Abstract

Recent advances in consumer research have shown that the billing schedule has a significant impact on consumer decisions and consumption patterns. The strategy of devising different billing schedules to influence a customer’s purchase decision (or choice of consumption pattern) is well accepted, and should be effective as long as billing schedules are exactly the same as the perceived payment outlays. Payment card technology makes the payment time perceived by consumers ambiguous and may enable the decoupling of payment outlay and billing schedule. If the decoupling hypothesis is supported, customers will no longer be subject to mental account manipulation by the payment scheme.

Working with a large electronic payment service provider, we conducted a survey to collect data on usage and perception of payment cards in late 2003. Our results strongly support the decoupling hypothesis, and firms need to rethink their bundling and pricing strategies based on billing schedules. The possible use of this decoupling phenomenon to increase the willingness to pay of consumers and other managerial implications are discussed.

Keywords: mental accounting, knowledge transfer, learning by analogy, categorization, innovative technology, payment card

INTRODUCTION

Recent advances in consumer research have shown that the billing schedule has a significant impact on consumer decisions and consumption patterns. This is of strategic importance to payment service vendors and merchants. Consumers should also be aware of such strategies to avoid being taken advantage of. The mental accounting literature shows that past payment has an adverse impact on future consumption. This is called the sunk cost effect. Gourville and Soman (1998) showed that the sunk cost effect would depreciate over time, and they called this phenomenon payment depreciation. When past purchases are paid with some delay in time (e.g., by credit card), the adverse impact on subsequent consumption is less serious (Soman 2001).

By temporally separating the bill payment from benefit consumption, firms can manipulate the behavior of unaware consumers to their interests. For example, a firm can offer discounts to encourage bulk purchases. Since consumers pay for all items (e.g., 12 bottles of beers in one pack) in advance, the sunk cost effect of the payment will have depreciated by the time that the items are actually consumed (e.g., drinking of a bottle of beer). As a result, the consumption will be faster than it should be. As long as this gain from increased consumption exceeds the cost of offering the discounts, the firm stands to increase profit. Consumers need better understanding of this phenomenon to avoid overspending unintentionally.

To use bill payment timing effectively as a strategic tool, there is one important requirement: the billing schedule offered by the firm must be the same as the payment outlays perceived by the consumer. If consumers always pay by cash, there is no problem. Unfortunately, this is not the case in practice (a good thing for the paying consumers). Consumers pay by cash or any other payment means as they wish, provided that the payment method is accepted.

With payment card technology, the payment outlay perceived by a consumer can be detached from the billing schedule offered by firms. There are three main types of payment cards: stored-value cards, debit cards, and credit cards. Consider the use of a stored-value card. There are three possible instances that a consumer may perceive as the payment time – the time when the actual payment happens. The first is the time when the consumer loads money into the stored-value card – the load
time. The second is the time when the consumer makes the purchase – the purchase time. The final one is the time when the consumer’s wealth is depleted – the wealth depletion time. In this case, the wealth depletion time coincides with the purchase time.

But which one is the payment time? With payment card technology, it is not clear whether the payment outlay perceived by a consumer matches the billing schedule offered by firms. Recent advances in technology make the situation even more complicated: a stored-value payment card can offer consumers options of loading money into the card with cash, from a bank account, or from a credit card account. Will this innovative function have any impact on the perceived payment outlay associated with purchases made with such payment cards? Consumers need to know the answer to protect themselves from being exploited, while payment service vendors and merchants need the information to optimize their strategy.

The perceived payment time is also related to the endowment effect proposed in the mental accounting literature (Thaler 1980). Consumers treat foregone gains as opportunity costs and losses as out-of-pocket costs. Opportunity costs appear less painful than out-of-pocket costs. Hence, consumers are willing to pay more when considering the payment as an opportunity cost rather than an out-of-pocket cost.

When paying for goods with endowment, consumers think of the payment as a foregone gain of giving up the endowment. When paying for goods with cash, they perceive the payment as a loss of cash. Whether the use of payment cards can induce the endowment effect depends on when the payment is perceived to take place. For instance, if the purchase time is perceived as the payment time, paying for goods with a payment card will be judged as an opportunity cost and paying by cash as an out-of-pocket cost.

Therefore, we conducted a large-scale survey to address the following research questions. When consumers use a payment card, which time – the load time, the purchase time, or the wealth depletion time – do they perceive as the payment time for purchases? For a payment card equipped with an innovative function that allows consumers to load money into the card by cash, or from a bank account or a credit card account, how will consumers perceive the payment outlay?

