

**Exploring the origin of pain of payment in cash  
and its relevance to computer payment interface**

by

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## DEDICATION

I dedicate this dissertation to my parents, without them I would have never set my foot to study in the US from the beginning. Their lives exemplify what true strength is. I also dedicate this dissertation to my wife Dafang, whose smiles make every bit of effort worthy.

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## ABSTRACT

Past research has found that consumers spend more with credit card than with cash. The current studies shows that the necessity to count out cash can partially explain the effect, and the pain of paying due to counting cash is lowered when the process of counting is disrupted. Subjects in Experiments 1 and 2 hypothetically bought office supplies for a company using a computer. In Experiment 1, subjects paid by dragging-and-dropping (DD) images of cash, DD tokens, typing the virtual check amount, or with a one-click credit card payment. Spending was higher with credit card than with tokens or cash. In Experiment 2, subjects paid with cash using one-click and DD interfaces, and credit card with one-click, DD, and swipe-card interfaces. Spending was significantly lower in the DD conditions than in the one-click conditions, while no difference was observed between cash and credit card. Based on a hypothetical financial profile that controls for budget constrain, subjects in Experiments 3 and 4 were asked to pay their past expenses and then indicated their purchase intention for a discretionary product. In Experiment 3, subjects paid with credit card using one-click or regular DD cash interface, or DD cash interface where subjects were asked to either memorize some English letters or the payment amount right before their payment. The pain of paying was significantly lower in the DD cash interfaces with memory load relative to the regular DD cash interface. In Experiment 4 subjects paid with credit card using one-click interface, DD cash interface with bills of small (\$20) or larger (\$100) denomination. Purchase intention was significantly higher in the large denomination condition relative to the one-click condition while there was no difference in pain of paying across conditions. It is concluded that the need to count cash inhibits spending (Experiment 1 & 2), and the likely mechanism is one's attention to counting rather than the mental rehearsal of the payment amount (Experiment 3) or physical effort (Experiment 2). In

addition, the size of bill denomination also affects one's purchase intention for a product (Experiment 4). Implications of the findings were discussed.

## CHAPTER 1. INTRODUCTION

The US has the highest bankruptcy rate in the world, and part of the problem can be attributed to credit use that leads to rising personal debt (Lown, 2005). This is an issue that is even more relevant nowadays for two reasons. First, online shopping has been more popular than ever, in which most of the transactions are paid by credit card. In 2010, the Internet purchase penetration rate reached 90% of US consumers, and 16% of all consumers will increase the use of mobile devices to purchase over the Internet (2010 BAI & Hitachi study of consumer payment preferences, 2010). The rising online shopping penetration rate implies that one can purchase impulsively without physically going out or when one is on the go with one's mobile devices. Second, more and more transactions will be made by non-cash payment methods. Despite an increase in cash use following the beginning of the economic recession in 2008, in 2009 cash payments represented 28.2% of payments made by consumers in a typical month, compared to 47.8% of transactions made with debit, credit, or pre-paid cards (Foster, Meijer, Schuh, & Zabek, 2011). In addition, the US Federal Reserve estimates that in the economy as a whole, non-cash payments increased at a compounded rate of 4.6% per year between 2006 and 2010 (Board of Governors of the Federal Reserve System, 2011). Therefore, understanding what factors drive overspending that is related to credit card use is of paramount importance not just at a household level but also at a national level.

Since "overspending" with credit cards cannot exist without reference to another payment method such as cash, the mechanisms that lead to "under spending" in cash relative to credit card payment are investigated. With a better understanding of the origin of the spending-inhibiting effects of cash and other payment methods and its relevance to the growing popularity of online

shopping, society could be in a better position to mitigate the issue of debt arising from the use of credit cards. The current paper is structured as follows. First, the evidence for different consumer spending patterns across different payment methods is reviewed. Unique factors that are inherited by specific payment methods that are shown to affect spending are then introduced. Next the concepts of payment transparency and pain of payment as well as their relevance in explaining spending differences across payment methods are introduced and discussed. Finally, the origin of the spending-inhibiting effect of cash and its relevance to today's computer payment interfaces is explored across four experiments. The findings are summarized and their implications are discussed.

## CHAPTER 2. LITERATURE REVIEW

### **Consumer Spending as a Function of Payment Method**

Normatively speaking, one's preference should not be dependent on how information is framed (Kahneman & Tversky, 1979; Tversky, Sattath, & Slovic, 1988). In the context of consumer spending, the decision to purchase should be independent of how the transaction is paid, such as whether it is paid by cash, by a check, or by a credit card. For instance, how likely a consumer is to purchase a product or how much he or she is willing to pay for the product should be the same regardless of the payment method. However, there is considerable amount of evidence that payment method can have a substantial impact on one's spending behavior.

Two studies that used real-world data show that when consumers paid by credit card, they either paid significantly more or were more likely to make a purchase compared to when they paid by other payment method. Using actual transaction data, Hirschman (1979) showed that consumers who use credit cards spent more than the counterparts who used other payment methods such as cash or check, after controlling for other factors. More recently, Inman, Winer, and Ferraro (2009) interviewed more than 2300 consumers across multiple stores and found that when consumers paid by cash, they were significantly less likely to commit to unplanned purchases compared to consumers who paid by either check or credit card. Although important in establishing that payment method influences spending in real-world transactions, the correlational nature of these studies does not allow one to draw causal inferences.

Supporting the evidence of real-world data, ample experimental studies also show that the mere expectation of a specific payment by credit card can elicit significantly higher spending

compared to expected cash payment. For instance, Raghurir and Srivastava (2008) found that when subjects were asked to estimate the cost of a party based on a prepared menu for another person (Experiment 2), those who expected the payment would be made by credit card gave significantly higher cost estimation than those who expected the payment would be made by cash. The effect of increased willingness-to-pay (WTP) due to the use of credit card was also replicated by Monger and Feinberg (1997). They showed in a laboratory experiment that when participants were told that they would use credit card for payment, the estimated fair prices for various products were significantly higher than the counterparts who were informed to pay by cash. A similar conclusion was obtained by Prelec and Simester (2001) in a real second price sealed bid auction for tickets to sporting events. Subjects paid substantially more for the tickets when payments were made by credit card than cash (Experiment 1). Consequently, substantial evidence demonstrates that the expectancy of paying with credit card increases one's spending relative to expected cash payment.

### **Factors Inherited in Payment Methods that Affect Spending**

Various experimental studies attempted to investigate the features inherited in different payment methods that cause difference in spending amount or the probability of making purchase, and one of the earliest factors identified was the effect of credit card logo. Feinberg (1986) found across two experiments that participants indicated higher WTP for various consumer goods in the presence of a credit card logo than when it was absent. In addition, the reaction time for deciding the WTP for consumer goods (Experiment 2) as well as for the decision of actually donating money to a charity (Experiment 4) was almost halved in the presence of credit card logo (6.72s vs. 12.04s in Experiment 4). Feinberg suggested that this effect might be due to long-term conditioning that associates the presence of a credit card logo

with spending money since the primary function of credit card is for making payment. McCall and Belmont (1996) extended this effect across two field studies in different restaurants and found that in both studies diners tipped significantly more in the presence of credit card logo than in its absence. For instance, those who did not see the credit card logo tipped an average of 17.5% of the bill amount while those who saw the credit card logo tipped an average of 21.9% of the bill amount. Raghurir and Srivastava (2008) came to the same findings that people's WTP for a meal was significantly higher when credit card logo was present (Experiment 1).

In the case of cash, one's familiarity with the currency and whether one pays by bank notes or by coins have been shown to influence the perceived purchasing power of one's money, a precursor that could lead to a difference in subsequent spending. Alter and Oppenheimer (2008) showed that participants perceived higher purchasing power for currency with a familiar form (e.g. two \$1 bill) than currency with an unfamiliar form (e.g. a \$2 bill). When participants' currency was given in a familiar form, participants' estimates of how many various low value items (e.g. pencils) they could purchase were significantly higher than when the currency was given in an unfamiliar form. The authors attributed the disparity of perceived purchasing power to the processing fluency of the currency, where familiar currency could be processed more fluently compared to unfamiliar currency. As for the case of bank notes versus coins, across four experiments Tessari et al. (2011) showed that people were willing to pay more for the same merchandises when they paid with coins than with bank note. They argued that bank notes and coins were associated with high and low value purchase, respectively. By using the Implicit Association Test, they showed that the association of coins with low value purchases (e.g. a pencil) was significantly stronger than the association of coins with high value purchases (e.g. a diamond ring), supporting their argument.

