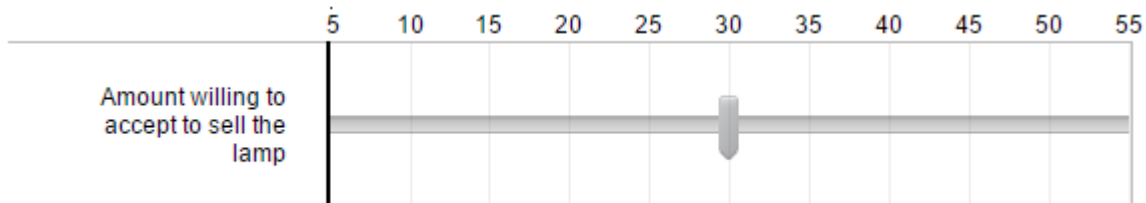
## Study 1 Loss-aversion task-endowment effect



1. The lamp featured has a retail price of \$29.99. Use the slider to indicate the amount of money in dollars and cents you would be willing to pay for this lamp.



2. Imagine that you own the lamp featured in the previous question. A person asks if he/she is able to purchase it from you and asks what you think a fair price would be. Use the slider to indicate how much you would be willing to sell the lamp if you in fact owned it.



## Appendix C

## Study 2 Sunk-cost perspective-taking questionnaire

1. While at the library, you spot a best-selling novel that looks interesting. As you begin reading, the 200 page novel just doesn't seem to be written in a way that grabs your attention and your mind wanders. Which option will you choose?
  - a. Stop reading the novel immediately
  - b. Read 25 more pages
  - c. Read 50 more pages
  - d. Read 75 more pages
  - e. Finish reading the novel
2. You started reading a novel by a best-selling author. You have spent a (small/medium/large) amount of your (time reading or energy reading or money on the book) and 200 pages remain, however, the novel just doesn't seem to be written in a way that grabs your attention. Whenever you read the novel, your mind wanders. Which option will you choose?
  - a. Stop reading the novel immediately
  - b. Read 25 more pages
  - c. Read 50 more pages
  - d. Read 75 more pages
  - e. Finish reading the novel
3. Why did you decide to continue to read the novel?
  - a. Because it is better to chance that you will continue to dislike the book, than know for certain that the (time, money or energy) you spent was a waste
  - b. Because otherwise you will have lost the (time, money or energy) you have already spent with the best-selling novel.
  - c. Because if you stop, it would mean you made a bad decision in deciding to read the book. If it was the right decision then, it is still the right decision.
  - d. To teach yourself that next time you should be more careful about what books you spend your (time, money or energy) on.
4. You decide to learn how to play the cello and borrow one from your school at no cost. After just beginning, you find you are no longer interested and contemplate quitting. Which option will you choose?
  - a. Discontinue from practicing immediately
  - b. Practice for 2 more weeks
  - c. Practice for 3 more weeks
  - d. Practice for 4 more weeks
  - e. Continue to practice without thought of quitting
5. You decide to learn how to play the cello. You have spent a (small/medium/large) amount of your (time practicing diligently or energy practicing diligently or money for the cello), and you find you are no longer interested and

- contemplate quitting. Which option will you choose?
- Discontinue from practicing immediately
  - Practice for 2 more weeks
  - Practice for 3 more weeks
  - Practice for 4 more weeks
  - Continue to practice without thought of quitting
6. Why did you decide to continue to play the cello?
- Because it is better to chance that you will continue to dislike playing, than to know for certain that the (time, money or energy) you spent was a waste.
  - Because otherwise you will have lost the (time, money or energy) you already spent with the cello and lessons.
  - Because if you stop that would mean you made a bad decision in deciding to take cello lessons. If it was the right decision then, it is still the right decision.
  - To teach yourself that next time you should be more careful about what hobbies you select for yourself.
7. You select a school group project for which supplies are included. You suspect that the project will take the group around 6 weeks to complete. After you and your group members begin working on it, you discover a better project for the assignment. Which option will you choose?
- Discard the current Project
  - Continue with the project for 1 more week
  - Continue with the project for 2 more weeks
  - Continue with the project for 3 more weeks
  - Continue the project until it is complete
8. You select a school group project. After you and your group members spent a (small/medium/large) amount of your (time, money or energy) on it and suspect you can finish in 6 weeks, you discover a better project for the assignment. Which option will you choose?
- Discard the current Project
  - Continue with the project for 1 more week
  - Continue with the project for 2 more weeks
  - Continue with the project for 3 more weeks
  - Continue the project until it is complete
9. Why did you decide to continue with the group project?
- Because it is better to chance that this project will not be as good, than to know for certain that the (time, money or energy) you spent was a waste
  - Because otherwise you will have lost the (time, money or energy) you already spent with the school group project
  - Because if you stop that would mean your first idea wasn't a good one. If it was the right decision then, it is still the right decision
  - To teach yourself that next time you should be more careful about starting a project without considering alternatives