Most research on these psychological effects of card payments has focused on debit cards and credit cards only, and has discussed the topic theoretically, drawing on assumptions of behavioral economics (e.g., Prelec et al. 1997, Thaler 1999). Empirical study on the topic is much needed. The current research contributes by empirically comparing the use of cash, debit cards, credit cards, and stored-value smart cards. An innovative smart card-based payment technology, which may complicate the psychological effects, is studied. The results have practical implications for firms devising sophisticated billing schedules and choosing which payment technology to apply. Consumers will find the results useful to comprehend their innate psychological bias. This will help aware consumers not to overspend unintentionally and be exploited by firms. Payment technologies may be used in both online and off-line contexts, and thus are relevant to electronic markets.

The rest of the paper is organized as follows. The next section briefly reviews the background of the research grounded on mental accounting and related literature. The third section develops the hypotheses. The fourth section outlines the research methodology used. The fifth section presents the results, and the last section concludes and discusses the results, and identifies future research directions.

BACKGROUND

Prospect theory and mental accounting

It is widely observed that consumers deviate from the rational behaviors predicted by expected utility theory in systematic ways. Kahneman and Tversky (1979) explained these anomalies by proposing a descriptive model of decision-making – prospect theory. In prospect theory, consumers make decisions by evaluating pleasures and pains associated with gains and losses brought by their decision, relative to a chosen reference point. The hedonic values of those gains and losses are represented by a value function that has the following three essential characteristics:

- Reference dependence: gains and losses are relative to some reference point.
- Loss aversion: the value function is steeper in the loss domain than in the gain domain.
- Diminishing sensitivity: as gains and losses get larger and larger, they carry smaller and smaller hedonic values to the consumers.

Equipped with the prospect theory value function, Thaler (1980, 1985) proceeded to deal with how consumers frame their decisions and evaluate the corresponding outcomes. He proposed the hedonic editing hypothesis: consumers code outcomes to maximize their happiness. Due to the value function’s property of diminishing sensitivity, as losses and gains increase in magnitude, consumers prefer to aggregate losses and segregate gains.

The payment card as a device for aggregating losses

Theoretically, consumers can frame the outcomes in any way through arbitrary aggregation and segregation of gains and losses. In practice, there are other factors affecting how consumers frame the outcomes. One
important factor is the timing of the outcomes. Previous research has shown that the temporal separation of outcomes facilitates their segregation, while the temporal proximity facilitates integration (Thaler et al. 1990).

Following this line of thought, consumers will prefer to pay for their purchases with payment cards rather than cash, *ceteris paribus*. Cash payments (i.e., losses) for each purchase are separated temporally and thus cannot be aggregated. If payment cards are used, payments of several purchases will be lumped together at some point in time. For example, all purchases by credit card can be paid at one time per month when the statement arrives. As such, losses are aggregated, and this is preferable to consumers. Payment card technology is therefore a device for consumers to aggregate losses and reduce the associated pains. Firms refusing to accept payment cards put themselves at a disadvantage. The strategic impact of payment cards is unavoidable.

**Sunk cost, payment depreciation, and payment immediacy**

Thaler (1980) referred to the observation that past purchases have significant impact on future consumer behavior as the sunk cost effect. For example, consumers who have bought a ticket for a show are more likely to go to the show, even under adverse weather conditions, than those who have not. A number of publications have shown the existence of sunk cost (e.g., Health 1995, Kahneman et al. 1984).

There is evidence that consumers will eventually ignore sunk costs (Arkes et al. 1985). Prior expenditures are less and less relevant to subsequent consumer decisions as time passes. This gradual reduction of the sunk cost effect is called payment depreciation (Gourville et al. 1998). Deferral of payment also affects consumer decisions. Soman (2001) studied the role of payment immediacy on spending behavior. When payment is not immediate, the effect of the purchase on following consumption is reduced. Both payment depreciation and immediacy suggest that the timing of payment outlay has a significant impact on consumer behavior. For instance, firms can take advantage of payment depreciation through strategies such as volume pricing and bill scheduling for scarce resources.

However, for firms to use payment timing effectively as a strategic tool, the billing schedule offered by the firm must be the same as the payment outlays perceived by the consumer. When consumers pay by payment cards rather than cash, they may perceive various instances as the actual payment time. It is thus possible to decouple the billing schedule from perceived payment outlay by payment card technology. Previous research has not addressed this possibility, but we propose to investigate it here.