## **Payment Transparency and Pain of Payment**

While some studies focus on factors that are specific within a payment method (e.g. credit card logo and familiarity of currency), Soman (2003) proposed the concept of payment transparency that attempts to explain different spending patterns across different payment methods, and provides a conceptual framework for understanding past studies. Payment transparency refers to the salience of making a payment with a given payment method. The more transparent the payment method is, the stronger the cues associated with the payment method that remind one of one's wealth depletion. This should increase the "pain of payment" – the negative emotion experienced when parting with money (Prelec & Loewenstein, 1998) – and thus decrease spending. For instance, Thomas, Desai and Seenivasan (2011) showed that subjects who expected to pay by cash indicated that the payment was more painful than subjects who expected to pay by credit card. The pain of payment reported by subjects, which was measured on a 5-point non-verbal scale from a sad face (☹) to a happy face (☺), mediated the effect of payment method on spending, supporting the hypothesis that the reduced pain of payment associated with credit card use contributed to the increase in spending. Despite the fact that payment transparency and the related concept of pain of payment provides a useful framework for understanding why different payment methods lead to different spending patterns, few studies discussed or directly measured them. Some studies that can be explained by this conceptual framework are discussed in the following paragraphs.

Payment coupling, which Prelec and Loewenstein (1998) defined as the salience of the link between payment and consumption at the time that either is occurring (Raghubir & Srivastava, 2008; Thaler, 1999), fit well with the explanation of payment transparency. Prelec and Loewenstein (1998) propose that the utility of making a purchase incorporated both the

pleasure of consuming the good or service and the pain of payment that was associated with wealth depletion. The more closely coupled the payment and consumption was, the greater was the aversive impact of payment on the pleasure of consumption. The well-documented evidence of overspending with credit cards relative to cash can be explained by the fact that credit card use reduces payment coupling in two ways compared to cash. First, the actual payment is made on a monthly statement that combines multiple purchases into a single bill, obscuring the connection between any one purchase and the act of payment. Second, credit card purchases allow consumers to buy now and pay later. This creates a temporal separation between the purchase and the payment that reduces payment coupling. In essence, the event of product acquisition and the event of actual payment are decoupled, making credit card spending less transparent and therefore less painful. Supporting the notion of payment coupling, Soman (2001) found that when one's wealth was depleted immediately in paying past expenses, purchase intention for a product was significantly lower than when wealth was depleted with a delay (Experiment 2).

Besides payment coupling, the extent to which one perceives their cash as real money or toy money has also been shown to affect one's spending. For instance, this could happen when one deals with foreign currency during a trip. The holder of foreign currency might treat the cash at hand, arguably cash of identical objective value as its home currency counterpart, as if it is toy money due to the holder's unfamiliarity with the foreign currency. From the payment transparency perspective, the payment transparency of spending cash in the form of foreign currency should be relatively low when one perceives their cash as toy money. The reason is that the holders of toy money do not feel that it is real money, and thereby they do not feel that their wealth is depleted as they spend the toy money. The opposite is true when one perceives toy money as real money, leading to lower spending. Raghurir and Srivastava (2008) provided

evidence for this notion (Study 4). They showed that a gift certificate was felt more like real money when it was stored in the subjects' wallet for an hour and then subsequently pulled out to be redeemed for either a dollar or a candy bar. The act of removing the gift certificate from one's wallet made one feel that it was more like real money than toy money. This contextual cue that made the gift certificate as if it was real money inhibited subjects from spending their dollar to get the candy. On the other hand, subjects in another experimental condition that received the gift certificate immediately before the redemption decision had a significantly higher likelihood of spending their dollar to get the candy because the gift certificate was treated as toy money.

Another factor that appears to influence payment transparency is the extent to which one mentally rehearses the payment amount, which could be due to writing the payment amount as in the case of check or the physical action of payment as in the case of cash. In a study that investigated how the effects of past payments affected future purchase decisions, Soman (2001) either had participants sign credit card receipts or had participants write and sign checks in order to pay for past expenses (Experiment 1). Soman found that subjects who paid past expenses by merely signing credit card receipts were significantly more willing to purchase a discretionary product in a subsequent purchase decision than subjects who paid by writing and signing a check. He argued that check payment was more salient than credit card payment because it required writing the payment amount both in words and numbers, so the amount must have been mentally rehearsed. In Experiment 2, he further showed that those who paid past expenses by payment methods that involved mental rehearsals (e.g. check) had a significantly higher accuracy of memory about past expenses (e.g. recall of past expenses) compared to those who paid past expenses by methods that did not involve mental rehearsal (e.g. debit card). The results of these two experiments are in line with the payment transparency framework, where mental rehearsal of

the payment amount through writing checks increases the salience of wealth depletion, which in turn decreases one's spending intention in a subsequent purchase decision.

The actions used to make a payment may also increase payment transparency. Soman (2003) demonstrated that subjects made fewer photocopies when they paid by putting dimes into copy machines than when they paid by prepaid copy card, even though both groups were given an identical amount of money: one group with \$20 in the form of dimes and another group in the form of prepaid copy card with \$20 in value. A similar effect the same paper reported in a field study at a Laundromat: consumers were more willing to pay for two washes to separate their whites and colors after the payment system was changed from accepting coins to prepaid cards. Soman argued that paying with coins had greater payment transparency than paying with a card due to the need to insert a number of coins when making copies or doing multiple washes in a Laundromat, and thus inhibited consumers' spending by increasing the pain of payment. On the other hand, in the case of prepaid cards, the process of wealth depletion was almost non-transparent unless one paid attention to how much money was deduced for each additional copy made or each additional wash done.

### **Appearance of Payment versus Action of Payment**

While previous studies shed light on what increases payment transparency, one or more factors are often confounded, which makes it unclear exactly which features of the payment methods are contributing to transparency. For instance, dimes and copy cards differ in both their physical appearance and in the action required to complete a transaction. In terms of appearance, dimes look like money, copy cards do not. In terms of action, putting dimes in a copy machine requires more physical and mental effort than using a card. With dimes one has to insert the exact amount of money needed for a specific number of copies, while copy cards instantly bring

the copy credit up to the prepaid value. The depletion in dimes as copies are made is thus very noticeable. On the contrary, one hardly notices the depletion of the prepaid card as long as the cost of copies made does not exceed the prepaid value. This is true more generally of the differences in spending among cash, checks, and credit cards: are they due to physical appearance, or the different actions needed to make a payment?

The physical appearance of cash is one attribute that may contribute to its high salience: because cash is the prototypical representation of money, handing cash over may make spending salient in a way that paying with a card, which does not “look like money,” does not. However, previous studies provide mixed evidence in this regard. Raghurir and Srivastava (2008) investigated the effects of the appearance of cash per se (Study 3), with action of payment held constant. In their Study 3 subjects hypothetically shopped for items on a grocery list with either a \$50 bill or with a \$50 grocery certificate, with change given in cash in both conditions. While there was no difference in the number of items purchased across conditions, the average amount spent per item was higher in the scrip condition than in the cash condition. Their Study 4 further showed an interaction between contextual cues and payment appearance on the likelihood of spending. As discussed above, when subjects received payment immediately before a real purchase decision, those who received a gift certificate were more likely to make the purchase relative to the counterpart who received equivalent amount of cash. This effect of payment appearance on spending disappeared when subjects were asked to store their gift certificate or cash in their wallet for one hour prior to making the purchase, thereby making the gift certificate more money-like. However, when a \$1 bill was displayed prominently at the time of purchase, subjects were once again more likely to make a purchase with a gift certificate than with cash, despite having kept the certificate in their wallet for an hour.

These studies suggest that the physical appearance of cash may have an inhibitory effect on spending, but that this effect is not absolute. In Study 3, in which the only cue present was the differing physical appearance, Raghurir and Srivastava (2008) found no significant difference in number of items purchased between the cash and gift certificate conditions, but the small sample size makes it difficult to draw conclusions from this. In Study 4, the appearance of cash had a varying effect: When the contextual cue of removing the cash or gift certificate from one's wallet was present, the physical appearance of cash had no additional effect unless it was emphasized by making a \$1 bill visually salient at the time of purchase. Thus, while there is some evidence that the physical appearance of cash contributes to the pain of payment, it remains unclear how large a role it plays in situations where other cues, such as action of payment, are also present.

Another possibility is that the action of paying with cash makes the amount spent more transparent. Paying with cash requires considering which bills one has, which bills to use, and keeping track of the amount paid relative to the payment goal (i.e., purchase amount). It involves greater mental effort than paying with a card, which may make the amount being spent more transparent than when paying with a card. Such level of mental effort is arguably higher than writing a check, which requires continuous mental rehearsal of the payment amount in memory until it is written both in words and numbers, but which requires no counting or math. As previous research has shown that writing checks for past expenses inhibited one's purchase intentions on a subsequent purchase decision relative to merely signing credit card receipts (Soman, 2001), a similar aversive impact on spending is expected in counting cash.

### **Objectives and Overview of the Current Studies**

The current studies attempt to extend previous research in several ways. First, the effect

of the physical appearance of cash is isolated from the act of paying with cash. This is accomplished by creating a token condition that does not have the appearance of cash, but that mimics every other aspect of cash payment (Experiments 1 and 2). Second, other factors that may contribute to payment transparency in cash payment are explored (Experiments 1, 2, and 3). These factors include the physical effort required in handing out cash, mental tracking of the current progress of cash payment, and the mental rehearsal of the payment amount. Third, the current studies are the first to examine the effects of payment transparency using a computer payment interface (all experiments), in the absence of physical payment. Does making cash payment lead to reduced spending even when paying with virtual cash rather than physical cash? The present studies examine whether the same factors that lead to increased payment transparency in physical form also lead to increased payment transparency in virtual form. Lastly, the effect of the size of bill denomination on pain of payment and purchase intention is also investigated (Experiment 4).