10. You find a 60 minute documentary film at the library that appears interesting, but as you begin to watch it, you are disappointed with the quality of the film and the depth of the information. Which option will you choose?
- Stop watching entirely
  - Watch for 10 more minutes
  - Watch for 15 more minutes
  - Watch for 20 more minutes
  - Watch until the end
11. You find a documentary film that appears interesting and you begin to watch it. After spending a (small/medium/large) amount of your (time watching or energy watching or money to rent it), there are 60 minutes remaining, but you are disappointed with the quality of the film and the depth of the information. Which option will you choose?
- Stop watching entirely
  - Watch for 10 more minutes
  - Watch for 15 more minutes
  - Watch for 20 more minutes
  - Watch until the end
12. Why did you decide to continue to watching the documentary?
- Because it is better to chance that you will not enjoy the rest of the film than to know for certain that the (time, money or energy) you spent was a waste.
  - Because otherwise you will have lost the (time, money or energy) you spent with the documentary film.
  - Because if you stop that would mean you made a bad decision in choosing the film. If it was the right decision then, it is still the right decision.
- d. To teach yourself that next time you should be more careful about which documentaries you spend your (time, money or energy) on.
13. You plan to drive to a state park for a hike for which you received free tickets. However, right as you get in the car, the weather has turned cold and rainy. You do not really want to hike in these conditions. Which option will you choose?
- Do not attempt the hike
  - Complete 1/3 of the hike
  - Complete 1/2 of the hike
  - Complete 2/3 of the hike
  - Complete the entire hike
14. You spent a (small/medium/large) amount of your (time driving or energy driving or money for a ticket) to a state park for a hike. When you arrive, it has turned cold and rainy. You do not really want to hike in these conditions. Which option will you choose?
- Do not attempt the hike
  - Complete 1/3 of the hike
  - Complete 1/2 of the hike
  - Complete 2/3 of the hike
  - Complete the entire hike
15. Why did you decide to continue hiking?
- Because it is better to chance that you will not enjoy it than to know for certain that the (time, money or energy) spent to get there was a waste.
  - Because otherwise you will have lost the (time, money or

- energy) you spent to get to the hike at the stake park.
- c. Because if you do not that would mean you made a bad decision in choosing to go there. If it was the right decision then, it is still the right decision.
  - d. To teach yourself that next time you should be more watchful about weather conditions.
16. You find a coupon for a large batch of free soup. After tasting it, you find that you do not really like the soup. Even after adding spices you do not like the taste. Which option will you choose?
- a. Do not eat any more servings of soup
  - b. Eat at least 1 more servings of soup
  - c. Eat at least 3 more servings of soup
  - d. Eat at least 5 more servings of soup
  - e. Finish eating all off of the servings of soup
17. You spent a (small/medium/large) amount of your (time or energy or money for ingredients) in preparing a large batch of soup using a new recipe. As you finish, you find that you do not really like the soup. Even after adding spices you do not like the taste. Which option will you choose?
- a. Do not eat any more servings of soup
  - b. Eat at least 1 more servings of soup
  - c. Eat at least 3 more servings of soup
  - d. Eat at least 5 more servings of soup
  - e. Finish eating all off of the servings of soup
18. Why did you decide to continue eating the soup?
- a. Because it is better to chance that you will not enjoy it than to know for certain that the (time, money or energy) spent on making it was a waste.
  - b. Because otherwise you will have lost the (time, money or energy) you spent on making the large batch of soup.
  - c. Because otherwise that would mean you made a bad decision in your choice of recipe. If it was the right decision then, it is still the right decision.
  - d. To teach yourself that next time you should be more careful about which recipes you select.
19. You are writing to your best friend, detailing a story that happened to you recently using stationery you found in your house. As you begin, you realize that if you tell the story in another way than you had planned, it will be funnier and easier to understand. It will take you about 30 minutes to finish the letter. Which option will you choose?
- a. Stop writing the letter immediately and start over
  - b. Write for 10 more minutes
  - c. Write for 15 more minutes
  - d. Write for 20 more minutes
  - e. Finish the entire letter