**Endowment effect and payment cards**

Consumers treat foregone gains as opportunity costs, and losses as out-of-pocket costs. Because of loss aversion, opportunity costs appear less painful than out-of-pocket costs. Hence, consumers are willing to pay more if they consider the payment an opportunity cost rather than an out-of-pocket cost. This is called the endowment effect (Thaler 1980). Much research has studied the changes in valuation of goods when they are within and outside the endowment of a consumer (e.g., Knetsch 1989, Tversky et al. 1991).

Figure 1 illustrates the endowment effect. Consider two scenarios of a consumer considering whether to buy a TV set. In scenario one, the consumer pays with cash after deciding to buy. The payment follows arrow no. 4 in the figure, and the TV set goes to his/her endowment following arrow no. 1. The consumer treats the payment as an out-of-pocket cost since the outflow comes out of the box ‘Cash’. In scenario two, the consumer is given a money-back guarantee and takes the TV set home for a two-week trial. After two weeks, the consumer decides whether to return the TV set for the money back. Returning the TV set follows arrow no. 2, and the cash back follows arrow no. 3. As the outflow comes from the box ‘Endowment’, the cost of keeping the TV set is considered an opportunity cost. By the endowment effect, the consumer is more likely to buy the TV set in scenario two.

From Figure 1, we can see that a possible role is played by the payment card in inducing the endowment effect. When paying for goods with cash, the cost involved is an out-of-pocket cost, which is treated as a loss. If consumers pay for goods with a payment card and treat the time of purchase as the time when payment happened, they will be considering whether to keep the money in the card or get the goods. The payment outflow comes from the endowment of the consumer (i.e., the payment card); therefore, the cost of getting the goods is viewed as an opportunity cost. There will be no endowment effect if the consumer considers that the payment happens when cash is paid ‘out-of-pocket’ to settle the payment card transaction. The perceived timing of the payment by consumers using payment cards is crucial in whether the endowment effect is induced. By examining the consumer perception of

![Figure 1. Endowment effect](image-url)
actual payment time, this paper takes a first step in studying the possibility of inducing endowment effect with payment technology.

THEORETICAL FOUNDATIONS AND HYPOTHESES

As discussed in the introduction, there are multiple instances that consumers may consider as the payment time for a purchase. Figure 2 illustrates the cash flow of the three traditional types of payment card – stored-value card, debit card, and credit card. From Figure 2, we can see that the payment card, cash, and the bank account may be considered as one group and the credit card account and the merchants as another. When money is stored as cash, in the payment card, or in the bank account, consumers may consider that their wealth is not yet depleted. The wealth is depleted once money is paid to the credit card account or the merchants. We call this the wealth depletion time. The two other possible instances to be considered as the payment time are (1) the time when money is loaded into the payment card (the load time), and (2) the time when the purchase is made (the purchase time).

For cash payments, it is clear that the wealth depletion time is the perceived payment time. No matter when a purchase is made, the consumer’s payment outlay is exactly the same as the billing schedule, which equals the timing of the consumer’s wealth depletion, in cases of cash payments.

How do consumers perceive the payment outlay when payment cards are used? When payment cards were first introduced to the market, they were really new products that defied simple classification in terms of existing product concepts (Gregan-Paxton et al. 1997). Much research has been done on how consumers transfer their existing knowledge about established products to completely new products. For example, researchers have devoted much time to brand extension (e.g., Aaker et al. 1990, Boush et al. 1991, Broniarczyk et al. 1994), country-of-origin effects (e.g., Hong et al. 1989, Shimp et al. 1993), and comparative advertising (e.g., Pechmann et al. 1991, Sujan et al. 1987).

There are two main lines of research on consumer knowledge transfer: the categorization literature and the analogical learning theory. In the categorization literature, consumers are assumed to use categorization as a primary tool for organizing their knowledge (Fiske et al. 1990). When consumers put a new product into an existing category, knowledge about that category is transferred to the new product as a by-product of the categorization process. The concept of categorization-based knowledge transfer is limited in assuming that knowledge transfer can only occur between products in the same category.

There was no suitable category for payment cards when they first became available. The conception of transferring knowledge based on categorization is not applicable for learning about payment cards. Analogy learning theory, on the other hand, focuses on the transfer of knowledge from one domain (the base) to another (the target) as a function of the correspondence between the two (Gentner 1989). There is no requirement that the two domains should belong to the same category. This theory provides a broader perspective on knowledge transfer, which can occur between any two domains as long as they are similar enough. Hence, it is more suitable for studying the knowledge transfer occurring between cash and various types of payment card.