In Experiment 1, the effects of payment action as well as the appearance of cash is investigated. The effect of cash appearance is investigated by comparing cash payment to a token payment condition, which mimics cash in every aspect except appearance. If the spending-inhibiting effect of cash relies solely on appearance, spending in the token condition should be similar to spending with a credit card and higher than spending in the cash condition. If it is the action of paying with cash that increases payment transparency and thereby inhibits spending, then spending in the token condition should be similar to that in the cash condition and lower than spending with a credit card. The results support a role of action of payment but not a role of cash appearance.

Experiment 2 extended the findings of Experiment 1 by ruling out two possible

confounding variables: the effects of expectation of payment method (cash or credit card) per se and the presence of credit card logo. As discussed earlier, past studies (Monger & Feinberg, 1997; Prelec & Simester, 2001; Raghurir & Srivastava, 2008) showed that when people expected to pay by credit card, they spent significantly more compared to when they expected to pay by cash. There are many aspects of cash vs. credit card that could lead to this effect besides those of appearance and action of payment examined in Experiment 1 (for example, payment coupling as discussed above). To rule out the possibility that some aspect of payment method that was not controlled for caused the spending differences in Experiment 1, the cash-token comparison is repeated with two new conditions: a cash condition that included the appearance of cash without the payment action (paying with cash, but using a one-click method with an image of cash prominently displayed) and a credit card condition that included the action of payment by cash (paying with credit card but needed to utilize the token payment interface to pay). This allows the test of whether the spending-inhibiting effects of cash are due to effect of expectancy or due to the action of payment that one must go through. Action of payment was further supported while the effect of a specific form of payment was not. Similarly, the presence of a credit card logo was shown to increase one's spending (Feinberg, 1986), and it was present in Experiment 1 due to its more natural setting. To rule this out as an explanation of the results of Experiment 1, the credit card logo was removed in Experiment 2. Experiment 2 further tested whether the spending-inhibiting effect of action of payment was due to physical effort required in handing out the payment or was due to the mental tracking of the payment progress. Results showed that both components were necessary in inhibiting spending.

Experiment 3 extended the effects of the action of payment to a more realistic situation where participants need to consider budget constraints, and purchase decision that is more

relevant to them. All participants were given an identical financial profile, which indicated their monthly income, expenses on different categories for a specific month, and funds available in their savings and checking accounts. Experiment 3 also clarified whether the mechanism of the inhibitory effect on spending due to the action of payment is the result of mentally rehearsing the cash payment amount or the counting process itself. Participants were requested to memorize nothing (baseline condition), the payment amount, or some random English letters before making the payment and were asked to recall the stimulus immediately after the payment was finished (not applicable in the baseline condition). If the pain created by the action of cash payment is due to simply rehearsing the payment amount, those who needed to memorize the payment amount should exhibit similar or even greater pain of payment than those not required to memorize anything. On the other hand, if the pain created by the action of cash payment is due to counting out the cash, any memory load during the act of paying cash should interrupt the mental counting process and thereby should lower one's pain of paying and increase purchase intention. Results supported the effect of counting on one's pain of payment, but no difference in purchase intention was found across conditions.

Experiment 4 explored whether the denomination of the bills used to make a payment moderate one's pain of payment as well as purchase intention. It tested the premise by having participants pay the same amount of money with many bills with small denomination (e.g. \$20 bills) or few bills with larger denomination (e.g. \$100 bills). Given that humans prefer an integrated large loss to multiple small losses (Kahneman & Tversky, 1979), paying with many small bills should inhibit spending to a greater extent than paying with few large bills. But paying with small bills should lead to higher pain of paying compared to payment with large bills. While the results showed an effect of payment interface on purchase intention (between a

one-click method and large denomination condition), the effect of payment interface on pain of payment was not significant.

## CHAPTER 3. EXPERIMENT 1

Experiment 1 had two goals. The primary goal was to disentangle the effects of the appearance of cash from the act of paying with cash. The secondary goal was to replicate previous findings concerning the effects of payment methods on spending using virtual payments via a computer interface rather than physical payments.

Experiment 1 included four virtual payment conditions: virtual checks, drag-and-drop (DD) cash, DD tokens, and virtual credit card payments. In both the DD token and DD cash conditions, the denominations, actions, and thought processes required were identical. However, in the DD cash condition subjects paid by dragging and dropping images of cash, while in the DD token condition they paid by dragging rectangles marked with the payment denomination. The inclusion of the DD token condition allowed us to distinguish between the effects of payment appearance and payment action. If the transparency of cash payment is based primarily on the appearance of cash, spending should be lower in the DD cash condition than in the DD token condition or the credit card condition. If the act of counting out the cash payment elicits payment transparency, then spending should be similar in both the DD cash and DD token conditions, and both should be lower than credit card spending. If both the appearance and action of cash payment play a major role in payment transparency, then spending in the DD token condition should fall between spending in the DD cash and credit card conditions.

Based on Soman's (2001) finding that writing a check inhibited spending relative to signing a credit card receipt, the current experiment included a virtual check condition. The rationale was that a virtual check would inhibit spending relative to paying with a credit card because it required subjects to enter the amount spent, but that it would produce higher spending

than the DD cash or token condition because it did not require as much attention to the amount or act of payment as counting out bills or tokens.

Credit cards were expected to produce the highest spending because the one-click payment did not require subjects to think about the amount spent at all, thereby minimizing its transparency and its corresponding pain of payment.

## **Method**

**Participants.** One hundred and seventeen undergraduates from a large Midwestern university participated in the study for partial fulfillment of a research requirement in an undergraduate psychology or communication studies class.

**Design.** Experiment 1 used a single factor (payment method: DD cash, DD token, credit card, and check) within-subjects design. All subjects used all four payment methods. Subjects were told to imagine they were employees of a company purchasing office supplies to be used at their office. The dependent variable was the average amount spent in each condition. The payment methods are shown in Figure 1.

**Materials and Procedure.** Subjects were told the hypothetical office supplies were to be paid for by the company, not by the subject, and that there were specific categories of products they needed to buy. There was no budget constraint, and within each category they were told to decide which item to purchase based on a trade-off between quality and price. It was also mentioned that the more expensive items were generally of higher quality.

The experiment was programmed in Adobe Flash CS4 and presented on lab computers. It had four blocks, each consisting of five trials of the same payment method. The blocks were presented in random order.

In each trial, subjects were presented with three rows, each with five different photos of office supply products as shown in Figure 2. Each row represented a different product category (e.g. pens, staplers). There were four total sets of 15 items (three rows of five products each) and one of these sets was chosen randomly for each trial. Both the row order and the product order within each row were randomized in each trial. Below each photo the price of the corresponding item was shown. These prices were based on the actual prices of the items on a major retail website. The actual prices of the items ranged between \$1 and \$26.54. Due to a programming error, for the first 25 subjects, the original price of the product was used and prices for each product remained constant throughout the experiment. The prices for subsequent subjects were randomized between 95% and 105% of the original prices in each trial so that subjects did not see the same item with the same prices repeatedly. The photos used were chosen by the experimenters in such a way that the experimenters felt that the more expensive items in a category were higher quality than the less expensive items and that this could be inferred from the photographs.

In the lower left portion of the product selection page, shown in Figure 2, subjects were reminded to select one product from each row. They were also reminded of how they would pay for their purchase: tokens, cash, check, or credit card. Next to these instructions was a photo that represented the current payment method. The lower right portion showed the current total value of the selected products. This amount was updated whenever there was a change in product selection.

After selecting one item from each of the three categories and submitting their selections, subjects moved on to the checkout page that corresponded to the current payment condition. On all checkout pages, the total amount to be paid was shown on the top of the page. In the DD cash condition, subjects paid by using a mouse to drag and drop images of \$1, \$5, and \$10 bills. They could drag each bill more than once if needed. The DD token condition was identical to the cash condition, except the monetary notes were replaced by squares in which the corresponding value was shown. In the check condition, subjects typed the purchase amount into the numerical input area of an image of a check (Soman, 2001; Soman & Lam, 2002). Lastly, in the credit card condition subjects paid simply by clicking a payment button, mimicking the one-click checkout methods used by some online retailers that retain customer's payment information. After their payment, subjects moved to the rest page in which they could rest up to 60s and then began a new trial. At the end of the experiment subjects were asked to indicate which payment method they preferred. Most subjects finished the experiment within twenty minutes.

## **Results and Discussion**

The amount spent in each payment condition was averaged across the five trials. Due to a programming error, instead of recording the amount spent in each trial, some trials mistakenly recorded the value of the previous trial. This occurred when subjects clicked on the pictures of the items, rather than the radio button beneath the item. Subjects' data were excluded for analysis if any one of the payment conditions included only repeated values or if there were 10 or more trials with repeated values. Eleven subjects' data were excluded from analysis, leaving usable data from 106 subjects. For 29 additional subjects, the repeated values were removed and the remaining trials in the corresponding payment condition were averaged. Eighty-three trials in total were removed in this way. The remaining 77 subjects did not have any repeated values.