20. You are writing to your best friend, detailing a story that happened to you recently. You have spent a (small/medium/large) amount of your (time writing or energy writing or money on stationery) when you realize that if you had told the story another way it would have been funnier and easier to understand. It will take you about 30 minutes more to finish the letter. Which option will you choose?
- Stop writing the letter immediately and start over
  - Write for 10 more minutes
  - Write for 15 more minutes
  - Write for 20 more minutes
  - Finish the entire letter
21. Why did you decide to continue with the current letter?
- Because it is better to chance that it will not be as good than to know for certain that the (time, money or energy) spent on it was a waste.
  - Because otherwise you will have lost the (time, money or energy) you spent with the letter to your best friend.
  - Because if you do not that would mean you made a bad decision in describing your story this way. If it was the right decision then, it is still the right decision.
  - To teach yourself that next time you should be more thoughtful about how you describe your stories.
22. As a private in the Army, you plan a way to inventory weapons for your commanding officer. After just beginning to work on it, you figure out a new method that will work better. If you continue with the current plan, it will take you about 5 weeks to complete. Which option will you choose?
- Immediately discontinue your current method of inventory
  - Continue with the current method for 1 more week
  - Continue with the current method for 2 more weeks
  - Continue with the current method for 3 more weeks
  - Continue with the current method without thought of changing
23. As a private in the Army, you plan a way to inventory weapons for your commanding officer. After spending a (small/medium/large) amount of your (time, money or energy) to work on it, you figure out a new method that will work better. If you continue with the current plan, it will take you about 5 weeks to complete. Which option will you choose?
- Immediately discontinue your current method of inventory
  - Continue with the current method for 1 more week
  - Continue with the current method for 2 more weeks
  - Continue with the current method for 3 more weeks
  - Continue with the current method without thought of changing
24. Why did you decide to continue with the current plan?
- Because it is better to chance that it will not be as good than to know for certain that the (time, money or energy) spent on it was a waste.



- b. Because otherwise you will have lost the (time, money or energy) you spent with the current plan to inventory weapons for your commanding officer.
  - c. Because otherwise that would mean you made a bad decision in devising the plan the way you did. If it was the right decision then, it is still the right decision.
  - d. To teach yourself that next time you should be more thoughtful in how you devise your inventory plan.
25. You join a recreational soccer team available through your city for free. After just beginning, you decide you would rather play softball. Which option will you choose?
- a. Do not attend any more weeks
  - b. Attend 1 more week
  - c. Attend 2 more weeks
  - d. Attend 3 more weeks
  - e. Attend all of the remaining weeks
26. You join a recreational soccer team. After you have given a (small/medium/large) amount of your (time to practices or energy to practices or money to join and buy equipment), you decide you would rather play softball. Which option will you choose?
- a. Do not attend any more weeks
  - b. Attend 1 more week
  - c. Attend 2 more weeks
  - d. Attend 3 more weeks
  - e. Attend all of the remaining weeks
27. Why did you decide to continue participating in soccer?
- a. Because it is better to chance that you will not enjoy it than to know for certain that the (time, money or energy) spent on it was a waste.
  - b. Because otherwise you will have lost the (time, money or energy) you spent participating in the recreational soccer team.
  - c. Because if you do not that would mean you made a bad decision in joining the team. If it was the right decision then, it is still the right decision.
  - d. To teach yourself that next time you should be more thoughtful about which sports you decide to participate in.
28. You are trying to lose weight and increase your level of fitness. You signed up for a 15-week fitness and weight loss program offered through your gym at no additional cost. After just beginning the program, you have not lost any weight and lose interest in the program. You are already discouraged. Which option will you choose?
- a. Do not attend any more weeks
  - b. Attend 2 more week
  - c. Attend 4 more weeks
  - d. Attend 6 more weeks
  - e. Attend all of the remaining weeks
29. You are trying to lose weight and increase your level of fitness. You signed up for a fitness and weight loss program. After spending a (small/medium/large) of your (time

in or energy in or money in buying) with the program, you still have not lost any weight and you lose interest in the program. You are beginning to get discouraged. There are 15 weeks remaining in the program. Which option will you choose?