Based on the analogy learning theory, Gregan-Paxton and John (1997) developed the consumer learning by analogy (CLA) model. The CLA model provides the necessary conceptual framework for understanding how consumers form perceptions of payment timing for different types of payment cards, on the basis of established knowledge about cash payments. It incorporates key aspects of the analogical knowledge transfer paradigm, which describes the process by three stages: accessing the base domain, mapping the elements of the target to the base, and transferring knowledge from the base to the target. It also includes the moderating role of expertise in the process of consumer learning by analogy.

Consider how consumers transfer knowledge from cash payments to payments by cards. As both payment cards and cash are used for paying for purchases, it is natural that consumers take cash as the base for payment
cards in the access stage. Then in the mapping stage, consumers link the payment cards with cash through their common property (termed ‘relation’ in the CLA model) – being used to pay for purchases. In the CLA model, this type of mapping is called relational mapping and requires consumer expertise on the product. Consumers know well how to use cash, and thus the expertise requirement should be satisfied. In the final transfer stage, consumers transfer relevant knowledge from cash to payment cards. Consequently, the consumer is expected to perceive the wealth depletion time as the payment time for payment cards as well as cash. Given this perception, as long as the purchase time does not coincide with the wealth depletion time, the perceived payment outlay is decoupled from the billing schedule. The following hypothesis summarizes the discussion so far:

H1: When using traditional types of payment cards (i.e., stored-value cards, debit cards, and credit cards), the time of wealth depletion is perceived as the payment time.

The innovative payment technology: personalized Octopus card

Recent advances in payment card technology enable a new type of payment card: the personalized Octopus card, which is available in Hong Kong. The ordinary Octopus card was originally a stored-value smart card for micropayment. With over 13 million cards in circulation (i.e., nearly two cards per Hong Kong resident), it is now the closest thing to an electronic cash system anywhere in the world. The personalized Octopus card is an advanced version equipped with an innovative function: consumers can choose to load money manually by cash, automatically from a bank account, or automatically from a credit card account. In other words, the innovative function enables consumers to use the settlement methods of stored-value cards, debit cards, and credit cards for their personalized Octopus card.

Given the perceived payment time of traditional payment technology, how will consumers use this knowledge in deciding the payment time of personalized Octopus cards? Consumers are expected to transfer knowledge from the relevant types of payment card based on this innovative function. For example, consumers loading money automatically from a bank account to their personalized Octopus cards may transfer related knowledge from a debit card.

The personalized Octopus card is categorized as a multi-purpose smart card, instead of simply a payment card. In fact, most common payment cards nowadays are magnetic cards, not smart cards. Thus, knowledge transfer is not naturally taken as the base. Then, in the mapping stage, the consumer will link the personalized Octopus card with the credit card through their common property (termed ‘relation’ in the CLA model) – settling the purchase with the credit card account. In the CLA model, this type of mapping is called relational mapping and requires consumer expertise on the product. Given the widespread use of payment cards today, the expertise requirement should be present. In the final transfer stage, consumers transfer relevant knowledge from the credit card to the personalized Octopus card. Consequently, the consumer is expected to perceive the personalized Octopus card as a payment-deferring device like the credit card.

Similar reasoning can be applied to cases where consumers choose to load money into the personalized Octopus card by cash or from their bank accounts. Therefore, the following hypotheses are formulated:

H2: The payment time perception of cash is transferred to the innovative payment card, given that its stored-value is loaded with cash.

H3: The payment time perception of a debit card is transferred to the innovative payment card, given that its stored-value is loaded from a bank account.

H4: The payment time perception of a credit card is transferred to the innovative payment card, given that its stored value is loaded from a credit card account.

METHODOLOGY

In cooperation with the system provider of the Octopus card system, an online survey was conducted in Hong Kong in late 2003 to collect the data. There are both pros and cons for using the online survey approach (Ilieva et al. 2002). The major concern is that the sample may not be representative of the population due to the poor access to the Internet and poor computer literacy of respondents. However, given the high Internet penetration and computer literacy in Hong Kong, administering an online survey there should be an effective means of reaching the entire population. In total, 8,030 responses were received. This large sample is also an indication that the online survey approach is quite effective.