A one-way repeated measures ANOVA revealed that the main effect of payment method was significant ( $F(3, 315) = 5.532, p < .001, \eta^2 = .050$ ). Subsequent pairwise comparisons showed that the average spending for credit card ( $M = \$33.29; SE = \$.859$ ) was significantly higher than that for DD cash ( $M = \$30.38; SE = \$.925$ ) and DD token ( $M = \$30.68; SE = \$.995$ ) ( $t(105) = 3.46, p < .001$  and  $t(105) = 2.89, p = .005$ , uncorrected) These differences survived a Bonferroni correction for multiple comparisons (adjusted alpha = .0083). Before the adjustment for multiple comparisons, the average spending in the check condition ( $M = \$32.08; SE = \$.912$ ) was significantly higher than for DD cash and DD token ( $t(105) = 2.29, p = .024$  and  $t(105) = 2.02, p = .046$ , respectively) but this did not survive the Bonferroni correction. Results for Experiment 1 are reported in Table 1<sup>i</sup>.

The results of Experiment 1 suggest that the effects of payment method previously demonstrated with physical cash can also occur with virtual cash in a computer interface. The amount spent in the DD cash and DD token conditions did not differ significantly, and both were less than spending in the credit card condition. Therefore, evidence supports that it was the action of counting out the cash payment, and not the appearance of the cash itself, that reduced spending in the DD cash and DD token conditions.

In contrast to findings of Soman (2001) and Soman and Lam (2002), the amount spent in the check condition was not significantly different from any of other three payment conditions after Bonferroni adjustment. The failure to find a difference between check and credit card could be due to the fact that in the current experiment subjects entered only the numeric amount on the check as opposed to Soman's (2001) study, where subjects were required to enter the amount in both numbers and words. Another possibility is that the act of typing the amount on a virtual

check does not elicit the pain of payment as much as writing the amount on a paper check with a pen as subjects did in Soman (2001).

Although the results of Experiment 1 are consistent with the hypothesis that payment transparency influences spending, there is one other possible explanation for our finding that credit card payments increased spending. At the bottom of the product selection screen an image indicating the current payment method was included. For the credit card payment, this image was a credit card with a VISA logo. Although it was important that the subjects recognize the current payment method as they selected their products, past research suggests that the mere presence of a credit card logo is sufficient to increase spending when buying consumer goods, tipping in restaurants (McCall & Belmont, 1996), or ordering meals (Raghubir & Srivastava, 2008). The fact that there was a small credit card logo present on the screen as subjects made their selections leaves the possibility that the increased spending in the credit card condition was due to the presence of the logo and not to the transparency of the payment method per se. Experiment 2 addresses this issue by investigating whether increased spending with credit cards persists in the absence of the credit card logo.

## CHAPTER 4. EXPERIMENT 2

There were three goals in Experiment 2. The first was to replicate the findings of Experiment 1 and confirm that they were not due only to the presence of the credit card logo. It was expected that spending in the credit card condition would continue to be higher than the DD cash condition in the absence of the logo.

Second, Experiment 2 further addressed the question of the roles of the appearance versus the action of paying with cash in payment transparency. It did this by including two new conditions. The first was a one-click payment made with cash including an image of cash (appearance of cash, but not action of payment). The second was a DD credit card condition, identical to the token condition in Experiment 1 except that in Experiment 2 it was specified that the payment was being made by credit card via the token-dragging mechanism (action of payment with cash, but not the appearance). These new conditions were compared with the same DD cash and one-click credit card conditions used in Experiment 1. If the appearance of cash is sufficient to decrease spending, it is expected to result in lower spending with cash than with credit cards regardless of whether the payment mechanism is DD or one-click. On the other hand, if the mechanism of payment plays a major role, the subjects should spend less with DD than with one-click regardless of whether they are paying with cash or a credit card.

Third, in Experiment 2 the goal was to further separate the effect of mental effort from physical effort. In a DD payment mechanism, physical effort from dragging and dropping as well as mental rehearsal from keeping track of which bill/token to hand out and when to stop are needed. Therefore, while evidence from Experiment 1 supports the notion that DD payment mechanism inhibits spending, it is uncertain whether it is due to mental or physical effort or both. To differentiate one effect from the other, a swipe-card condition that requires the participants to

swipe a virtual credit card repeatedly was included, duplicating the physical effort of paying with cash/tokens, but not the mental effort of working out what tokens were needed to make the payment. Three pairs of comparisons are of specific interest. By comparing one-click card payment and swipe card payment, the effect due to physical effort can be isolated. Similarly, by comparing the swipe card and DD credit card condition, the effect due to mental effort can be isolated. Given that the evidence from Experiment 1 shows that payment through a computer interface is enough to elicit difference in spending across different virtual payment interfaces, it is hypothesized that it is mental effort in the DD payment mechanism that inhibits spending.

## **Method**

**Participants.** One hundred and eighteen undergraduates from a large Midwestern university participated in the study for partial fulfillment of a research requirement in an undergraduate psychology or communication studies class.

**Design.** The basic design and procedure of the current experiment was similar to Experiments 1, and items, item sets, and prices were identical. Experiment 2 kept two payment conditions from Experiment 1: the DD cash and the one-click credit card payment, this time with no credit card logo. Experiment 2 included three new payment conditions. The first was a one-click cash payment, in which subjects are told they are paying with cash in the product selection page and in which a photo of a bank note is displayed at check-out. The second is a DD credit card payment, which was similar to the DD token payment condition used in the previous experiment. However, in the DD credit condition, the subject was told he/she was paying with a credit card, and a picture of a credit card without the credit card logo was displayed in the product selection page as in Experiment 1. The third condition required subjects to pay by repeatedly swiping a credit card. Subjects had to swipe the card by dragging-and-dropping 5

times, which was the mean number of drags required in the cash and token conditions in Experiments 1. The three new payment conditions are shown in Figure 3.

## Results and Discussion

Results for Experiment 2 are reported in Table 1. Ten subjects' data showed spending totals that persisted from one trial to the next, but none met the elimination criteria as in Experiment 1. Each subject had 8 or fewer repeated values, for a total of 25 trials removed. The remaining values in the corresponding payment condition were averaged as in Experiment 1.

To test the effects of the mental effort of payment (one-click vs. DD) and payment type (cash vs. credit) on spending, a 2 x 2 repeated measures ANOVA was performed. There was a significant main effect of payment action ( $F(1, 117) = 12.17, p = .004, \eta^2 = .094$ ), meaning that subjects spent more money with one-click payments ( $M = \$31.89; SE = \$.85$ ) than with drag-and-drop payments ( $M = \$30.19; SE = \$.75$ ). The ANOVA did not show a main effect of payment type ( $F(1, 117) = .09, p = .77, \eta^2 = .001$ ), meaning that subjects did not spend more money with credit cards ( $M = \$31.11; SE = \$.75$ ) than with cash ( $M = \$30.97; SE = \$.85$ ) after controlling for payment action. The interaction was also not significant ( $F(1, 117) = 1.44, p = .23, \eta^2 = .012$ ).

To examine whether the results of Experiment 1 would replicate in the absence of a credit card logo, the average spending in the DD cash condition ( $M = \$29.86; SE = \$.809$ ) was compared with that in the one-click credit card condition ( $M = \$31.71; SE = \$.821$ ), finding that as in Experiment 1, spending in the DD cash condition was significantly lower than in the one-click credit card condition ( $t(117) = 2.44, p = .015$ ) despite the absence of the credit card logo.

In order to test the effect of physical effort and mental effort on one's spending, several planned comparison t-tests were conducted. The effect of physical effort alone was not significant, as indicated by comparing one-click credit card condition and swipe-card condition ( $t(117) = .628, p = .531$ ). Neither was the effect of mental effort alone significant, as indicated by comparing swipe-card condition and DD credit card condition ( $t(117) = 1.42, p = .159$ ). However, the two effects together significantly inhibited spending, as indicated by the significantly lower spending observed in DD credit card condition compared to the one-click credit card ( $t(117) = 2.03, p = .045$ ). This significant spending-inhibiting effect from the combined physical and mental effort (i.e. DD payment mechanism) has been consistent with the results of Experiment 1 as well as analysis conducted earlier in this section.

Subjects spent significantly less when paying with a DD method than when paying with a one-click method regardless of whether these methods represented cash or credit card payment, providing further evidence that it is not the appearance of cash that leads to reduced spending but the action of counting out the bills or tokens. This is also supported by the lack of a main effect of payment type (cash vs. credit), which suggests that differences in spending were due to the action of making the payment and not due to the payment type per se. This also shows that the difference between credit card and cash is not due to the expectancy effect where expected credit card payment led to increase spending. The failure to find an interaction indicates that the effect of the action used to make the payment did not differ between cash and credit, and thus is not specific to cash payments. While the combined effect of mental counting during the payment process and physical dragging of the bills/tokens was found to inhibit spending, neither effect by itself was significant enough to affect spending.