- a. Do not attend any more weeks
  - b. Attend 2 more week
  - c. Attend 4 more weeks
  - d. Attend 6 more weeks
  - e. Attend all of the remaining weeks
30. Why did you decide to continue the program?
- a. Because it is better to chance that it will not help you lose

weight than to know for certain that the (time, money or energy) spent on it was a waste.

- b. Because otherwise you will have lost the (time, money or energy) you spent with the weight loss program.
- c. Because otherwise that would mean you made a bad decision in purchasing it. If it was the right decision then, it is still the right decision.
- d. To teach yourself that next time you should be more thoughtful about which weight loss programs you decide to purchase.

## Appendix D: Informed Consent Forms

### Study 1

My name is Veronika Tait, I am a graduate student at Brigham Young University and I am conducting this research under the supervision of Professor Harold Miller, from the Department of Psychology .You are being invited to participate in this research study of decision making. I am interested in finding out about participants react to scenarios with subtle differences.

Your participation in this study will require the completion of the following questionnaire. This should take approximately 30 minutes of your time. Your participation will be anonymous besides leaving your email address if you choose so. This will not be linked to your answers and you will not be contacted again in the future.

You will compensated with a \$10 Amazon gift card if you choose to participate and leave us your email at the end of the questionnaire. This survey involves minimal risk to you. The benefits, however, may impact society by helping increase knowledge about decision making.

You do not have to be in this study if you do not want to be. You do not have to answer any question that you do not want to answer for any reason. We will be happy to answer any questions you have about this study.

If you have further questions about this project or if you have a research-related problem you may contact me, Veronika Tait at [vrtait@byu.edu](mailto:vrtait@byu.edu) or my advisor, Harold Miller at [Harold\\_miller@byu.edu](mailto:Harold_miller@byu.edu).

If you have any questions about your rights as a research participant you may contact the IRB Administrator at A-285 ASB, Brigham Young University, Provo, UT 84602; [irb@byu.edu](mailto:irb@byu.edu); (801) 422-1461. The IRB is a group of people who review research studies to protect the rights and welfare of research participants.

Now that you are informed about the nature of the survey, clicking the Continue button will constitute as your consent. If you choose to withdraw, click the Withdraw button at this time.

Continue

Withdraw

## Study 2

My name is Veronika Tait. I am a graduate student at Brigham Young University and am conducting this research under the supervision of Professor Harold Miller of the department of psychology. You are being invited to participate in this research study about decision making. I am interested in participants' reactions to scenarios that will include subtle differences.

Your participation in this study will require the completion of a questionnaire. This should take approximately 20 minutes of your time. Your participation will be anonymous. You will be compensated with Amazon credit. The survey involves minimal risk to you. The benefits, however, may impact society by helping increase knowledge about decision making.

You do not have to be in this study if you do not want to be. You do not have to answer any question that you do not want to answer for any reason. Dr. Miller and I will be happy to answer any questions you have about the study. If you have further questions about this project or if you have a research-related problem you may contact me, Veronika Tait at [vrtait@byu.edu](mailto:vrtait@byu.edu) or my advisor, Harold Miller at [harold\\_miller@byu.edu](mailto:harold_miller@byu.edu).

If you have questions about your rights as a research participant you may contact the Institutional Review Board (IRB) Administrator at A-285 ASB, Brigham Young University, Provo, UT 84602; [irb@byu.edu](mailto:irb@byu.edu); (801) 422 – 1461. The IRB is a group of people who review research studies to protect the rights and welfare of research participants.

Now that you are informed about the nature of the survey, clicking the Continue button will constitute your consent. If you choose to withdraw, click the Withdraw button at this time.

Continue

Withdraw