There are two main types of online survey, each with its own advantage. Web-based surveys reach a wide
audience and present the questionnaire better. Email surveys enable control over respondents. In the current research, a mixed approach was adopted. We used both email solicitation and Web-based questionnaires, gaining the advantages from both approaches (Ilieva et al. 2002).

We administered the questionnaire on a non-profit, public Web portal run by the Hong Kong government, on a membership basis. The membership is free to all permanent residents. All 160,000 members were invited to participate in the survey by email. Only Octopus card holders could participate, since we needed information about the payment perception of Octopus cards with different money-loading sources. The percentage of Hong Kong residents having an Octopus card is over 90%, so there should not be sampling bias because of this requirement. Respondents did the survey by clicking on a direct link, embedded in the email, pointing to the Web-based questionnaire. To encourage participation, incentives, such as free money loaded to Octopus cards, were provided through a lucky draw. The online survey lasted for about four weeks. There were in total 9,299 initial attempts to complete the questionnaire. Among them, 8,030 respondents completed the whole questionnaire with usable responses.

ANALYSIS AND RESULTS

In the survey, respondents were presented with the following description:

There are generally three types of payment timings: pre-pay, pay-as-you-go, and post-pay. Pre-pay payments refer to payments made before the physical acquisition or consumption of the goods or services. Pay-as-you-go payments refer to payments made at the same time as the physical acquisition or consumption of the goods or services. Post-pay payments refer to payments made after the physical acquisition or consumption of the goods or services.

Respondents were then asked to classify various payment means as either pre-pay, pay-as-you-go, or post-pay.

Each respondent was required to classify each of the following payment means: cash, debit card, credit card, and the Octopus card that the respondent was using (it could be one with money loaded manually with cash, automatically from a bank account, or automatically from a credit account). According to the consumer classification of the payment means, the implied payment time can be found as shown in Table 1.

Manipulation checks

It is clear that (1) cash payments must be a pay-as-you-go mechanism, (2) a debit card cannot be considered a post-pay device, and (3) a credit card is never a pre-pay method. If a respondent pays attention to answering the questionnaire, the response should be consistent with the above three patterns. Hence, we used the three patterns as a filter to ensure the quality of responses got.

First, we removed all respondents who had chosen cash payment as either a pre-pay or a post-pay mechanism. From the 8,030 completed questionnaires, we were left with 6,485 respondents. Second, all respondents choosing debit card payment as a post-pay mechanism were discarded. Thus, a further 941 data records were eliminated, leaving us with 5,544 useful responses. Finally, responses classifying credit card payment as pre-pay were excluded from further analysis. A total of 5,112 useful responses finally remained.

The 5,112 respondents were asked to provide demographic information and the loading function they used with their Octopus card. There are three available money-loading options: (1) loading money manually with cash; (2) loading money automatically from designated bank accounts; or (3) credit card accounts, when the stored value of Octopus card is used up. The demographic information and distribution of card holders with different money-loading source are summarized in Table 2. The demographic groupings of income groups and education levels were based on predefined categories. Respondents were required to report their birth year, and age was calculated from that. The age group categorization was done ex post.

<table>
<thead>
<tr>
<th>Payment Means</th>
<th>Load Time (when cash is put into stored value card, or bank account for debit cards)</th>
<th>Purchase Time</th>
<th>Wealth Depletion Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>N/A</td>
<td>Pay-as-you-go</td>
<td>Pay-as-you-go</td>
</tr>
<tr>
<td>Debit Card</td>
<td>Pre-pay</td>
<td>Pay-as-you-go</td>
<td>Pay-as-you-go</td>
</tr>
<tr>
<td>Credit Card</td>
<td>N/A</td>
<td>Pay-as-you-go</td>
<td>Post-pay</td>
</tr>
<tr>
<td>Octopus Card loaded with cash</td>
<td>Pre-pay</td>
<td>Pay-as-you-go</td>
<td>Pay-as-you-go</td>
</tr>
<tr>
<td>Octopus Card loaded with bank account</td>
<td>Pre-pay</td>
<td>Pay-as-you-go</td>
<td>Pay-as-you-go</td>
</tr>
<tr>
<td>Octopus Card loaded with credit card account</td>
<td>Pre-pay</td>
<td>Pay-as-you-go</td>
<td>Post-pay</td>
</tr>
</tbody>
</table>
The payment timing classification of respondents for the two conventional payment technologies – debit and credit cards – is shown in Figure 3. Note that only respondents classifying cash as pay-as-you-go were included after the manipulation check. Thus, cash is not included in Figure 3. The majority of responses classified debit cards as a pay-as-you-go payment means, while most classified credit cards as post-pay. By the perceived payment timing of the traditional payment means, we see that the wealth depletion time is perceived as the payment time (see Table 1). We performed the chi-square test to verify the payment classification results. The robustness of the results was tested by applying the chi-square test on subsamples of different genders, age groups, education levels, and annual income of the respondents. Due to the nature of chi-square test, we tested the significance of the results across two different age groups, while age was a continuous variable in our data. Since our objective was to ensure the validity of the results across demographic groups, this current approach was considered to be sufficient. The null hypothesis that there is no systematic payment classification for traditional payment cards was rejected at almost all levels. Hence, H1 is supported. Table 3 summarizes the results. The numbers in Table 3 are the chi-square test statistics for the whole sample and all demographic subsamples. For example, in the ‘Age’ column of the ‘Debit card’ row, 2328.49 is the chi-square test statistic for the subsample with age at most 30.