## CHAPTER 5. EXPERIMENT 3

While Experiments 1 and 2 consistently showed that the DD payment mechanism inhibits spending, the results were limited in several ways. First, participants were told to imagine buying office supplies for a company, making their purchase decisions relatively self-irrelevant. A more suitable context to understand consumer spending is personal purchase decisions. Second, the purchase scenario did not take financial budget into consideration, which is a likely constraint in any real-world purchase decision. In particular, participants in Experiments 1 and 2 might have presumed different levels of budget at their disposal based on their understanding of the cover story, and such variability might have increased the error variance across conditions. Third, both experiments are also limited in the sense that the effect of drag-and-drop essentially encouraged the buyers to give up quality for money because the participants were told that the higher-priced items were of higher quality. The extent to which making the DD payments affects consumers' decisions in terms of purchase intention for an item is uncertain. This is an important measure because the likelihood that consumers will purchase something can affect their overall spending. Fourth, neither experiment directly measured the construct that supposedly increases payment transparency: pain of payment.

To address these limitations, Experiment 3 created a purchase scenario by asking participants to consider buying an item for themselves, so the purchase scenario is closer to the context of everyday consumer decisions. Also, participants needed to take their budget into consideration based on a hypothetical financial profile given to them, which included their monthly income, deposits in the savings and checking accounts, and various categories of expenses in a particular month. This approach was previously used by Soman (2001), who

across two experiments showed that when payment was mentally rehearsed as in the case of writing a check, the purchase intention for discretionary products were lowered. By using an identical financial profile, the effect of budget and wealth was held constant across participants. The primary task was to have participants pay with a specific payment method, and then they were asked to indicate their purchase intention for an item that they desired. The pain of payment was measured in the end.

Experiment 3 further tested whether the pain of payment was due to one's attention toward counting or one's attention to the payment goal when using the drag-and-drop payment mechanism. In DD payment, the primary mental process is counting toward a numeric goal. In order to perform this task, not only does it require one to keep track of the amount that has already been paid (i.e., the counting process), but at the same time it requires remembering the payment goal. The pain of payment could therefore be due to one's attention on the counting process, to the need to memorize the payment goal, or the combination of both.

Three conditions related to a memory task were used to differentiate between these two possible originations of the pain of payment in the DD payment interface. In the baseline condition, participants paid with the DD payment interface as in the last two experiments, without additional memorization. In the *English letter* and *payment amount* conditions, participants were asked to memorize some randomly generated English letters and the payment amount, respectively, immediately before they paid through the DD payment interface. The rationale is that if the pain of payment is due to one's attention to counting, both memory conditions would disrupt this process and the pain of payment of both memory conditions would therefore be lower than the baseline condition, where pain of payment could be due to counting. On the other hand, if the pain of payment is due to rehearsing the payment goal temporarily, then

the payment amount condition should exacerbate the pain of payment. The net result is that the payment amount condition would lead to the highest level pain of payment, followed by the baseline condition and then by the English letter condition.

The current experiment also differed from the first two in that participants were recruited from Amazon Mechanical Turk, where registered adults from all over the world could be recruited for participating in an online study for a small payment. It also allows experimenters to recruit base on geographical region, gender and other characteristics. Recent studies show data gathered from Amazon Mechanical Turk are reliable (Rand, 2012) and of high quality (Buhrmester, Kwang, & Gosling, 2011). The current experiment recruited US participants because US bills were used in the DD payment interface. This also allows testing whether effects identified in Experiments 1 and 2 could be generalized beyond college students to a larger US sample.

## **Method**

**Participants.** Two hundred and forty adult participants from the US were recruited through the Amazon Mechanical Turk. Each participant was paid \$.40 for their participation. .

**Design.** Experiment 3 used a single factor (payment method: one-click, DD cash, DD cash English letters, and DD cash spending amount) between-subjects design. Participants were randomly assigned to one of the payment conditions, all of which were credit card payments with different payment interfaces.

**Materials and Procedure.** Participants were provided with a hypothetical scenario, based on which they made a decision. First, they were provided with a financial profile. They were told that they had been working for a couple years and they had a stable before-tax monthly

salary of \$3,000, and they had \$3,000 in their checking and savings accounts combined. They also finished paying off their college loan and have wanted to save money for the down payment on their own apartment. They were told to carefully study their salary and their expenses on each category so that they knew their financial status.

Participants were then told that there were six categories of expenses that had been incurred for the month, including rent, phone bill, car payment, car insurance renewal, utilities, and groceries as shown in Table 2. They were further instructed that it was the end of the month and they needed to make their payments, but some of the expenses had been paid and therefore they only needed to pay expenses that were shown in bold fonts, including phone bill, car payment, and car insurance renewal. The order of payment for each unpaid category was randomized for each participant, so participants did not know what to pay next until they saw the payment interface, which provided the specific unpaid category and the corresponding unpaid amount. Participants then continued to one of the payment conditions.

Participants were told that they were paying using a credit card but they needed to pay through the assigned payment interface. Each participant paid three times with the same payment method for three different unpaid expenses. The one-click method was identical to that used in Experiment 2. It was expected that the same difference between the one-click method and the DD payment interface found in Experiments 1 and 2 would be replicated. In other words, the one-click methods would elicit lower pain of payment and higher purchase intention.

The baseline DD cash condition was similar to Experiment 2's except that it used \$50 dollar bills instead of bills with smaller denomination, and this was also true for the other two conditions that involved DD cash. In the DD cash English letters condition, immediately before

proceeding to the payment interface, a randomly generated string of six English letters (e.g. dhjgdj) was shown. This string length echoes the length of significant figures in each category's expense plus the decimal point. In each payment, participants were instructed to memorize this string without writing it down so that they could correctly recall it after their payment. The English letters were shown for ten seconds and then it automatically moved to the payment interface. After completing the payment through the payment interface, participants were prompted to recall the stimulus shown earlier. After receiving their input, participants then continued to pay for the second and third unpaid expenses in a manner similar to the first one: prior to each payment, participants were given a stimulus to memorize, and were prompted for recall after the payment. The DD cash spending amount condition was identical to the English letters condition, except that participants needed to memorize a certain amount of money. While the amount they needed to memorize was actually the amount they needed to pay in that trial, they were not explicitly told that was the case.

After completing their payments for the three unpaid expenses, participants were presented with a shopping scenario. They were asked to imagine that they were in a mall and they noticed a boxed set of DVDs of their favorite TV show from last season. They were told that they did not crave for it but it would be nice to add to the collection. They then indicated their purchase intention for the item (1 = definitely will not buy; 10 = definitely will buy). Lastly, they also indicated their level of pain of payment for paying the monthly expenses (1 = not painful at all; 10 = extremely painful).

## Results and Discussion

Seven participants answered zero on either the purchase intention or the pain of payment question, where the allowed range was between 1 and 10, so their data were excluded from analyses, resulting in 233 usable cases.

To test the effect of the payment method on purchase intention as well as on pain of payment, a one-way between-subjects MANOVA was performed on purchase intention and pain of payment. The main effect of payment method on purchase intention was not significant ( $F(3, 229) = .821, p = .484, \eta^2 = .011$ ). On the other hand, the effect of payment method on pain of payment was highly significant ( $F(3, 229) = 4.864, p = .003, \eta^2 = .060$ ). Before adjustment for multiple comparisons, the pain of payment in both DD cash English letter condition ( $M = 2.27; SE = .252$ ) and DD cash payment amount condition ( $M = 2.24; SE = .273$ ) were significantly lower relative to either the one-click condition ( $M = 3.18; SE = .365$ ) or the control DD cash condition ( $M = 3.60; SE = .333$ ),  $p < .045$ . But only the difference between the control DD cash and the other DD cash conditions with memorization survived after Bonferroni adjustment. The means of purchase intention as well as pain of payment across experimental conditions are shown in Table 3.

Memorizing some random English letters during DD cash payment led to significantly lower pain of payment relative to no memorization condition. Memorizing the payment amount also led to similar significantly lower pain of payment relative to the baseline condition. The fact that only one participant got the payment amount wrong (due to a blank answer) in the DD cash payment amount condition while 23 out of 56 participants in the DD cash English letters condition got one or more of the English letters wrong indicated that memorizing the payment

amount was easier than memorizing the English letters, but the relative ease of memorization did not translate into difference in the pain of payment.

The current results suggested that the cognitive load of recalling a string or number during the counting process disrupted the registration of pain of payment in the DD payment mechanism. That fact that both memorization conditions in the DD cash payment led to lower pain of payment supported this notion. The current results also indicated that mental rehearsal of the payment amount during the DD payment might not be a necessary contributor to pain of payment, as there was no significant difference between the English letter and the payment amount conditions. If mental rehearsal of the payment amount really has no effect in contributing to pain of payment, what was left in the DD payment mechanism that could lead to pain of payment? The hypothesis of Experiment 3 was that it was the mental counting of the bills that lead to pain of payment. However, another possibility is that pain of payment might be created by seeing the bills leaving one's disposal. The current design could not clarify exactly which of these two factors was contributing to pain of payment nor could it tell which of the factors was more interfered with by the cognitive load.