Note that H2–H4 suggest that payment timing perceptions from some additional payment technology will be transferred to the innovative Octopus payment card, as stimulated by the money-loading option chosen. As H2–H4 concern user perceptions of payment timing given the money-loading option chosen, the subsequent analyses test user judgments of the Octopus card conditional on the event that the respondents concerned had already chosen a specific loading method. The consumer choice of whether to load money with cash or other sources could be related to some other psychological factors. Analysis results should be interpreted with this limitation in mind.

To test the three hypotheses, we need a concrete definition of what aspects of payment timing perception are being investigated for knowledge transfer. For this purpose, we used two definitions of payment timing perception: one focusing on the overall distribution of payment timing perceptions among users – a strong one – and the other looking at the modal (not mean as payment timing perception is measured on an ordinal scale) payment timing perception – a weak one. The weak one only considers the modal payment timing perception, while the strong one takes into account also the variations in user payment timing perceptions by considering the overall distribution. H2–H4 can each be broken down into two, using the weak and strong definitions:

H2a: The modal payment time perception of cash is transferred to the innovative payment card, given that its stored value is loaded with cash.
H2b: The payment time perception distribution of cash is transferred to the innovative payment card, given that its stored value is loaded with cash.
H3a: The modal payment time perception of a debit card is transferred to the innovative payment card, given that its stored value is loaded from a bank account.
H3b: The payment time perception distribution of a debit card is transferred to the innovative payment card, given that its stored value is loaded from a bank account.
H4a: The modal payment time perception of a credit card is transferred to the innovative payment card, given that its stored value is loaded from a credit card account.
H4b: The payment time perception distribution of a credit card is transferred to the innovative payment card, given that its stored value is loaded from a credit card account.

We first tested the weak form of the three hypotheses H2a–H4a. Figure 4 displays the perceived payment timing of Octopus cards with different money-loading sources.

The majority of respondents perceived the Octopus card with value loaded from cash or bank account as a pay-as-you-go payment method, while an Octopus card
with value loaded from credit card was perceived as a post-pay method. From Table 1, we infer that consumers take wealth depletion time as the payment time, just as they do for the conventional payment means. The modal knowledge of traditional types of payment means is indeed transferred to the Octopus card according to the money-loading option. Chi-square tests on the reported association between the Octopus card’s money-loading option and payment timing were performed. The robustness of the results was established by repeating the chi-square test on subsamples of different demographic groups – gender, age, education, and income. The results were significant at all levels, rejecting the null hypothesis that the payment classification is independent of the money-loading option. Thus, the hypotheses \( H2a \), \( H3a \), and \( H4a \) are supported. Table 4 summarizes this result.

To test the strong form of the three hypotheses \( H2b-H3b \), we used the chi-square test.\(^7\) Our objective was to test whether the distributions of two variables – the payment timing perception of the relevant traditional payment technology, and that of the innovative payment card – are identical.

To test \( H2b \), we created a subsample of users loading their Octopus card with cash, yielding 3651 cases. We performed the chi-square test\(^8\) on the subsample, to check the null hypothesis that the payment timing perception distribution of cash is identical to that of the innovation card. The test statistics should be insignificant for \( H2b \) to be supported. To check for robustness of the results, we divided the subsample into two age groups (age at least 30 and age over 30) and did the chi-square test on each of the two age groups. Following the same procedure, the subsample was in turn divided into two gender groups, two income groups, and three education groups. For each of the demographic groups, the chi-square test was done to check whether the payment perception distribution of traditional payment technology (debit cards for users loading money from bank accounts, and credit cards for users loading money from credit card accounts) is identical to that of the innovative payment card. To test \( H3b \) and \( H4b \), the same procedure was repeated for a subsample with users loading the Octopus card with bank account (129 cases), and another subsample with users loading from credit card account (1,332 cases) respectively. Table 5 summarizes the results.