The fact that payment method had an effect on pain of payment but not on purchase intention was unexpected based on the framework of payment transparency. It could be due to a lack of significant relationship between the two dependent variables. To examine this notion, correlational analyses on the two dependent variables were performed for all the participants as well as for participants within each experimental condition. The correlations between purchase intention and pain of payment, for the study sample as a whole as well as within each experimental condition, were not significant,  $ps > .162$ . What was also unexpected was that there was no difference on purchase intention between the one-click condition and the DD cash

payment conditions. Unlike the first two experiments, Experiment 3 had participants make three consecutive payments for three different expenses. One potential outcome of the rapid one-click payments was that the pain of payment may have gradually added up to the level similar to the DD payment mechanism. Another possibility was that the payment interface simply did not affect purchase intention, while it did affect the level of spending when a purchase was actually made (the dependent measure in Experiments 1 and 2).

## CHAPTER 6. EXPERIMENT 4

The primary goal of Experiment 4 was to explore factors that moderated the effect of DD payment, which was shown to inhibit spending (Experiment 2). Will more drags of lower value bills inhibit spending compared to fewer drags of higher value bills, controlling for the spending amount? Previous studies show that the likelihood of spending money is lower with a single large denomination (e.g., a \$100 bill) than with many smaller denominations (e.g., five \$20 bills). One hypothesis was that people could process a single large bill more fluently compared to many smaller bills, and the difference in processing fluency led to perceived higher value of the single bill (Mishra, Mishra, & Nayakankuppam, 2006). In one of their studies, Mishra, Mishra and Nayakankupamm (2006) found that holding the total value of one's money in possession constant, participants who had a \$100 bill had a significantly lower intention to purchase some products compared to participants who had five \$20 bills, who in turn had a lower purchase intention compared to participants who had a \$50 bill, two \$20 bills, and two \$5 bills. The reason was that the more different types of bills one had, the more different value points they formed, which lowered one's processing fluency of the money at hand. Raghubir and Srivastava (2009) replicated the same denomination effect across three field studies, showing that spending on real transactions was more likely with small denominations than with large denominations. However, they proposed a different mechanism, suggesting that money in large denominations was classified as real money while money in small denominations was classified as petty cash, money that was more ready to be spent.

The applicability of the denomination effect in real life is based on the assumption that people at least somewhat know the number of bills they have in each denomination size before considering a purchase decision. However, it is unlikely that people will check the money

composition in their wallet before making a purchase. A question that is more relevant not only in the domain of physical cash payment but also on computer payment interface is that how paying using different compositions of bills would affect the next purchase decision due to the pain of payment. But it is uncertain if handing out the same amount of money across the two denomination types will result in different levels of payment transparency, which in turn affects subsequent spending decisions.

According to Prospect Theory (Kahneman & Tversky, 1979), the disutility of multiple small losses is higher than a big loss of equal magnitude. That happens because the disutility of a loss is not linear with the size of the loss: disutility increases rapidly for small losses, then at a slower rate as loss increases. Consequently, when given a choice, people tend to prefer one big loss rather than multiple small losses of equal magnitude. Supporting this notion in a consumer decision context, Kim (2006) found that the purchase intention for a product was higher when the selling price was integrated (e.g. \$150 for a stroller including shipping) than when it was segregated (e.g. \$130 for a stroller plus \$20 shipping). The relevance of Prospect Theory in the DD payment interface context is that each drag-and-drag of the money bill can be considered as a loss, with handing out small and large denomination bills as small and big losses, respectively. Consequently, it is hypothesized that handing out many small denominations will lead to higher pain of payment and lower purchase intention in subsequent purchase decisions compared to handing out few large denominations.

## **Method**

**Participants.** Two hundred and fifteen undergraduates from a large Midwestern university participated in the study for partial fulfillment of a research requirement in an undergraduate psychology or communication studies class.

**Design.** Experiment 4 used a single factor (payment method: one-click, DD small denomination, and DD large denomination) between-subjects design. Participants were randomly assigned to one of the payment conditions, all of which were credit card payments with different payment mechanisms.

**Materials and Procedure.** The basic design and procedure of the current experiment was identical to Experiment 3 with the following noted differences. There was no memorization in any of the DD cash conditions. In the DD small denomination condition, \$20 bills were used whereas \$100 bills were used for DD larger denomination condition.

## Results and Discussion

A one-way between-subjects MANOVA was performed on purchase intention and pain of payment. The main effect of payment method on purchase intention was significant ( $F(2, 212) = 4.61, p = .011, \eta^2 = .042$ ). But the effect of payment method on pain of payment was not significant ( $F(2, 212) = 2.06, p = .130, \eta^2 = .019$ ). Post-hoc comparisons showed that relative to the large denomination condition ( $M = 4.21; SE = .249$ ), one-click condition ( $M = 3.18; SE = .226, p < .003$ ) and small denomination condition ( $M = 3.56; SE = .272, p < .064$ ) had lower purchase intention, but only the difference between the large denomination condition and one-click conditions was significant and survived adjustment for multiple comparisons. The means of purchase intention as well as pain of payment across experimental conditions are shown in Table 4.

While the significantly higher purchase intention in the large denomination condition compared to the small denomination condition (before controlling for multiple comparison) fit the payment transparency framework, there was no significant difference in pain of payment

across the two conditions. It was also unclear about what drove the significantly higher purchase intention in the large denomination condition relative to the one-click condition. Based on the framework of payment transparency, when one pays with cash in the DD payment interface, there should be a higher sense of pain of payment compared to the relatively painless one-click payment interface. This higher sense of payment should in turn inhibit spending, which is incompatible with the current results. One possible explanation is that participants used the value of \$20 or \$100 bills as a sign of their wealth even though based on the financial information presented their perceived wealth should have been the same in both conditions. This simple explanation can best explain the current results, where the one-click (did not signal wealth) and the large denomination conditions have the lowest and highest purchase intention, respectively. Notice the processing fluency account proposed by Mishra et al. (2006) does not make a prediction about how the one-click condition would be compared to the other two DD payment conditions. Even when the processing fluency account is applied to the two DD payment conditions, it still does not fit the current results because based on that account, those in the large denomination condition should be less likely to spend their money compared to those in the small denomination condition.

The current results are also different from Experiment 3's, where there was no effect on purchase intention between the one-click condition and the regular DD condition. This difference might have to do with the fact that in Experiment 3 \$50 bills were used while in the current study \$20 and \$100 bills were used. In Experiment 4, the difference in purchase intention between one-click and DD payment was minimal, with the effect largely being driven by a higher purchase intention for \$100 bills. This suggests that the DD mechanism inhibits

purchase intention more for small bills than for large ones. Perhaps the \$50 bills used in Experiment 3 were not large enough to create this effect.

Contrary to prediction and unlike the results of Experiment 3, there was no effect of payment method on pain of payment. In the current study, dragging more bills with smaller denominations did not lead to significantly higher pain of payment compared to either one-click payment or dragging bills with larger denomination, although dragging bills with smaller denominations did yield the highest measure pain of payment. Although the hypothetical financial profile was meant to control for participants' financial position, it might not have functioned as planned or there might have been a difference in terms of wealth level and the inclination to make a purchase across the samples in Experiments 3 and 4. The student sample in the current study showed a higher level of pain of payment in response to the experimental manipulations (Grand mean = 4.94;  $SE = .171$ ) compared to the US sample recruited from the Amazon Mechanical Turk service (Grand mean = 2.87;  $SE = .161$ ). Nonetheless, the student sample was less sensitive to the experimental manipulations regarding pain of payment. One possible explanation is that the US adult sample is generally wealthier than the student sample, so the pain of paying the same amount of money may be lower in the US adult sample. However, the US adult sample might be more cautious about spending money, thereby making them more sensitive to the subtle difference among the payment interfaces.

## CHAPTER 7. DISCUSSION

### **Summary of Findings**

There were several objectives of the current experiment. The first was to isolate the effect of the appearance of cash from the effect of action of payment. By using a token condition that mimics every aspect of cash payment except the appearance, Experiments 1 and 2 were able to show in a hypothetical purchase decision that it was the effect of action of payment that inhibits one's spending, not the appearance of cash. In particular, Experiment 1 showed that both DD conditions (DD token and DD cash) led to significantly lower overall spending relative to the one-click condition of credit card payment even after controlling for multiple comparisons.

Experiment 2 further strengthened the findings of the significant effect of the action of payment and the null effect of the appearance of cash by controlling for two potential confounds: the presence of credit card logo in the product selection page and the payment method per se separate from the action and appearance of cash payment. The presence of credit card logo in the product selection page could potentially confound the effect between DD payment methods (non-credit card payment) and 1-click method (credit card payment), because previous studies (Feinberg, 1986; McCall & Belmont, 1996; Raghurir & Srivastava, 2008) showed that in the presence of credit card logo, people spent significantly more compared to conditions where credit card logo was absent. Experiment 2 replicated the findings of Experiment 1 even in the absence of the credit card logo, showing that it was not credit card logo that drove the spending difference across payment conditions in Experiment 1. In addition, Experiment 2 showed that the effect of cash v. credit card per se was not significant while the effect of action of payment through the DD payment mechanism was. Previous studies (Monger & Feinberg, 1997; Prelec & Simester, 2001; Raghurir & Srivastava, 2008) showed that expecting to pay by credit card led to

significant increase in spending compared to the expectation of payment by cash. By using two new conditions—one that was cash payment but with the method of one-click payment mechanism, and another that was credit card payment but with the DD payment mechanism of cash—Experiment 2 was able to rule out that the finding in Experiment 1 was due to expectancy effect.

The second objective was to investigate the underlying mechanisms that contribute to the high payment transparency of cash payment. Experiments 1 and 2 showed that it was the action of payment and not the cash appearance that inhibited spending. Experiment 2 also attempted to break down the action of cash payment into the effort component (the need to hand out cash physically) as well as the mental component (the need to keep track of the current payment progress). It was found that either factor alone was not enough to lead to a significant difference in spending but together they had a significant inhibitory effect on spending. Using a different paradigm where participants' financial status was held constant and the purchase decision was self-relevant, Experiment 3 showed that it was the need to count the payment rather than the need to rehearse the payment amount that led to significantly higher pain of payment. When the process of counting was disrupted by a memory load task during the DD payment, one's pain of payment was significantly lower compared to the condition where there was no memory load. The lack of difference between the condition where one needed to memorize the payment amount and the condition where one needed to memorize some English letters showed that mental rehearsal of the payment amount alone was not a significant factor in eliciting pain of payment, or the effect was too small to be detected in the corresponding paradigm.

The third objective was to investigate whether the factors that increase payment transparency and thereby decrease spending in various real-world payment methods (e.g. checks

and cash) could also have an effect on computer payment interface, where the physical payment of cash or check is not present. A robust effect was detected regarding the influence of computer payment interface on spending (Experiments 1, 2, and 4). Moreover, factors that were found to inhibit spending in real physical payment were also found to inhibit spending in the computer payment interface. For instance, although the effect was not significant after controlling for multiple comparisons, those who completed payment by entering the spending amount on a virtual check spent significantly less compared to those who paid by the one-click credit card payment in Experiment 1. This replicated the spending-inhibitory effect of writing a check identified by Soman (2001). Moreover, Experiments 1, 2, and 4 also echoed the findings of two field studies conducted by Soman (2003), in which the action of counting out a cash payment (e.g. putting money into a copy machine or a washing machine) significantly inhibited spending compared to the prepaid card condition, where payment transparency was believed to be low. The fact that the current experiments only used hypothetical purchase decisions should also increase confidence in the current findings because cues that lead to payment transparency in real transactions should arguably be stronger than those found in hypothetical transactions.

The last objective was to investigate whether the size of denomination of bills could moderate the effect of action of payment on inhibiting one's spending. Although Experiment 4 found that those who paid with large denomination bills had a significantly higher purchase intention on a discretionary product compared to those who paid with small denomination bills, the effect was not significant after controlling for multiple comparisons nor was it in the predicted direction. It was not clear what drove the difference on purchase intention, but it was not consistent with the payment transparency framework.

## **Relevance to the Literature and Contribution**

The current findings generally supported the mounting evidence that one's spending behavior is a function of the payment method (Hirschman, 1979; Inman, et al., 2009; Prelec & Simester, 2001; Raghurir & Srivastava, 2008; Soman, 2001, 2003; Thomas, et al., 2011). In particular, Experiments, 1, 2, and 4 showed that spending varied based on the specific payment interface to which participants were assigned.

While the current findings could be understood under the framework of payment transparency, where factors that are believed to lead to high payment transparency and pain of payment and thereby should decrease spending, the link between the pain of payment and spending was less clear. Only few studies in the past (Thomas, et al., 2011) directly measure one's perception of pain of payment for a specific payment method, and the current results were inconclusive regarding the relationship between pain of payment and spending behavior. On the one hand, while Experiments 1 and 2 identified factors (i.e. action of payment) that were believed to lead to high payment transparency and pain of payment, pain of payment was not measured and therefore it was not certain whether pain of payment was the underlying mechanism that drove the spending difference across payment conditions. On the other hand, although Experiments 3 and 4 measured pain of payment as well as one's purchase intention, the current results failed to find significant correlations between the two variables across the two experiments.

There are several areas in which the current studies contribute to the consumer payment literature. First, it is shown that even in the absence of physical payment, the design of computer payment interface can significantly affect one's spending. To the best of my knowledge, these are the first studies that investigate the effect of computer payment interface on consumer

spending. It is found that depending on the features of the payment interface, one's pain of payment, total spending, and purchase intention can be systematically altered. Second, the current studies disentangle the effect of the action of cash payment from the appearance of cash and showed that it was the action of cash payment that inhibits spending. While previous studies showed that paying by cash inhibits spending relative to credit card payment, the effect of payment method (cash vs. credit card) and the effect of cash appearance and action of payment have not been systematically investigated. Results from Experiment 2 show that it is not the payment method per se that affect one's spending. Rather, it is whether there is a need to count out cash payment that affects spending, with the counting action tending to reduce spending. Third, the current studies further explore the underlying mechanism that inhibits spending in cash payment. Experiment 3 showed that when the process of counting cash was disrupted, one's pain of payment was decreased even when the disruption was due to the mental rehearsal of the payment amount. It provides initial evidence that it is the counting of payment that leads to the registration of pain of payment. Fourth, Experiment 4 attempted to investigate the effect of the size of bill denomination on one's subsequent purchase intention. It was found that the denomination size did influence subsequent purchase intention for a discretionary product, but it was unclear what drove the difference. In sum, the current studies identify that it is the need to count the payment in cash payment but not the cash appearance that inhibits one's spending. It also shows that the effect of the payment counting process can be extended to computer payment interface.

## **Implications**

The current studies suggest that virtual payment interfaces do influence consumer spending, which has several implications from a consumer welfare and regulatory perspective.

First, if one's spending is influenced by the payment interface, consumers may be systematically manipulated to spend more by big companies. In spite of the fact that it is not online shopping and not due to the effect of pain of payment, specifically designed payment interfaces might have already been exploited by big companies. For instance, Square, a mobile payment company based in Silicon Valley, recently introduced a payment interface that nudges consumers to tipping. Upon swiping their credit or debit card, consumers then need to choose among certain salient preloaded tip amounts (e.g. 15%, 20%, or 25%), or to enter their customized tip amount, or decide not to tip at all. It was reported that the introduction of this payment interface increased the proportion of tipping by 38 percent (Weissmann, 2014). Second, consumers should be educated about this bias and also learn that the desire for online payment efficiency may be in conflict with the desire to reduce spending. As some of the current results show, the easier it is for consumers to make online payments, the less transparent the payment method and the greater the tendency to spend more. As online payment methods become more efficient with saved payment information and one-click payment methods such as those used by iTunes and amazon.com, the tendency to overspend is likely to increase.

Consequently, policy makers may need to determine the acceptable options for consumers to complete their payments, whether they are online or not, instead of letting companies have full control as they do now. This requires immediate attention as online transactions will only increase with the increasing popularity of mobile handheld devices (2010 BAI & Hitachi study of consumer payment preferences, 2010). In addition, brick-and-mortar service companies may take advantage of a computer payment interface already as Square has already done. Policy makers should further explore alternative payment interfaces that can balance the convenience of paying and its corresponding spending-regulatory effect. While it

seems unlikely that the drag-and-drop payment mechanism will be implemented on any online payment interface due to its inconvenience, there might be alternative solutions. One potential feasible option is the scrolling method that has been widely used on a variety of mobile devices such as the Apple iPhone, where numeric input for each digit can be achieved through scrolling a 3D wheel as in the case of some types of combination lock. In this proposed method, consumers dial in the payment amount and proceed to complete the payment. If consumers are knowledgeable about the effect of payment interface and such payment interface is available to choose from, it might be their choice of payment method.

### **Limitations**

The current studies are limited in a number of ways. First, all purchase decisions were hypothetical, meaning that there were no actual transactions. It is logical to assume that if the spending-inhibitory effect due to aspects of cash payment is effective in hypothetical purchase decisions, it should be more so in the case of real purchase decision where one's wealth is actually depleted. But this notion remains to be tested in future studies. Second, three out of the four studies use student samples, which are usually lower in income compared to the general public. To what extent this disparity in income would affect the current findings is uncertain, yet it appears to be an important factor to be considered. For instance, paying a total of \$600 of expenses from the past month seems to be much more tolerable for the US sample recruited in Experiment 3 compared to the student sample recruited in Experiment 4, as reflected in the difference in pain of payment. This difference in pain of payment seems to fit well with the wealth disparity explanation. Nonetheless, the US sample seems to be more sensitive to the experimental manipulations on pain of payment compared to the student sample. Third, the current studies limit the purchase decisions on one product category in a given experiment, so to

what extent the pain of payment due to computer payment interfaces affects one's purchases across different product categories is uncertain. For instance, it was shown that the pain of payment due to cash curbs one's purchase on unhealthy food while credit card does not (Thomas, et al., 2011). Would the difference in virtual payment interface have a differential effect on different type of food consumption?