From Table 5, all \( H2b \), \( H3b \), and \( H4b \) are rejected. The overall payment timing distributions of cash, debit card, and credit card are not transferred to the innovative payment card loaded with cash, bank account and credit card account respectively. All results were robust across gender, age, income, and education.

### DISCUSSION AND CONCLUSION

Using the CLA model of knowledge transfer, we investigated the payment time perception of traditional payment cards and an innovative payment technology. Our results shed light on the behavioral impact of payment time perception, help consumers to understand their possible innate psychological bias stimulated by payment technologies, and highlight the strategic importance of payment cards in terms of decoupling.

![Figure 4. Payment timing perception of Octopus Card with different money loading sources](image-url)
payment outlay from billing schedule and inducing endowment effects.

The time of wealth depletion is perceived as the actual payment time (H1). Therefore, as long as the purchase time does not coincide with wealth depletion time, the perceived payment outlay is decoupled from the billing schedule. Payment service providers can enhance the value of their system if it enables decoupling of payment outlay in a way stimulating consumer spending. For example, credit cards stimulate consumer spending by deferring the actual payment schedule. In such cases, retailers and merchants should take into consideration the actual payment outlay perceived by consumers when formulating strategy based on billing schedule. Consumers should be aware of the strategic use of the payment timing perception against their interests.

Advances in payment card technology hide the actual payment outlays of consumers from merchants. When using a personalized Octopus card, firms simply cannot tell whether a consumer is loading money from cash, a bank account, or a credit card account. In such situations, manipulating consumption behavior with the billing schedule may not be feasible. Consumers

### Table 4. Chi-square test statistics on payment timing classification against Octopus Card’s money loading option

<table>
<thead>
<tr>
<th>Money Loading Option</th>
<th>Overall (No Control)</th>
<th>Gender</th>
<th>Age</th>
<th>Education</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>1744.99***</td>
<td>Male: 750.23***</td>
<td>&lt;=30: 1200.81***</td>
<td>&lt;=Secondary: 745.85***</td>
<td>&lt;=75000: 1005.29***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&gt;=College: 462.58***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female: 17.33***</td>
<td>&gt;31: 29.70***</td>
<td>Tertiary: 7.75***</td>
<td>&gt;75001: 24.43***</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>&gt;=College: 27.41***</td>
</tr>
<tr>
<td>Credit Card</td>
<td>315.53***</td>
<td>Male: 142.98***</td>
<td>&lt;=30: 119.10***</td>
<td>&lt;=Secondary: 58.44***</td>
<td>&lt;=75000: 62.54***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female: 179.84***</td>
<td>&gt;31: 197.47***</td>
<td>Tertiary: 67.92***</td>
<td>&gt;75001: 262.12***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&gt;=College: 199.37***</td>
</tr>
</tbody>
</table>

**Notes:**
1. The null hypothesis for the chi-square test is that the proportions of responses choosing different payment timing for the same money loading option are the same.
2. * p<.05; ** p<.01; *** p<.001; NS indicates non-significance.

### Table 5. Chi-square test statistics on payment timing perception transfer hypotheses

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Overall (No Control)</th>
<th>Gender</th>
<th>Age</th>
<th>Education</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>H2b</td>
<td>1678.83***</td>
<td>Male: 853.60***</td>
<td>&lt;=30: 969.83***</td>
<td>&lt;=Secondary: 620.37***</td>
<td>&lt;=75000: 799.88***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female: 827.96***</td>
<td>&gt;31: 711.62***</td>
<td>Tertiary: 494.47***</td>
<td>&gt;75001: 881.06***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&gt;=College: 567.32***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&gt;=College: 22.61***</td>
</tr>
<tr>
<td>H4b</td>
<td>430.26***</td>
<td>Male: 275.94***</td>
<td>&lt;=30: 131.69***</td>
<td>&lt;=Secondary: 129.04***</td>
<td>&lt;=75000: 147.03***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&gt;=College: 195.16***</td>
</tr>
</tbody>
</table>

**Notes:**
1. The null hypothesis for the chi-square test is that the payment timing perception distribution is identical between traditional payment technology concerned (cash for cash money loading option, debit card for bank account money loading option and credit card for credit card account money loading option) and the innovative payment card.
2. * p<.05; ** p<.01; *** p<.001; NS indicates non-significance.
can take advantage of this to avoid being manipulated by the billing schedule.