## **Conclusion**

As the world becomes increasingly digitized, online purchases will only become more important in the lives of consumers. The economic importance of consumer spending and consumer debt means that studying how, why, and how much people spend has great potential benefits to their financial lives. The present studies demonstrate that some of the same biases shown in traditional forms of commerce extend into the computer payment interface, suggesting possibilities for future research into how far these biases extend and into what, if anything, can be done about them.

Table 1. Mean (standard error) of spending in Experiments 1 and 2. Means that do not share the same subscript differ significantly ( $p < .05$ ) before correction for multiple comparisons

| Experiment 1 (n=106)             |                                    |                                  |                                  |  |
|----------------------------------|------------------------------------|----------------------------------|----------------------------------|--|
| DD Cash                          | One-Click<br>Credit Card<br>(Logo) | Check                            | DD Token                         |  |
| \$30.38 <sub>a</sub><br>(\$.925) | \$33.29 <sub>b</sub><br>(\$.859)   | \$32.08 <sub>b</sub><br>(\$.912) | \$30.68 <sub>a</sub><br>(\$.995) |  |

| Experiment 2 (n=118)             |                                  |                                  |                                  |                      |
|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------|
| DD Cash                          | One-Click<br>Credit Card         | One-Click<br>Cash                | DD Credit<br>Card                | Swipe Credit<br>Card |
| \$29.86 <sub>a</sub><br>(\$.809) | \$31.71 <sub>b</sub><br>(\$.821) | \$32.08 <sub>b</sub><br>(\$.888) | \$30.52 <sub>a</sub><br>(\$.682) | \$31.32<br>(\$.809)  |

Table 2. Monthly expenses used in Experiments 3 and 4. Bold expenses were the ones participants needed to pay

| Date          | Type of expense              | Amount (\$)   |
|---------------|------------------------------|---------------|
| 8-May         | Rent                         | 715.50        |
| <b>9-May</b>  | <b>Phone bill</b>            | <b>100.00</b> |
| <b>15-May</b> | <b>Car payment</b>           | <b>300.00</b> |
| <b>18-May</b> | <b>Car insurance renewal</b> | <b>200.00</b> |
| 25-May        | Utilities                    | 70.33         |
| 28-May        | Grocery                      | 53.42         |

Table 3. Mean (standard error) of purchase intention and pain of payment in Experiment 3. Means that do not share the same subscript differ significantly ( $p < .05$ ) before correction for multiple comparisons

|                    | One-click                   | DD English letters          | DD payment amount           | Regular DD                  |
|--------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Purchase intention | 2.73 <sub>a</sub><br>(.252) | 3.21 <sub>a</sub><br>(.287) | 3.28 <sub>a</sub><br>(.363) | 2.93 <sub>a</sub><br>(.211) |
| Pain of payment    | 3.18 <sub>a</sub><br>(.365) | 2.27 <sub>b</sub><br>(.252) | 2.24 <sub>b</sub><br>(.273) | 3.60 <sub>a</sub><br>(.333) |

Table 4. Mean (standard error) of purchase intention and pain of payment in Experiment 4. Means that do not share the same subscript differ significantly ( $p < .05$ ) before correction for multiple comparisons

|                    | One-click                   | Small<br>denomination       | Large<br>denomination       |
|--------------------|-----------------------------|-----------------------------|-----------------------------|
| Purchase intention | 3.18 <sub>a</sub><br>(.226) | 3.56 <sub>a</sub><br>(.272) | 4.22 <sub>b</sub><br>(.249) |
| Pain of payment    | 4.91 <sub>a</sub><br>(.292) | 5.40 <sub>a</sub><br>(.314) | 4.55 <sub>a</sub><br>(.277) |

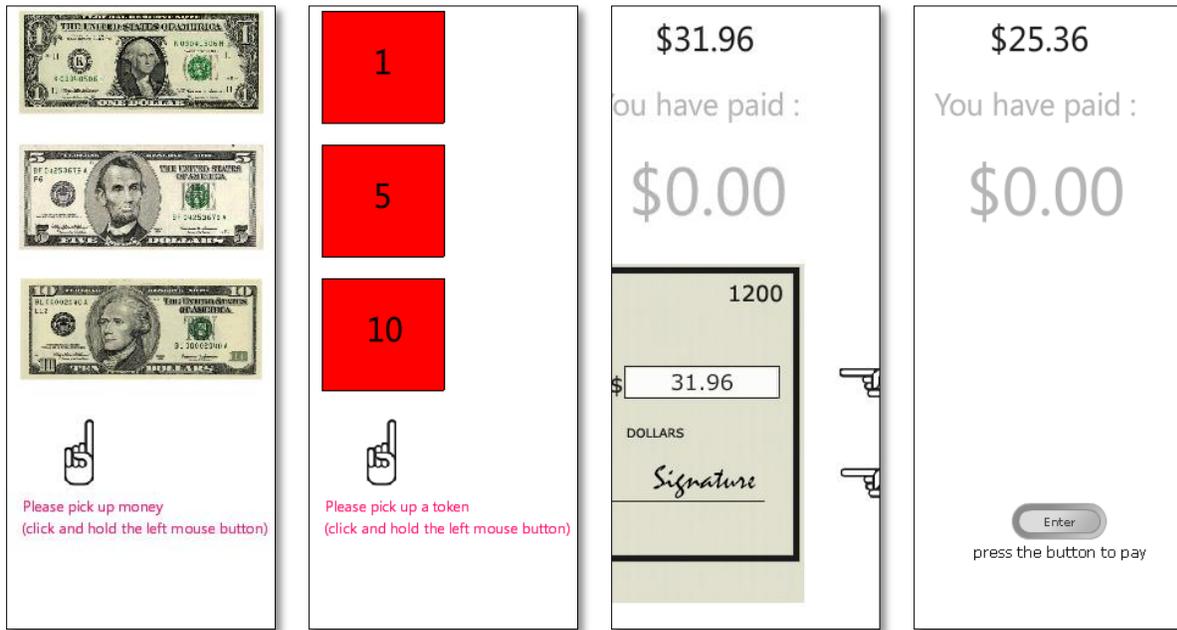


Figure 1. Virtual payment methods used in the Experiment 1 (From left to right: DD cash, DD token, check, one-click credit card)

Please select one product from each category. You can see your total on the right.

Your payment method will be: pay with Check

**RFB BANK** RFB BANK BSHAD  
 131 1585 9258 58-44-85 9C 00002290708 26

Your total value = \$0.00

Figure 2. Graphical interface of the product selection page (payment condition: check)

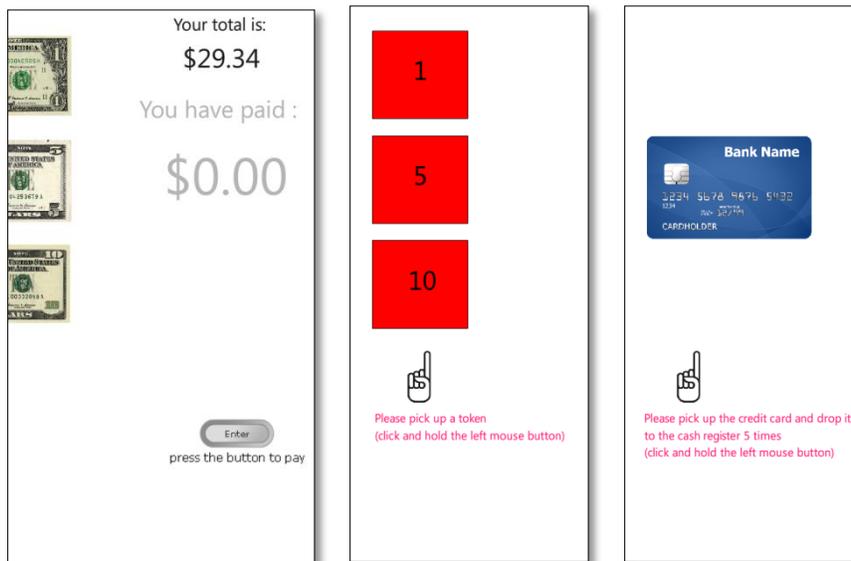


Figure 3. Additional payment conditions used in Experiments 2 (From left to right: one-click cash, DD credit card, swipe credit card)

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<sup>i</sup> A separate analysis was ran with only the 77 subjects who were not affected by the programming error. Before the Bonferroni adjustment, the pattern of results was the same as when all the subjects were included in the analysis. With the Bonferroni adjustment, the difference between the cash and check conditions, and between the credit card and token conditions, were marginally significant in the 77-subject group. In short, the influence of the programming error was minimal on the pattern and the interpretation of the results.