For payment cards where the purchase time coincides with the wealth depletion time (e.g., debit cards), the endowment effect is induced. This is another point that payment service vendors may consider in designing their system. Consumers using a payment system that induces endowment effects will have higher willingness-to-pay. Merchant managers may take advantage of this and formulate their strategy of payment card acceptance. Consumers should be aware of the tendency of overspending when paying with such cards.

The hypotheses (H2–H4) of knowledge transfer between the innovative type of payment cards and the traditional counterparts are partially supported. Inspection of the modal payment timing perceptions among consumer shows that user knowledge of payment timing about a new payment technology is strongly influenced by the relevant traditional payment means (H2a–H4a). However, the relevant knowledge is not exactly copied. The payment timing distributions of the new and the corresponding conventional payment technologies are not identical (H2b–H4b).

From the knowledge transfer between the innovative type of payment cards and the traditional counterparts, we see that it is possible to manipulate consumer perception of a technology through innovative functions that facilitate the linking of the technology with other, better understood ones. Consumers may expect payment service providers to increase the value of their system by enabling them to load stored-value cards from their credit cards. By analogical learning, consumers may transfer knowledge from credit card experiences to perceptions of the stored-value cards. This can stimulate usage and spending of consumers, as the credit card knowledge transfer makes the payment less painful. This is to the interest of both payment service vendors and merchants. Consumers should thus be cautious when using such cards.

Fortunately, consumers should be well aware of the fact that the source of money is a credit card, as this is a necessary condition for the transfer of knowledge from credit card experience. For example, in the actual implementation of this strategy mentioned in this paper (the personalized Octopus card), there are clear explanations, both on paper and from the staff of the service vendor, that if a consumer chooses to load money from a credit card account, the fund will be debited from the corresponding credit card account immediately. The money charged will be taken as normal credit card expenses, so as long as consumers pay the money back before the payment due date, no interest will be charged.

When consumers load money into their personalized Octopus card with the credit card, other attitudes, beliefs, and procedural knowledge other than the payment time perception may also be transferred from the credit card to the Octopus card. This is favorable if the Octopus card issuer wants to expand its market to the large amount transactions traditionally served by credit cards. Further studies into other types of knowledge transfer related to innovative technology functions are promising too.

Another interesting question for future research is what determines the consumer choice of whether to load money with cash or other sources. This could be related to the trade-off between self-control and convenience. For example, personal finance experts frequently advise people who want to save more money not to use credit cards. When using credit cards, payment is more convenient (e.g., the consumer does not need to worry whether there is enough cash) and individuals have less control over spending. The reverse is true for cash payments. This kind of trade-off may also apply when choosing between manually loading money (less convenient, more self-control) and automatically loading money from some accounts (more convenient, less self-control).

ACKNOWLEDGEMENTS

I thank the anonymous reviewers for the constructive feedback. This paper is dedicated in memory of my mother-in-law, Ms Tung Lai Man. Without her support and inspiration, this research would not have been possible.

Notes
1. People normally tend not to be loss averse for cash. See, for example, Kahneman et al. 1990.
2. Ibid.
4. For example, it can be used for authentication purposes in restricted area accessing. For details, see www.octopuscards.com.
6. There are three possible instances to be considered as payment time: the load time, the purchase time, and the wealth depletion time. The timing of these three instances varies across payment technologies, as shown by Figure 2. Table 1 shows the implication of perceiving each of the three instances on classifying a payment technology as pay-as-you-go, pre-pay and post-pay. From Table 1, we see that no matter which of the three is considered as the payment time, there are three patterns: (1) cash payment can only be classified as pay-as-you-go; (2) debit card payments cannot be classified as post-pay; and (3) credit card payments cannot be classified as pre-pay.
7. Though it is possible to test the hypotheses by the Wilcoxon test, it is not preferred, as the number of payment timing categories is small (only three: pre-pay, pay-as-you-go, and post-pay). With only three categories available, the number
of ties is excessive, and the Wilcoxon test has difficulty in dealing with ties. The chi-square test is preferred, as it accurately accounts for the low number of categories, although it does not take into account the paired nature of the observations.

8. To handle the low frequencies in some payment timing categories, a Monte Carlo simulation is used to approximate the distribution function of the test statistics.

References


